554045

COMMUNITY HEALTH PROGRAM
DESIGN WORK PLAN

OPERABLE UNIT 1
VASQUEZ BOULEVARD/INTERSTATE 70
SUPERFUND SITE
DENVER, COLORADO

Prepared for

U.S. Environmental Protection Agency
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VASQUEZ BOULEVARD/INTERSTATE 70 SUPERFUND SITE
COMMUNITY HEALTH PROGRAM
DESIGN REPORT

This design report has been prepared at the request of the U.S. Environmental Protection Agency, Region 8, by MFG, Inc. and Tetra Tech EM Inc. to address health risk-reduction activities in the residential portion of the Vasquez Boulevard / Interstate 70 Superfund Site in Denver, Colorado. The Community Health Program (CHP) component of the site remedy would be implemented to address health risks to young children from environmental sources of lead and arsenic.

TITLE AND APPROVAL SHEET

The following is responsible for remedial design at the Vasquez Boulevard/ Interstate 70 Superfund Site:

Bonnie Lavelle
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Date

This Remedial Design Work Plan is approved without conditions.

TABLE OF CONTENTS

LIST OF TABLES iii
LIST OF FIGURES iii
LIST OF APPENDICES iii
LIST OF ACRONYMS iv
1.0 INTRODUCTION 1
1.1 Site Description 1
1.2 Purpose and Scope of Design Report 1
1.3 Organization of Design Report 3
2.0 INFORMATION USED IN DESIGN OF COMMUNITY HEALTH PROGRAM 4
2.1 Anticipated Scope of Soil Removal and Replacement Actions 5
2.2 University of Colorado Health Sciences Center Kids at Play Survey 6
2.2.1 Study Design 6
2.2.2 Preliminary Summary Statistics 7
2.2.3 Participation Rate and Representativeness 7
2.3 EPA Environmental Testing Pilot Study 8
2.3.1 Study Implementation and Results 9
2.3.2 Study Findings 11
3.0 COMMUNITY HEALTH PROGRAM CONCEPT AND DESIGN 14
3.1 Community Health Program Objectives 14
3.2 Community Health Program Elements 15
3.2.1 Community Outreach, Awareness and Education Programs 15
3.2.2 Biomonitoring Programs 17
3.2.3 Environmental Investigation Program 19
3.2.4 Inter-Agency Coordination for Response Actions 19
3.2.5 Data Management/Record Keeping 20
4.0 COMMUNITY HEALTH PROGRAM ADMINISTRATION AND MANAGEMENT 21
4.1 Program Administration 21
4.1.1 Community Health Program Work Group 22
4.1.2 Medical Release and Property Access Agreements 23
4.1.3 Data Management and Record Keeping 24
4.2 Community Outreach, Awareness and Education Program 24
4.3 Biomonitoring Programs 24
4.4 Environmental Investigations and Access Agreements 25
5.0 COMMUNITY OUTREACH, AWARENESS AND EDUCATION PROGRAMS 26
5.1 Task 1 - Developing Program Strategies and Materials 28
5.2 Task 2 – Implementation of Community Programs During Soil Remediation 29
5.3 Task 3 – On-Going Implementation of Community Programs Following Completion of Soil Remediation 32
6.0 BIOMONITORING PROGRAM 33
6.1 Participation Eligibility and Scope of Monitoring 34
6.1.1 Lead 34
6.1.2 Arsenic 36

6.2 Potential Outreach and Recruitment Strategies 37
6.3 Testing Services 38
6.3.1 Blood-lead Screening 38
6.3.2 Urinary-Arsenic Testing 41
6.4 Case Management 41
6.5 Biomonitoring Result Reports 43

7.0 ENVIRONMENTAL TESTING AND EVALUATION PROGRAM 45
7.1 Eligibility and Prioritization 45
7.2 Property Access for CHP Investigations 45
7.3 Scheduling 46
7.4 Investigation Scope at Individual Properties 46
7.4.1 Family Interview and Questionnaire 47
7.5 Environmental Testing for Lead 47
7.5.1 Paint Testing 47
7.5.2 Dust Sampling 49
7.5.3 Soil Sampling 51
7.6 Environmental Testing for Arsenic 52
7.7 Environmental Data Management and Reporting 52

8.0 INTER-AGENCY COORDINATION OF RESPONSE ACTIONS 54
8.1 Response to Elevated Blood-lead Level 54
8.2 Response to Elevated Urinary-Arsenic Level 54
8.3 Response to Findings of Environmental Investigations at Residential Properties 55

9.0 DATA MANAGEMENT, RECORD KEEPING AND REPORTING 56
9.1 Electronic Data Entry and Export 57
9.2 Database Reports 58

10.0 PERFORMANCE MEASURES 59
10.1 Performance Measures 59
10.2 Duration of the Community Health Program Component of Remedy 60
10.3 Annual Reports and EPA Review 60

11.0 SCHEDULE 61

12.0 PRELIMINARY COST ESTIMATE 62

13.0 REFERENCES 63

LIST OF TABLES

5-1 Outreach, Awareness and Education Target Groups
6-1 Target Groups and Current Blood-lead Testing Services
6-2 Potential Methods for Contact and Recruitment
11-1 Community Health Program Implementation Schedule
12-1 Preliminary Cost Estimate for Annual Operating Expenses

LIST OF FIGURES

1-1 Vasquez Boulevard/I-70 Site, Operable Unit 1, Off-Facility Soils
2-1 2000 Census Results for Resident Children
4-1 Community Health Program Organization Chart
8-1 Response to Elevated Blood-lead Level
8-2 Response to Elevated Urinary-Arsenic Level

LIST OF APPENDICES

A Forms
B Educational Materials
C Standard Operating Procedures and Quality Assurance Project Plan for Environmental Data Collection
D Colorado Air Quality Commission, Regulation No. 19
E Sample Analysis and Quality Assurance Plan for Urinary Arsenic and Blood Lead Among Residents of VBI70 Neighborhoods

LIST OF ACRONYMS

ATSDR	Agency for Toxic Substance and Disease Registry
CDC	Center for Disease Control
CDPHE	Colorado Department of Public Health and Environment
CHP	Community Health Program
DDEH	Denver Department of Environmental Health
EPA	United States Environmental Protection Agency
EPC	Exposure Point Concentration
HUD	U.S. Department of Housing and Urban Development
ICP	Inductively Coupled Plasma Atomic Emission Spectrometry
LPN	Licensed Practical Nurse
LPPP	Lead Poisoning Prevention Program
mg/cm^2	milligrams per square centimeter
mg/ft^2	milligrams per square foot
mg/Kg	milligrams per Kilogram
NDHC	Northeast Denver Housing Center
NHANES	National Health and Nutritional Evaluation Survey
NPL	National Priorities List
OU	Operable Unit
PEHSL	Pediatric Environmental Health Specialties Unit
QAPP	Quality Assurance Project Plan
RI	Remedial Investigation
RN	Registered Nurse
ROD	Record of Decision
SOP	Standard Operating Procedure

LIST OF ACRONYMS
(Continued)

TSCA	Toxic Substances Control Act
UCHSC	University of Colorado Health Sciences Center
µg/dL	micrograms per deciliter
µg/L	micrograms per liter
$\mu g/ft^2$	micrograms per square foot
VB/I70	Vasquez Boulevard/Interstate 70
WIC	Women, Infants and Children (Supplemental Nutrition Program for)
XRF	X-Ray Fluorescence

1.0 INTRODUCTION

This document provides the conceptual design for the Community Health Program (CHP) component of the remedial action proposed by the U.S. Environmental Protection Agency (EPA) for the Off-Facility Soils Operable Unit of the Vasquez Boulevard/Interstate 70 Superfund Site (VB/I70 site), located in Denver, Colorado.

1.1 Site Description

The VB/I70 site covers an area of approximately 4-square miles in north-central Denver, Colorado. For the purpose of investigation and remediation, the VB/I70 site has been divided into three operable units (OUs). The residential soils discussed in this report are known as the Off-Facility Soils Operable Unit 1 (OU1) portion of the VB/I70 site. The locations of the former Omaha & Grant Smelter and Argo Smelter are identified as On-Facility Soils OU2 and OU3, respectively. The VB/I70 site is composed of a number of neighborhoods that are largely residential, including Swansea/Elyria, Clayton, Cole, and portions of Globeville and Five Points (Figure 1-1). Most residences at the VB/I70 site are single-family dwellings, but there are also some multi-family homes and apartment buildings. There are approximately 4,000 residential properties within the VB/I70 site boundaries. The VB/I70 site also contains a number of schools, parks and playgrounds, as well as commercial and industrial properties.

1.2 Purpose and Scope of Design Report

This report presents the design developed to provide a community-based health program to residents within the VB/I70 site. The report describes the program's objectives and conceptual approach, provides the general planning documents and standardized procedures needed to implement the program, and identifies participating agencies and their planned roles in implementing the program.

As currently envisioned, the CHP would be implemented to assist resident families in reducing their children's exposure to arsenic from soil-pica behavior and to lead from sources other than soil (soil remediation is a component of the remedy; EPA, 2003a and 2003b). The most effective means of providing this assistance will be to support the local health department, City and County of Denver Department of Environmental Health (DDEH), in their efforts addressing sources of children's lead exposure within the community and to coordinate with existing public health (e.g., Colorado Department

of Public Health and Environment [CDPHE]) and non-profit agencies, such as the Northeast Denver Housing Center (NDHC), in addressing sources of environmental hazards to children other than lead in soil. The DDEH response to a child with an elevated blood-lead level is an in-home investigation for potential sources of lead exposure and follow-up case-management services to the family including referrals to physicians or other health agencies, as appropriate. At present, and due to their limited resources, DDEH is only able to respond to cases for children with blood-lead levels of 15 micrograms per deciliter (µg/dL) or above. The CHP would support DDEH by responding to children with blood-lead levels of 10 µg/dL or above.

The CHP will be implemented to increase the level of health services available to the resident community within the VB/I70 site during the soil removal and replacement component of the remedy. The CHP has four main components that address this fundamental objective, as follows:

1. A biomonitoring program to provide routine and follow-up blood-lead and urinary-arsenic screening to young children residing within the VB/I70 site;

2. Community outreach and educational services to increase awareness about risks from exposure to various potential sources of lead and potential arsenic exposure for children with soil-pica behavior and reduce childhood lead and arsenic exposures from all possible sources;

3. Environmental investigation at properties where resident children have elevated blood-lead levels (defined as a confirmed blood-lead level of 10 µg/dL or above) or elevated urinary-arsenic levels (defined as a confirmed urinary-arsenic level of 30 micrograms per liter [µg/L] or above); and

4. Referrals to appropriate local health and public service agencies for case-management and lead-based paint abatement services.

The program's services will initially be provided by an EPA-led entity; however, EPA's intention is to develop and establish a program that would eventually be managed and administered through the cooperative efforts of the local health and housing agencies that currently serve this community and its residents.

The CHP will also provide EPA with additional biomonitoring data (blood-lead and urinary-arsenic levels for young children) that can be used for future evaluation of the effectiveness of the overall remedy, which includes soil removal and replacement in residential yards with lead or arsenic concentrations above removal action levels.

The remainder of this document provides a more detailed description of the CHP design and serves as the design report for the CHP component of the VB/I70 site remedy. This report was prepared at the direction of EPA but does not include all of the final design detail for the following principal reasons:

- EPA has not yet issued a final decision on the selected remedy for OU1. The Record of Decision (ROD) will provide information on the final objectives and scope of a community health program along with the other actions necessary to provide the overall remedy; and

- Details on how the program will be structured and implemented amongst the various agencies and organizations will be a key component of the design, but these discussions will not likely occur until after the ROD is issued.

1.3 Organization of Design Report

The CHP design report is organized to present the VB/I70 site-specific information that was used to develop the design (Section 2), provide the objectives and conceptual design for the program (Section 3), describe the project administration and organization (Section 4) and then present detailed plans for implementing the various components of the program, as follows:

- Community outreach, awareness and education programs (Section 5);
- Biomonitoring program (Section 6);
- Environmental testing and evaluation program (Section 7);
- Inter-agency coordination of response actions (Section 8);
- Database management and documentation (Section 9);
- Performance measures (Section 10); and
- Schedule (Section 11).

2.0 INFORMATION USED IN DESIGN OF COMMUNITY HEALTH PROGRAM

This section presents a summary of previous sampling results and associated technical analyses that form the basis for the CHP design.

The remedial action objectives for off-facility soils in residential areas of the VB/I70 site (OU1) are as follows:

Remedial Action Objective for lead in soil:

1) Limit exposure to lead in soil such that no more than 5 percent of young children (72 months or younger) who live within the VB/I70 site are at risk for blood-lead levels higher than 10 µg/dL from such exposure.

Remedial Action Objectives for arsenic in soil:

1) For residents of the VB/I70 site, prevent exposure to soil containing arsenic at levels predicted to result in excess lifetime cancer risk associated with ingestion of soil and ingestion of home-grown garden vegetables which exceeds 1×10^{-4} using reasonable maximum exposure assumptions.
2) For residents of the VB/I70 site, prevent exposure to soil containing arsenic in levels predicted to result in a chronic or sub-chronic hazard quotient associated with ingestion of soil and ingestion of home-grown garden vegetables which exceeds 1 using reasonable maximum exposure assumptions.
3) For children with pica behavior who reside within the VB/I70 site, reduce the potential for exposure to arsenic in soil that results in acute effects.

The Feasibility Study (EPA, 2001b) identified a number of alternative remedies to address these objectives, and in May 2002 EPA issued a Proposed Plan that identified preliminary remediation goals for soil and described their preferred remedy (EPA, 2002a). The May 2002 Proposed Plan identified soil removal and replacement in residential yards with lead or arsenic above action levels along with a community-based health program as components of EPA's preferred remedy.

Since issuance of the Proposed Plan, EPA has continued to work with the community and state and local public health agencies (i.e., CDPHE and DDEH) to further evaluate remediation goals. EPA currently plans to issue a revised Proposed Plan for public review in 2003. EPA's final remedy selection will be documented in the subsequent ROD. The following section describes the work that has been completed in developing the remedy for off-facility soils (OU1).

2.1 Anticipated Scope of Soil Removal and Replacement Actions

During 2002-2003, EPA prepared a *Soil Sampling and Remediation Design Work Plan* (EPA, 2003a) to describe the anticipated scope of soil removal and replacement actions and provide detailed procedures for implementing that component of the remedy. The Soil Sampling and Remediation Design Work Plan relies on data collected during EPA's Phase III soil investigation, which involved extensive soil sampling of the majority of the residential areas (approximately 3,000 properties to date) primarily during 1999 and 2000. The results of the investigation were reported in the Remedial Investigation (RI) report (Washington Group, 2001). Data from the investigation were used to calculate arsenic and lead exposure point concentrations (EPCs) for each sampled yard. These EPCs were later compared with the residential soil removal action levels being considered by EPA (70 milligrams per kilogram [mg/Kg] arsenic and 400 mg/Kg lead) to identify properties where soil removal and replacement actions (i.e., soil remediation) would be performed.

Soil sampling has yet to be completed for approximately 1,000 residential yards at the VB/I70 site. Soil in these yards will be sampled and analyzed for arsenic and lead as part of the soil remediation component of the remedy, and the sample results will be evaluated using the procedures described above to identify additional properties in this group that are candidates for remediation.

Based on the Phase III investigation results and assuming that the frequency of properties with lead and/or arsenic above the remedial action levels are the same in the unsampled properties, it is estimated that a total of 853 properties will be candidates for soil removal activities. Based on this scope of soil remediation, it is estimated that soil removal and replacement activities will be completed within three to four years (EPA, 2003a).

A portion of the properties to be remediated may be expedited as part of an earlier removal action. The removal action will target 141 properties with arsenic EPCs greater than or equal to 240 mg/Kg and lead EPCs greater than 540 mg/Kg (EPA, 2003b).

Completion of soil removal and replacement, in accordance with the final design report, will provide the risk reduction needed to meet the remedial action objective for lead and remedial action objectives 1 and 2 for arsenic.

2.2 University of Colorado Health Sciences Center Kids at Play Survey

In 2001, the CDPHE was awarded a grant from the Agency for Toxic Substances and Disease Registry (ATSDR) to conduct a health survey to investigate soil-pica behavior and associated soil ingestion by soil-pica children who live within the VB/I70 site. CDPHE contracted with the University of Colorado Health Sciences Center (UCHSC) to design and perform the survey, and the resulting program was called the "Kids at Play" survey. The primary goal of the survey was to describe the range of soil-contact activities reported by parents for children living within the VB/I70 site and to determine the extent to which high-contact activities associated with soil-pica behavior are reported. EPA performed the analyses of blood and urine samples collected from children during the survey.

2.2.1 Study Design

The door-to-door survey was conducted from July through October of 2002 and included (1) a census to count resident children less than 6 years old, (2) completion of questionnaires about child behaviors related to soil contact, and (3) collection of blood samples for lead analysis and urine samples for arsenic analysis. The Kids at Play health survey also provided health education to families with children who have either elevated blood-lead level (defined as greater than or equal to 10 µg/dL) or urinary-arsenic level above the national background (defined by UCHSC, for the purposes of their study, as greater than or equal to 30 µg/L), or both.

The UCHSC has not yet released results of the Kids at Play health survey but will prepare a report to the CDPHE and ATSDR to provide those results. As the agency performing the chemical analyses of the biological samples, EPA has access to blood-lead and urinary-arsenic test results from the Kids at Play survey. These results have been useful for development of the CHP design and are presented in general terms here. However, the information presented here should not be cited as the final results or conclusions of the Kids at Play study.

2.2.2 Preliminary Summary Statistics

The Kids at Play survey collected a total of nearly 1,600 blood-lead samples and nearly 1,400 urinary-arsenic samples for testing at EPA's contracted laboratory. Samples were collected mainly from young children, but some of the participants were older than 72 months (6 years). The UCHSC is currently preparing a detailed summary and analysis of the results, but this report is not yet available. However, by virtue of having performed the analyses, EPA is able to calculate preliminary summary statistics for the study. Because the UCHSC report is not finalized, these data should be considered draft and should not be cited as the final results or conclusions of the Kids at Play study.

Blood Lead. Based on the data set of all original samples, approximately 5 percent of the blood-lead test results were greater than or equal to 10 µg/dL. Participants with blood-lead values greater than 10 µg/dL were re-tested using a venipuncture collection method, and most of these repeat values were also higher than 10 µg/dL. The results from the re-tests indicate that less than 4 percent of children tested have confirmed elevated blood-lead levels. These preliminary data suggest that the current incidence of elevated blood-lead levels in children who reside within the VB/I70 site is approximately the same as reported by CDPHE (6 percent) for children under 6 years tested during 2000 (CDPHE, 2001) and somewhat lower than reported by the Center for Disease Control and Prevention's (CDC's) National Health and Nutritional Evaluation Survey (NHANES) and local health agencies for similar, older urban communities in the northeastern and mid-western United States within the last 5 years (CDC, 2000a; e.g., City of St. Louis Department of Health, 2000).

Urinary Arsenic. Based on the data set of all original samples, less than 1 percent of the urinary-arsenic values were above 30 µg/L. Participants with urinary-arsenic values above 30 µg/L were also re-tested, and nearly all of these were below 30 µg/L in the repeat test. At present, data are insufficient to judge if this pattern is significantly different than expected for other similar urban locations, but the results suggest that elevated arsenic exposures at VBI70 are both infrequent and intermittent.

2.2.3 Participation Rate and Representativeness

Although it is not possible to evaluate the participation rate in the study without information about the age-range of participating children, the data that are available indicate that a high percentage of the community's young children did have blood-lead and urinary-arsenic tests. According to year 2000 U.S. Census numbers, an estimated 2,200 children under the age of 6 and 4,700 children under the age of

12 reside within the Elyria, Swansea, Clayton and Cole neighborhoods, which are located predominantly within the VB/I70 site boundaries (Figure 2-1). Given these child populations and assuming that all children tested were under 6 years old, up to 72 percent of children under 6 participated in the biotesting program (had either blood-lead or urinary-arsenic test, or both). If some of the children tested were between the ages of 6 and 12, the actual participation rate for the age 1-6 group may be somewhat lower. The initial blood-lead and urinary-arsenic samples were collected at the home instead of at a clinic setting, and this approach may have also proved beneficial for overall participation. The actual numbers of children tested in different age groups will be reported by the UCHSC/CDPHE with the other Kids at Play survey results.

Because details of the study are not yet available, it is not possible to evaluate whether the children tested are representative by neighborhood, age group, or other variables with the potential to influence a child's exposure to lead and arsenic. However, given the apparently high participation rates, EPA concludes that children from all neighborhoods are likely to be represented in the survey results and that the door-to-door survey method was an effective means to recruit families for participation in the biotesting component of the study.

2.3 EPA Environmental Testing Pilot Study

During the fall of 2002, EPA conducted a pilot study designed to provide information that could assist in further development of the remedy's CHP component (EPA, 2002b). The primary objective of the pilot study was to collect information that could be used to evaluate children's exposures to lead and arsenic in and around their homes. The pilot study immediately followed and supported the Kids at Play survey by providing environmental testing at homes of families with children whose blood-lead or urinary-arsenic tests showed elevated levels (i.e., a confirmed blood-lead level $\geq$ 10 µg/dL or urinary-arsenic level $\geq$ 30 µg/L). Data collected through the pilot study were used to identify possible sources of lead or arsenic exposure at selected residences and any specific risk factors that may contribute to an individual child's exposure and health effects.

A secondary objective of the pilot study was to provide an opportunity to initiate coordination among the various existing agencies that participate in environmental risk reduction activities within the community. During the pilot study, EPA worked directly with DDEH to investigate properties for sources of lead exposure and provide follow-up reports of the results to families and to the NDHC.

EPA's pilot study data were provided to DDEH and NDHC for their use in addressing potential sources of the children's lead exposures.

The information and experience obtained through the pilot study were fully considered as part of the design process for the CHP. A brief summary of the study's activities and results is given below.

2.3.1 Study Implementation and Results

The pilot study included investigations at a total of 12 residential properties, as follows: 10 residential properties where young children with elevated blood-lead levels reside, 1 property where a child with an elevated blood-lead level spends several days a week in day care, and 1 property where a child with an elevated urinary-arsenic level resides.

The participating families were recruited by Kids at Play program staff from the families of children with confirmed elevated blood-lead or urinary-arsenic levels. This approach was adopted to maintain the confidentiality of medical test results obtained through the Kids at Play survey. The consent forms used by the UCHSC did not expressly state that results would be released to EPA for use in identifying properties for the pilot study, therefore, the DDEH requested that UCHSC not release any information to EPA about participating families until the family had agreed to participate in the pilot study and signed a release form related to medical test results obtained through the Kids at Play survey. The recruitment thus became a USHSC responsibility, not an EPA responsibility as originally planned, and proved less effective than expected. Out of more than 25 families identified with children having confirmed elevated blood-lead or urinary-arsenic levels, 14 families agreed to participate and 11 actually followed through with EPA and DDEH to arrange for the environmental investigation at their home.

For the families participating in an environmental investigation for lead, the investigation was performed through the cooperative efforts of DDEH and EPA. DDEH elected to participate in each property investigation, even those where children with blood-lead levels between 10 and 15 µg/dL resided. The DDEH representative conducted an interview of a family member, using the pilot study's questionnaire, while EPA's contractor collected the environmental investigation data in accordance with the pilot study work plan procedures. DDEH also assisted in focusing the environmental investigation at each property on any potential source areas for lead exposure in and around the home that may have been identified through the interview (i.e., based on child behaviors, family practices, etc.).

Yard soil, indoor and outdoor paint, indoor dust and drinking water were tested for lead content at 11 properties. Yard soil, indoor and outdoor paint and indoor dust results were used to identify hazardous levels of lead, as defined by EPA for use in evaluating lead-based paint hazards under the Toxic Substances Control Act (TSCA) (EPA, 2001). EPA has established the following hazard levels for lead from lead-based paint:

- ≥400 mg/Kg lead in play areas of bare soil; 1,200 mg/Kg (average) for other bare soils;
- ≥1 milligram per square centimeter ($mg/cm^{2)}$ lead in deteriorated paint; and
- ≥40 micrograms per square foot ($\mu g/ft^{2)}$ lead in floor dust; and
- ≥250 $\mu g/ft^2$ lead on interior window sills.

The lead content of drinking water collected from the kitchen faucet was compared to EPA's drinking water standard for lead (15 µg/L).

Lead-based paint and lead hazards from paint in deteriorated condition were identified at each of the 11 properties where paint was tested. Interior lead-based paint hazards were present in 9 of the 10 homes where interior testing was performed, and exterior lead-based paint hazards were present in 9 of the 11 homes where exterior paint was tested. Exterior paint was not tested at one property, and at another property exterior lead-based paint hazards were present but interior hazards were not. Lead loadings in dust were variable within a home, but in 7 of the 11 properties containing lead hazards from paint, hazardous levels of lead in indoor dust were also identified. Soil was sampled from bare areas and play areas within the yard. The lead concentrations were above EPA's lead hazard screening level of 400 mg/Kg in at least one of the targeted sampling areas at 3 of the 10 properties where soil samples were collected for lead analysis. At all three of the homes where bare soils contained more than 400 mg/Kg lead, exterior lead-based paint hazards were also identified and lead-based paint was a possible source of lead to soil. The lead concentration in drinking water was less than the drinking water standard (15 µg/L) at all of the properties where water was tested.

Other risk factors for lead exposure were identified through the family questionnaire. A number of children with elevated blood-lead levels also exhibited pica behaviors that may increase their risk of exposure to hazardous levels of lead in and around their homes. At one of the properties, frequently used glazed pottery from Mexico was identified as a possible source of lead exposure for a young child.

EPA performed an environmental investigation for arsenic at one property where a child tested had an elevated urinary-arsenic level. At this property, EPA administered the family-interview questionnaire and collected bare yard soils and also wipe samples of dust from exterior wood surfaces that may have been treated with chromated copper arsenate for arsenic analysis. The subject child was older than 6 years and did not exhibit any soil-pica behavior. Neither yard soil nor dust from potentially treated wood surfaces outside the home appeared to be likely sources of arsenic exposure for this child. After learning in a family interview that the child ate shellfish shortly before the urine sample was collected, the EPA concluded that the child's source of arsenic was likely dietary.

EPA provided the environmental investigation data collected at each property to DDEH and NDHC. DDEH and NDHC reviewed the information collected at each property with EPA, on a case-by-case basis, to evaluate the potential sources of lead or arsenic exposure for each of the elevated blood-lead or urinary-arsenic children.

EPA also prepared environmental investigation reports for distribution to the participating families. For properties where DDEH assisted with the investigation (i.e., lead properties), DDEH provided these reports to the resident family, and property owner if different, along with explanation of the results and recommendations for risk-reduction actions. This level of participation from DDEH was ultimately considered necessary to establish a longer-term case management relationship between DDEH and each family with an elevated blood-lead child. DDEH will continue to provide case-management services to these families as part of their routine environmental health services to Denver residents, including coordination between the family and NDHC for additional lead testing and abatement services, when appropriate.

EPA provided the results of the one arsenic investigation directly to the participating family along with information about potential sources of arsenic exposure and measures for prevention of exposure to arsenic. The arsenic levels identified in soil at this property are not considered a health risk to the child so no probable environmental sources of arsenic were identified by the investigation.

2.3.2 Study Findings

The results of the pilot study have been useful for identifying (1) site-specific risk issues, which should be the focus of community awareness and education programs; (2) the types of data most needed to assist the DDEH in case management of children with elevated blood-lead levels and non-profit

agencies that provide lead-based paint abatement assistance; and (3) recruitment strategies that will maximize resident participation in a CHP.

1. Site-specific risk issues

- Results of paint testing for lead confirmed the presence of lead-based paint hazards at homes occupied by young children with elevated blood-lead levels. Hazardous levels of lead were also frequently identified in indoor dust, especially dust collected from window troughs that are not routinely cleaned. Clearly, awareness of lead-paint hazards and actions to address or prevent those hazards are important components of any lead-risk-reduction program for this community.

- Services to identify and remove lead-based paint hazards from homes occupied, or likely to be occupied, by young children are important for overall lead risk reduction in this community. NDHC currently provides these services to the community through their U.S. Department of Housing and Urban Development (HUD)-grant-funded, lead-safe housing program. However, the CHP needs to be prepared to support NDHC to the extent necessary to provide these services to families residing within the VB/I70 site, especially in the event that NDHC's HUD funding is reduced at some point in the future.

- In addition to the EPA's Phase III sampling methodology used to determine property-specific EPCs, focused soil testing in bare soil and play areas is helpful to identifying lead hazards for young children based on the current property condition. Once identified, these types of soil hazards can be immediately addressed by NDHC's existing HUD-funded program. Lead concentration data for bare and play-area soils can also be used by EPA to prioritize properties for the soil remediation component of the remedy. When soil sampling at properties of young children identifies lead or arsenic concentrations above the remedial action levels, those properties would be given the highest priority when scheduling remediation.

2. Coordination with local agencies participating in the CHP

- Feedback from DDEH and NDHC during and following the pilot study has been helpful to improving communication and coordination among agencies that will participate in the CHP.

- EPA needs to obtain appropriate releases from families in order to share medical testing results with DDEH, the family's medical-care provider(s), CDPHE and potentially NDHC. Likewise, data collected by DDEH and NDHC needs to be accessible to EPA, if EPA is to coordinate case management or follow-up environmental testing or remediation services. A medical data release form allowing for data sharing among agencies participating in the CHP will be a necessary component of the biomonitoring program.

- DDEH elected to perform case management for all children with elevated blood-lead levels, regardless of their blood-lead level, and prefers to continue serving as the primary case-management agency for all elevated blood-lead cases in the future.

- NDHC prefers to be directly involved in risk assessments for lead-based paint hazards at the individual properties referred to their program rather than relying on another agency to collect that information. The data collected through the lead-based-paint risk assessment process are those needed to develop an abatement plan when lead-based paint hazards are identified. Therefore, it is most efficient for the abatement agency to also perform the risk assessment.

3. Recruitment strategies

- Recruitment by the agency providing services is desirable so that the family has a known point of contact for obtaining those services.

- Door-to-door recruitment for biomonitoring is effective but also time and labor intensive.

- Neighborhood volunteers accompanied the Kids at Play workers on their door-to-door survey, and that level of community participation may have increased residents' willingness to participate.

3.0 COMMUNITY HEALTH PROGRAM CONCEPT AND DESIGN

The CHP would be implemented to assist the community in addressing health risks to children from exposure to various environmental sources of lead and arsenic. The program will initially be managed by EPA as part of the overall remedy for the VB/I70 site to fill critical gaps in the current services provided by a number of existing programs currently run by different public and private agencies in Denver and exist as a collaborative, inter-agency effort, or coalition, to address sources of environmental health risks in the VB/I70 site. Two key service agencies, the DDEH and the NDHC, a private, HUD-funded non-profit agency, have already agreed to share resources with EPA in implementing the CHP.

3.1 Community Health Program Objectives

The remedial action objectives for the VB/I70 site will be met through the soil-removal and replacement actions described in the *Soil Sampling and Remediation Design Work Plan* (EPA, 2003a). The schedule for the soil removal and replacement action extends approximately four years, during which time individual yards will be addressed as needed to remove and replace soils with lead and/or arsenic EPCs above the remedial action levels set forth in the ROD. The community health program described by this document is designed to provide additional health-risk-reduction services to residents during and after implementation of the soil remediation actions.

The specific objectives for the community health program component of remedy are as follows:

1. Increase the level of environmental-health services available to the community for addressing sources of lead exposure other than lead in yard soil.

2. Reduce health risks to young children with soil-pica behavior through education and awareness programs targeting young families and pre-school, child-care providers.

In order to meet these objectives, the CHP's services are intended to be community based, or originating from existing community-based programs, with EPA support as needed to expand or establish services that can be maintained beyond the completion of soil removal actions. In addition, the CHP will provide EPA with additional information that may be used to better understand sources of lead and arsenic

exposure for children who reside within the VB/I70 site boundaries and thereby assist in evaluating the overall effectiveness of the remedy in protecting human health.

3.2 Community Health Program Elements

The CHP designed to meet the objectives listed above has the following individual but related elements:

- Program management and administration;
- Community outreach, awareness and education programs;
- Biomonitoring program;
- Environmental investigations at residential or child-care properties;
- Interagency coordination of response actions; and
- Data management, reporting and record keeping.

These elements are each described separately below. More detailed plans for implementation of these elements follow in Sections 4 through 9.

3.2.1 Community Outreach, Awareness and Education Programs

The community outreach, awareness and education programs will serve the following needs:

- Outreach to recruit participants in the biomonitoring program and for environmental investigation and abatement services;

- Awareness to inform residents about possible sources of lead and arsenic health hazards; and

- Education to equip parents and other child-care providers with the information needed to identify and prevent soil pica behavior and also prevent young children's exposure to hazardous levels of lead and arsenic, from all possible sources.

This element of the CHP will have three separate tasks: (1) program and materials development, (2) implementation during soil remediation activities; and (3) implementation following completion of soil remediation.

In order to develop effective outreach services and educational materials for the targeted population groups within the VB/I70 site, EPA will coordinate with neighborhood Steering Committees and other interested community-based groups, such as church groups, school parent associations, and daycare providers, to seek community input and involvement in this task. Different target groups may have different needs, such as bilingual materials for Spanish-speaking residents or materials specifically targeting pregnant women. Similarly, different neighborhoods are likely to have different needs or preferences for awareness and education programs that are consistent with their cultural backgrounds and unique community dynamics. EPA will seek guidance from interested community members or groups with the desire to assist in developing the outreach, awareness and educational programs (described conceptually in Section 5) through a series of face-to-face working sessions. The purpose of these sessions will be to solicit input on outreach and education strategies that will be effective for a given neighborhood and sensitive to neighborhood-specific concerns. The end-product of these sessions will be a detailed outreach and education plan for each neighborhood from which the CHP will develop specific materials and programs for target groups within the community.

The second task will be implementing the outreach and education plans to raise and maintain the community's awareness of the health risks from lead and arsenic exposures. The objectives of these efforts will be to provide information to the community about:

- The CHP and the services available to residents and property owners;
- The EPA's active soil remediation program in their neighborhood;
- The potential for children to be exposed to lead and/or arsenic from various sources in and around the home at levels that could have adverse health effects;
- Basic personal hygiene, household maintenance and childhood nutrition information to reduce contact with and risk from lead exposures and prevent elevated blood-lead levels;
- Health risks from lead exposure when older lead-based paint is disturbed by home remodeling or renovation and ways to limit those risks;
- Risks associated with soil pica behavior in young children and ways to identify and prevent that behavior; and

- Importance of blood-lead testing and guidance on requesting blood-lead tests from physicians or medical clinics.

Although parents are generally aware of the most common sources of lead exposure, such as lead-based paint, they are not as well informed about measures that they can take to prevent their children's exposure to such sources (Mehta and Binns, 1998). Therefore, the focus of education will be on prevention of young children's exposure to lead and arsenic from any source, including exposure to lead and arsenic in soil that results from soil pica behavior. This approach is consistent with the CDC's guidelines for prevention of lead poisoning in children (CDC, 1997).

The community awareness and education program will involve cooperative efforts with local government and private agencies, including the DDEH, CDPHE, Denver Public Schools, Women, Infants, and Children (WIC), Head Start, and NDHC. Upon completion of soil remediation, the CHP's awareness and education programs will be maintained by those agencies cooperating with EPA during development, initiation and implementation of those programs during soil remediation activities.

3.2.2 Biomonitoring Programs

Biotesting for blood-lead levels and urinary-arsenic levels will be offered at no cost to residents within the VB/I70 site as part of the CHP. The goal of the blood-lead screening program will be to provide at least one blood-lead test to children at the ages of 12 and 24 months, at least one test for every child between the age of two and six who has not previously had a blood-lead test, and follow-up blood-lead testing for children with elevated blood-lead levels as recommended by a physician or other health-care provider or until their blood-lead level is less than 10 µg/dL. Blood-lead screening will also be offered to, and encouraged for, pregnant women and nursing mothers. Urinary-arsenic screening will be offered to resident children ages 1 to 6 years old to allow parents to investigate whether their child is being exposed to arsenic.

CDPHE's Colorado Childhood Blood-lead Screening Plan (CDPHE, 2001) recommends universal blood-lead screening, at the ages of 12 and 24 months, for children who reside in neighborhoods where the risk for elevated blood-lead levels is highest (CDPHE, 2001). CDPHE considers the neighborhoods within the VB/I70 site as high-risk for elevated blood-lead levels and recommends blood-lead screening for each resident child at the ages of 12 and 24 months.

At present, there are limited services available to families residing within the VB/I70 site who seek out blood-lead testing for their children. For children receiving Medicaid benefits, blood-lead screening is mandated at 12 and 24 months. For children with other health insurance and receiving routine medical care, their physicians may recommend blood-lead testing if the physician determines that the child may be at risk from lead exposure (AAP, 1998). Uninsured families may need to request and pay for blood-lead testing at their own initiative. Recently, the NDHC worked with Colorado's Lead Poisoning Prevention Program to sponsor blood-lead screening clinics at local schools and day care facilities in the VB/I70 site. Through these efforts, the NDHC and Lead Poisoning Prevention Program have occasionally been able to provide blood-lead testing to children who reside within the VB/I70 communities. However, the availability of no- or low-cost testing services from these agencies depends on the future year-to-year budget status of each program and is not guaranteed in the near term.

Although CDPHE requires that physicians and other health-care providers report blood-lead test results to the state's Lead Poisoning Prevention Program, the number of test results reported to them suggest that screening rates for young children residing in Denver County are low. Therefore, it is unlikely that CDPHE's universal screening goal is currently being met within high-risk neighborhoods in Denver County.

The CHP seeks to increase the number of children receiving blood-lead tests by providing that service at no charge to resident families. In addition, the CHP will provide incentives for families to have their children tested at (or near) the ages of 12 and 24 months and to have their children return for follow-up testing when an elevated blood-lead level is detected. The blood-lead testing program will be supported by the CHP's outreach services to make families aware that testing is available to them and have families understand why testing is beneficial for their children. Outreach services will focus on an annual blood-lead screening drive that encourages parents to have their children tested.

Children between the ages of 1 and 6 years will be eligible for urinary-arsenic tests. These tests will be provided at the request of a parent or guardian that may want to investigate whether a child has been ingesting arsenic, either as a result of a child's soil-pica behavior or from another source. The community outreach and awareness program will also support the urinary-arsenic testing by making residents aware of the behaviors that put a child at higher risk for elevated arsenic intake, such as soil-pica behavior, and that no-cost testing services are available to families with children.

Results from these testing programs will be provided to each tested child's parents or guardian and also to DDEH and CDPHE.

3.2.3 Environmental Investigation Program

The objective of the environmental investigation program is to ensure that children with either elevated blood-lead levels or elevated urinary-arsenic levels receive appropriate follow-up environmental investigations, and if necessary, response actions to address environmental sources of lead and/or arsenic. The CHP will support existing services currently available from DDEH and NDHC as necessary to ensure timely and efficient testing at properties where such children reside.

The environmental investigation program will follow the same investigation protocols used during the 2002 EPA pilot study, which are described in Section 7 of this report.

3.2.4 Inter-Agency Coordination for Response Actions

A key element of the CHP is coordination of response actions taken to address elevated blood-lead levels and urinary-arsenic levels in young resident children. The types of response actions that will be taken include:

- Investigation and management of elevated blood-lead cases;
    - Lead-based-paint risk assessment, including focused soil hazard assessment
- Investigation and management of elevated urinary-arsenic cases; and
    - Investigation of environmental arsenic in soil through the Phase IIII soil sampling program results
    - Coordination with family physician to track and potentially address soil pica behavior
- Responses to findings of lead or arsenic sources at investigated residential properties.
    - Soil remediation in response to lead or arsenic hazards identified through environmental investigation

- Lead-based-paint abatement services, as appropriate to conditions at the home

At present, DDEH and NDHC coordinate their response to children with elevated blood-lead levels who reside in homes with lead-based paint hazards. However, once the biomonitoring element of the CHP is in place, it is likely that a larger number of children will receive blood-lead testing and a larger number of children will be identified with elevated blood-lead levels. If DDEH does not have the resources to respond to an increased number of elevated blood-lead cases, the CHP can support DDEH's investigation efforts at residential properties. Similarly, if NDHC cannot respond to an increased case load for their lead-based-paint risk assessment program, the CHP can assist NCHC in performing risk assessments at residential properties.

When lead-based paint hazards are identified, the NDHC's Lead Safe Denver Program can work with the property owner to provide lead abatement services.

When soils in the yard contain high concentrations of lead or arsenic, the CHP may recommend soil remediation for the yard. Soil remediation will be performed as part of the site remedy; however, homes where resident children have either elevated blood-lead or urinary-arsenic levels will be higher priority properties for remediation than others within the site.

3.2.5 Data Management/Record Keeping

The CHP will establish and maintain an environmental database to manage and track environmental testing data and environmental response actions at individual properties within the VB/I70 site boundaries. The CHP database will also include blood-lead and urinary-arsenic test results linked to individual properties. The data maintained by the CHP will be available for use by EPA, DDEH, NDHC, and any other participating agencies in investigating, and responding to resident inquiries about sources of lead and arsenic in and around their homes and in investigating properties where children with elevated blood-lead or urinary-arsenic levels reside.

4.0 COMMUNITY HEALTH PROGRAM ADMINISTRATION AND MANAGEMENT

The work performed for the CHP will be accomplished through the cooperative efforts of EPA, DDEH , NDHC and any other new or existing agency committed to addressing the goals of this program. The overall program organization is illustrated on Figure 4-1. Program organization, responsibilities and administrative requirements are described in this section.

EPA will initially be responsible for overall program administration, biomonitoring, soil remediation and environmental data management. Funding for the CHP will be provided through EPA's Superfund process for remedy implementation.

4.1 Program Administration

An EPA Remedial Project Manager will have overall responsibility for implementation of the CHP. A contractor project manager will assist EPA in projecting annual budgets and tracking and reporting annual expenditures.

EPA, or their contractor, will implement the program from a local office within the VB/I70 site boundaries. This office will available for coordination of remedial actions during soil remediation and as long as EPA continues to administer the CHP. The office will be staffed by a full-time Program Administrator and supporting part-time staff, including a Field Investigations Coordinator, Biomonitoring Nurse and Education and Outreach Coordinator (Figure 4-1).

The Program Administrator will be responsible for overall management and implementation of the CHP. These responsibilities include:

- Coordinating, tracking and documenting completion of program activities;
- Coordinating and recording program meetings and working sessions;
- Coordinating with and scheduling work by subcontractors;
- Coordination and communications with participating agencies;
- Reporting blood-lead test results to DDEH and CDPHE;
- Contracting and scheduling for laboratory analyses in support of the biomonitoring and environmental investigation programs;
- Reporting environmental results to NDHC and EPA soil remediation program;

- Maintaining program records and providing data to the database manager; and
- Reporting to EPA project manager.

The responsibilities of the Program Administrator's support staff are described separately below.

4.1.1 Community Health Program Work Group

Although EPA will be responsible for initiating and managing the program, a technical working group of health-agency and neighborhood representatives will participate in program management and decision making. The role of this "work group" will be to make recommendations to EPA for CHP activities. EPA will be responsible for coordinating the group's participation in review of CHP activities.

The work group shall include, at a minimum, one representative each from (1) EPA, (2) CDPHE's Lead Poisoning Prevention Program (LPPP), (3) DDEH and (4) NDHC, as well as up to two additional volunteer representatives each from the five neighborhoods within the VB/I70 site boundaries (Elyria, Swansea, Clayton, Cole and Five Points) who are also residents of those neighborhoods. The final CHP work group membership will comprise at least 7 and at most 17 representatives total from EPA, CDPHE, DDEH, NDHC and neighborhoods within the VB/I70 site. The work group will operate by consensus or, if that is not achievable, defer to the EPA remedial project manager for final decision making. All members will be invited to participate fully in discussions and developing recommendations. When consensus is not possible, the views of the minority shall be presented along with the work group's final recommendations to the EPA project manager. Neighborhood representatives do not need specific education or professional experience, but they should be knowledgeable about their neighborhood's primary environmental health concerns and committed to working cooperatively with EPA by communicating neighborhood issues to the CHP work group.

Day to day management of the CHP will be the responsibility of the Program Administrator (see Figure 4-1), but the work group will assist by providing general direction and oversight of the program. The work group will have the following functions and responsibilities:

- Provide guidance in development phase of community outreach, awareness and education programs;

- Respond to any public comments on or concerns about EPA's implementation of response actions, including soil remediation;

- Assist in identifying the community's environmental health services needs;
- Prioritize environmental investigations and response actions when multiple properties need to be addressed; and
- Periodically evaluate community outreach and education programs and make recommendations for improvement.

These responsibilities will be addressed through quarterly work group meetings convened at the CHP's local office by the Program Administrator. The work group's meeting schedule may be modified depending on program demand that may vary throughout the life of the program. Meetings will be scheduled at least 2 weeks in advance with notification via phone or email. The Program Administrator will develop the meeting agenda and distribute it to the work group members upon scheduling of the meeting. The Program Administrator will keep meeting minutes to record discussions, recommendations and decisions reached by the work group at each meeting. Work group meeting minutes will be provided to the EPA Remedial Project Manager and all members of the work group for their future reference.

4.1.2 Medical Release and Property Access Agreements

The CHP will obtain and record participant agreements for release of medical test results and property access for environmental investigations. The Program Administrator, or their designee, will be responsible for explaining these agreements to participants and why they are necessary for EPA to perform biotesting and investigation services as part of the CHP. The medical-release and access-agreement forms that will be used are included in Appendix A.

The medical-release agreement requests families to release blood-lead records and family questionnaire information for shared use by the EPA, DDEH and CDPHE. Families having medical tests performed by EPA shall be required to release the results of these tests to EPA, DDEH and CDPHE. If the family objects to sharing of the test data among these agencies, then the CHP will refer the family to a private physician or a pediatric clinic where they can request blood-lead and urinary-arsenic tests independent of the CHP. Families will be strongly encouraged to have their children's blood-lead levels tested by either the CHP or by their own physician or other medical-care provider.

The Program Administrator, or their designee, will also be responsible for obtaining a property access agreement from residents and owners of properties where EPA is performing an environmental

investigation. Residents who request investigations must sign an access agreement granting EPA the permission to sample the property. If the property is not owner occupied, then the property owner must also grant EPA access for sampling. The access agreement indicates that environmental investigation results will be recorded in the CHP's database for potential future use by EPA, DDEH and NDHC. The access agreement must be signed by the property owner and current residents (if different) before environmental testing is scheduled and performed.

Participation in the environmental investigation element of the CHP is voluntary and open to all residents and owners of properties within the VB/I70 site boundaries where there are children residing with confirmed elevated blood-lead or urinary-arsenic levels. Residents or owners of properties eligible for environmental testing by the CHP, must grant EPA access for sampling on the property before an environmental investigation can be performed by the CHP.

4.1.3 Data Management and Record Keeping

Whereas the Program Administrator has primary responsibility for maintaining hard-copy records associated with the CHP's activities, a Database Manager will be responsible for establishing and maintaining the CHP's electronic database. The purpose of the electronic database is to maintain environmental and biomonitoring test results in an accurate, consistent and readily accessible format for use by agencies participating in the CHP.

4.2 Community Outreach, Awareness and Education Program

The Program Administrator will work with a Community Outreach and Education Coordinator and the CHP work group to implement this element of the program. Additional details regarding implementation of the community outreach, awareness and education program are provided in Section 5.

4.3 Biomonitoring Programs

The Program Administrator will work with a qualified registered nurse (RN) or licensed practical nurse (LPN) to implement the biomonitoring program. The Biomonitoring Nurse will provide initial health-based counseling to participating families, collect blood-lead and urinary-arsenic samples, submit those samples to a laboratory for the appropriate analyses and report the test results to the family. The

Biomonitoring Nurse will also coordinate reporting of elevated blood-lead test results to DDEH and CDPHE. Additional details on implementation of the biomonitoring program are included in Section 6.

4.4 Environmental Investigations and Access Agreements

The Program Administrator will work with the Field Investigations Coordinator to identify properties for environmental investigations, develop the scope of investigation at each property, obtain access agreement(s), schedule the property investigation and coordinate all of these activities with the DDEH and NDHC. If EPA performs the environmental investigation, then the Field Investigations Coordinator will be responsible for completing the investigation in a timely manner, documenting property conditions and sample locations, providing samples to an analytical laboratory for the appropriate analyses and compiling a report of the investigation results for DDEH, NDHC and EPA records. The Field Investigations Coordinator will also be responsible for providing property results to the Database Manager for inclusion in the CHP environmental database.

All of the environmental investigation activities will be conducted in accordance with the procedures specified in Section 7 of this report.

5.0 COMMUNITY OUTREACH, AWARENESS AND EDUCATION PROGRAMS

As described above in Section 3.2, this critical element of the CHP will be implemented in three separate tasks:

Task 1: Development of outreach, awareness and education program strategies and materials specific to various target groups within the VB/I70 site;

Task 2: Implementation of outreach and education programs during soil remediation; and

Task 3: Ongoing implementation of outreach and education programs following completion of soil remediation.

The fundamental goal of these three tasks is the same, to make the entire community aware of services offered through program and to invite voluntary participation in environmental risk reduction. The outreach, awareness and education programs each has its own more specific goals, which are listed below.

Outreach for participation in program services:

- Provide information to community residents about biomonitoring and environmental testing services available to them through the CHP;
- Encourage participation by families with young children in these programs; and
- Provide referrals for services offered by the NDHC.

Awareness of health hazards from environmental sources of lead and arsenic:

- Provide general information to all residents about sources of lead and arsenic in the residential environment;
- Provide general information to parents and other child care providers about risk factors for childhood exposure to potentially harmful levels of lead and arsenic, including pica behavior;

- Provide relevant information to local physicians, pediatricians and other health-care workers in local settings about children's health hazards from sources of lead and arsenic and services provided by the CHP and affiliated agencies;

- Provide specific information to individuals or contractors performing remodeling or renovation work at residential properties where lead-based paint may be present about the increased health hazard to children resulting from disturbance of older painted surfaces;

- Provide specific information to rental-property owners/landlords about potential for lead-based paint hazards and need for lead risk assessments to protect children's health; and

- Collect and present specific information to residents and property owners about sources of lead and arsenic at properties occupied by young children.

Education about prevention of elevated blood-lead and urinary-arsenic levels in young children, including:

- Child behaviors that increase an individual's risk for elevated blood-lead or urinary-arsenic levels;

- Potential for children to be exposed to lead at levels that could have adverse health effects;

- Home maintenance and routine cleaning recommendations;

- Basic personal hygiene and childhood nutrition measures to reduce health risks from exposure to lead or arsenic;

- Methods for reducing children's contact with lead-based paint dust generated during remodeling and renovation activities;

- Methods for reducing children's contact with soil that may contain lead or arsenic;

- Household products or items that may contain lead or arsenic at levels hazardous to children.

Table 5-1 is a preliminary listing of target groups for the CHP outreach, awareness and education programs.

Table 5-1. Outreach, Awareness and Education Target Groups

Target Group	Outreach for Biomonitoring	Outreach for Environmental Investigation	Awareness and Education Programs
Parents/guardians of children under 6 years old	Lead and Arsenic	Lead and Arsenic	Lead and Arsenic
Day care workers	Lead		Lead and Arsenic
Elementary school teachers/school nurses			Lead and Arsenic
Homeowners and owners of rental properties		Lead	Lead
Local pediatricians and general practitioner physicians	Lead		Lead and Arsenic
Medical clinics serving community	Lead		Lead and Arsenic
Renovation/remodeling contractors		Lead	Lead

As described below, development and ongoing maintenance of the outreach, awareness and education programs will involve cooperative efforts with local agencies, including DDEH and NDHC, the CHP work group and community-based citizen groups.

5.1 Task 1 - Developing Program Strategies and Materials

In order to develop effective outreach services and educational materials for the targeted population groups within the VB/I70 site, EPA will coordinate with neighborhood Steering Committees and other interested community-based groups, such as church groups, school parent associations, and daycare providers, to seek active community input and involvement in this task. EPA will seek guidance from community groups and individuals interested in becoming more involved in environmental risk reduction within their neighborhoods.

This process is scheduled to take place during the first 6 to 12 months of remedy implementation through a series of working sessions convened by EPA to solicit input on outreach and education strategies that will be effective for a given neighborhood and sensitive to neighborhood-specific concerns. The end-product of these sessions will be a detailed outreach and education plan for each neighborhood from which EPA will develop specific materials and programs for the various target groups within each neighborhood. The resultant outreach and education materials will be developed and reviewed by the

work group and prepared with cooperation from affiliated agencies for distribution to the public by various contact methods.

Specific educational tools will be developed in both English and Spanish for each aspect of the program, as needed. Many bilingual educational brochures have already been developed in support of HUD's and EPA's national lead programs and to support community involvement in the VB/I70 site remedy development and selection process (Appendix B). Whenever possible, the CHP will continue to use these materials. A few examples of new materials that will be developed in support of the CHP include:

- An initial mailing for all property owners and residents within the VB/I70 site boundaries introducing the CHP;
- Follow up mailings to property owners and residents to describe services available through the CHP; and
- Educational brochures addressing specific risk factors or prevention measures, such as soil-pica behavior, nutritional recommendations for young children and guidance for safety conducting renovations that disturb lead-based paint.

Additional information about development of the outreach program for biomonitoring services is given in Section 6 of this report.

A number of different distribution and contact methods will likely be used to provide information to the various target groups, and the neighborhood-specific plans will identify methods with the greatest potential effectiveness. Specific outreach and education methods may change over time. The work group will periodically review, evaluate and recommend improvements to the outreach programs and educational materials used by the CHP.

5.2 Task 2 – Implementation of Community Programs During Soil Remediation

Following completion of the outreach, awareness and education plans for each neighborhood, the CHP will implement those plans at the same time as soil sampling and remediation are being conducted across the VB/I70 site. Soil remediation is scheduled to extend for a period of approximately 4 years.

At the start of the CHP, property owners and residents within the boundaries of the VB/I70 site will be notified of the CHP and introduced to the program through an initial mass mailing. The mailing will provide information about the potential health risks associated with exposure to sources of lead and arsenic, potential health risks associated with soil pica behavior, and include a full description of the services offered to property owners and to residents, especially families with young children and pregnant/nursing women, by the CHP. In addition, periodic mailings to (or other contact with) property owners and residents will describe potential risks related to sources of lead, methods to reduce risks to residents, recommended dust suppression and remodeling methods and disclosure requirements for residential real-estate transactions.

The CHP will establish a local telephone information line where residents, or other interested individuals, can call for information about the program and its services. The objectives of the information line are to:

- Provide parents or caretakers of young children with information about lead risk reduction activities including the CHP's blood-lead testing program;
- Provide access to the environmental testing program for families with young children that have elevated blood-lead levels;
- Provide residents with information and guidance about reducing the exposure to lead;
- Provide residents with information about recognizing a child's soil pica behavior and reducing a pica child's exposure from soil ingestion; and
- Monitor citizens' concerns and make referrals to the appropriate personnel.

General information will also be available in the community through a variety of media, including advertisements in local newspapers. Advertisements will focus either on total community awareness or on a specific topic for a target group such as families with children under the age of six years. Advertisements will change periodically depending on the time of year and feedback from the public.

Special emphasis will be made to reach families with children less than 72 months old and pregnant/nursing women. Educational information will be given at public and private daycares, at the

elementary school and to other groups that focus around young children by CHP staff visits to these locations. Periodic updates will continue and educational brochures will be available for distribution at these facilities.

Other methods that will be considered for providing CHP information and services to residents and property owners include:

- Internet website (for general information on CHP, CHP events, and soil remediation), if recommended by work group;
- A "remediation newsletter" (e.g., quarterly mailing and distribution) providing updates on soil remediation progress, biomonitoring program events and schedules, annual biomonitoring result reports, and other community environmental resources; and
- CHP participation in community events such as health fairs, neighborhood association meetings, etc.

The CHP may want to establish a more unique name for the program. The name of the program would be selected with input from community members (e.g., Healthy Homes for Kids, Environmental Health for Kids, Safe at Home) so that it accurately reflects the community's greatest health concerns or goals for the program.

The most effective education is individual face-to-face consultations with residents. This approach will be possible with participants in the blood-lead, urinary-arsenic and environmental testing programs. The Biomonitoring Nurse managing the blood-lead and urinary-arsenic programs will provide initial education and counseling to participating families with young children. Individual family concerns can be noted and potentially addressed at the time of testing. The environmental investigation program can often make customized recommendations for specific actions that will reduce the residents' risk from lead exposure based on the results of environmental sampling at their homes and specific information collected by the program about their daily habits and activities.

5.3 Task 3 – On-Going Implementation of Community Programs Following Completion of Soil Remediation

The CHP is intended to be a community-based initiative that is initially fostered by EPA funding, development, and management and later maintained by community-based organizations and affiliated agencies. Upon completion of the soil removal and replacement actions, the remedy will be considered complete, including EPA's management of the CHP. Long-term maintenance of community outreach, awareness and education programs to address sources of lead other than soil and risks associated with soil-pica behavior will be turned over to the various agencies and community groups participating in the CHP.

6.0 BIOMONITORING PROGRAM

Biomonitoring is one of the services associated with the Community Health Program; it will be used to track resident children's blood-lead levels and test urinary-arsenic levels. The biomonitoring program will give parents and guardians of young children access to:

- routine blood-lead testing for their children;
- information about blood-lead levels and the health effects of exposure to lead from any source;
- urinary-arsenic testing for their children;
- information about sources of arsenic and the acute and chronic effects of exposure to arsenic from any source.

In other communities, ready access to blood-lead screening combined with education about lead hazards has been shown to increase residents awareness of sources of lead and ways to prevent children's exposure to lead (e.g., Kimbrough et al. 1994; USEPA, 1996; and Matte, 1999).

The biomonitoring program will rely on the outreach services described in Section 5 to gain and maintain participation from the community. Similar to the outreach program, the final design of the biomonitoring program will be determined through active input from community members, especially regarding the methods considered to have the highest effectiveness in involving families with young children.

In order for biomonitoring to provide a benefit to the entire community by raising awareness of and preventing exposures to environmental sources of lead and arsenic it must be readily available to all resident families regardless of their income, primary language or location and type of housing. Because biotesting will be provided at no cost to residents, there are no financial barriers to family participation. However, if there are cultural or social barriers to active participation of families, then the program may need to provide incentives to families to gain their participation.

The following section describes the intended scope of the biomonitoring program followed by a number of options for structuring the outreach and associated biomonitoring services to best serve the diverse community within the VB/I70 site. The final design of this element of the CHP will come about

as part of the same process used to design the outreach, awareness and education services elements, as described above in Section 5. At the end of that process, a Biomonitoring Services Plan will be prepared by EPA to describe the specific procedures, schedules and outreach methods that will be used by the CHP.

6.1 Participation Eligibility and Scope of Monitoring

The CHP will provide no-cost blood-lead and urinary-arsenic testing for children, accompanied by one-on-one educational services, to all families who reside within the VB/I70 site boundaries. All young children under the age of 6 years and residing within the site boundaries will be eligible for annual blood-lead testing, or more frequent testing for children with elevated blood-lead levels as recommended by the child's physician or primary medical-care provider. Pregnant and nursing women will also be eligible for blood-lead screening to identify potential health risks from lead for their child. All children under the age of 6 years will also be eligible for annual urinary-arsenic testing, or more frequent testing if recommended by the child's physician or primary medical care provider. Children older than 6 years, and residing within the site, may also be eligible for either blood lead or urinary arsenic testing services if they have shown elevated levels at a younger age or if their primary guardian has reason to suspect recent exposure to hazardous levels of lead or arsenic. Decisions to test older children will be made by the Biomonitoring Nurse, with consultation from DDEH and the child's physician or medical-care provider, on a case-by-case basis.

6.1.1 Lead

Colorado's Blood-lead Screening Plan (CDPHE, 2001) identifies neighborhoods within the VB/I70 site as among those where children in Colorado have the highest risk for elevated blood-lead levels. The CDPHE Blood-lead Screening Plan recommends universal blood-lead screening for young children residing in such high-risk communities. This approach is based on CDC recommendations for screening of high-risk groups (CDC, 1997), including low-income children receiving Medicaid benefits (CDC, 2000b). CDC and CDPHE have the same goals for blood-lead screening of high-risk groups:

- blood-lead screening for children at 12 months and 24 months or when between 36 and 72 months if not previously tested and

- blood-lead retesting as needed for management of elevated blood-lead levels in young children.

In response to CDC recommendations for universal blood-lead screening for children from low-income families, Medicaid providers are now required to test blood-lead levels at the ages of 12 and 24 months for all young children receiving Medicaid benefits. However, at present there is no mechanism or organization involved in funding blood-lead tests for non-Medicaid-insured or un-insured resident families for whom the CDPHE has also recommended blood-lead screening.

The goals of the CHP's blood-lead screening program are as follows:

1. Provide all resident children with blood-lead screening at 12 and 24 months or between 36 and 72 months if not previously tested, either through the CHP's services or other health services within community, such as Medicaid providers for children with Medicare benefits.
2. Recommend and provide follow-up tests to confirm an elevated blood-lead level and refer to the child to DDEH for longer-term case management.

In order to meet these goals, the blood-lead monitoring program will strongly encourage families to have young children's blood-lead levels tested at 12 and 24 months. When a child is identified with a confirmed elevated blood-lead level (i.e., a venipuncture test result greater than or equal to 10 µg/dL), more frequent testing will be encouraged thereafter to track the child's blood-lead level as sources of lead are being investigated and addressed. CHP recommendations for follow-up testing and medical management for elevated blood-lead levels will be based on CDC guidelines (CDC, 1991 and 1997) and American Academy of Pediatrics treatment guidelines (AAP, 1995) (refer also to Section 6.4 below).

Appropriate incentives for families to have their children's blood-lead levels tested will be identified and evaluated for use in the CHP as part of the final design for the biomonitoring outreach program. For example, the CHP could give each family a $25 voucher for use at a local grocery store, up to one time per year, when they have a child's blood-lead level tested before 24 months or at 36 months.

6.1.2 Arsenic

Arsenic does not accumulate in a child's body over time. Therefore, urinary-arsenic testing is a used to identify effects from a recent exposure event rather than effects from long-term exposure. Ingestion of a large amount of soil can result in exposure to arsenic and other potentially toxic, but naturally occurring, constituents of soil. Children who repeatedly ingest large amounts of soil exhibit soil-pica behavior, which can be recognized by a parent or care giver. Therefore, the purpose of urinary-arsenic testing for children is to allow care givers to evaluate a child's exposure to arsenic as a result of pica behavior, which puts them at greater risk for exposure to arsenic and other potentially toxic constituents of soil.

The arsenic testing program will provide urinary-arsenic tests to young children who either exhibit soil-pica behavior or are suspected of having soil-pica behavior (e.g., elevated blood-lead level and frequent mouthing behavior). The focus of the arsenic testing program will be children under the age of 6 years, because these are the children most likely to exhibit soil pica behavior that results in possible health effects from arsenic exposure. Tests will be offered annually, to evaluate a child's recent exposure to sources of arsenic. In addition, urinary-arsenic testing may also be provided at other times of the year to a resident child who has a known recent ingestion from a potential source of arsenic, to evaluate potential health effects from that exposure. The program will rely on the awareness and education program to make parents and child-care workers aware of the outward symptoms associated with soil-pica behavior (e.g., frequent hand-to-mouth activity and ingestion of soil or other found objects) and the potential health risks from pica behavior in young children, including risk of acute exposure to arsenic and other soil constituents.

When a child shows an unusually high urinary-arsenic level (i.e., greater than 30 µg/L) the family will receive additional information and counseling regarding potential sources of the child's exposure and methods for prevention of ongoing exposure. The counseling provided by the CHP may include referral to a physician or medical case worker, and all elevated urinary-arsenic levels will be reported to the DDEH for tracking and potential further evaluation. More information about such referrals is provided in Section 6.4 below.

6.2 Potential Outreach and Recruitment Strategies

The fundamental objective of the outreach program described in Section 5 is to make residents aware that these testing services are available from the CHP. The primary target population is families with children under the age of 6. The outreach program will also target families with older children (ages 6 to 12), child-care workers, pre-school teachers and the medical providers serving communities within the VB/I70 site. In order to maximize the effectiveness of the outreach program, outreach strategies will be tailored to each target group and their specific needs or concerns. Target groups and the current level of biomonitoring outreach and services known to be available to them are listed in Table 6-1.

A number of contact and recruitment strategies will be considered during development of the outreach program. These strategies will be based on the group targeted, their needs for biomonitoring services and the extent and effectiveness of services currently available to them. Preliminary strategies for contact and recruitment are listed in Table 6-2; these options will be considered and evaluated, with community input, during the final design phase of the outreach program.

Table 6-1. Target Groups and Current Blood-lead Testing Services

Target Group	Current Outreach Services	Providers	Resultant Testing of Target Group
Medicaid families	Blood-lead testing at 12 and 24 months, or testing between 36 and 72 months if not previously tested, is a component of Medicaid coverage	Medicaid providers	CDPHE reports that some Medicaid children are still not being tested.
Non-Medicaid families in WIC[1] or similar health-services programs (e.g., Head Start)	Colorado Lead Poisoning Prevention Program encourages testing	Physicians or clinics, not reimbursed	Few families seek testing.
Non-Medicaid families enrolled in Colorado's Child Health Plan Plus program	None	Health Plan Plus providers	Not known.
Non-Medicaid, uninsured families	None	Physicians or clinics, not reimbursed	Few families seek testing.
Non-Medicaid, but insured families	None	Private physicians, partially reimbursed	Testing provided at physician's recommendation.

Notes:
[1] WIC = Supplemental Nutrition for Women, Infants and Children

Table 6-2. Potential Methods for Contact and Recruitment

Target Group	Contact Locations	Contact Methods
All families with children less than 72 months old	• Nursery/day care facilities • Pre-schools • Kindergartens (public schools) • Health fairs • Community groups • Door-to-door	Visits by CHP staff Printed materials for families "Give aways" for families and children (e.g., coloring book, soap kit) Presentations to adult groups
New mothers	• Hospital maternity ward • Maternity clinics • Nursery/day care facilities • WIC & other well-baby care programs	Printed materials for mothers "Give aways" for mothers and their babies (e.g., bibs)
Private practice pediatricians/family physicians	• Physician/medical associations • Local hospitals and clinics • Door-to-door	Printed materials Visits by CHP staff Phone
Public hospital and clinic pediatricians (Denver Health Medical Center)/family physicians	• Local hospitals and clinics • Physician/medical associations	Printed materials Visits by CHP staff with presentation

6.3 Testing Services

There are also a number of options for providing the biotesting services to residents, and these are to be considered and more fully evaluated through the final design process before finalization in the Biomonitoring Services Plan. Quality assurance protocols for blood and urine testing procedures are described in the *Sample Analysis Quality Assurance Plan for Urinary Arsenic and Blood Lead Among Residents of the VB/I70 Neighborhoods*, included as Appendix E.

6.3.1 Blood-lead Screening

Blood-lead testing will be available to site residents who are (1) children between the ages of 6 months and 72 months (6 years old), (2) pregnant and/or nursing women or (3) older children previously tested who continue to exhibit elevated blood-lead levels. Spanish interpretation will be available to Spanish-speaking families. Families with children ages 6 to 72 months will be encouraged to have their children tested annually unless a child's blood-lead level is at or above 10 μg/dL in which case more frequent monitoring will be recommended. Financial incentives to participate in the blood-lead monitoring program may be offered as appropriate (Section 3.2). Reminder cards will be mailed to all families either annually or as needed to have their children's blood-lead levels re-tested.

Four preliminary options for the blood-lead screening program are summarized below.

1. Blood-lead screening nurse service.

    - A nurse is available to visit locations where children can get blood-lead screening (homes, day cares, health fairs, etc.);
    - CHP funds nurse position and associated testing costs;
    - CHP manages all data and reports to DDEH and CDPHE lead program;
    - CHP provides referrals to medical providers.

2. Voucher-type screening service.

    - Families and physicians provided with vouchers for blood-lead testing by EPA's selected lab;
    - CHP funds testing and administrative costs;
    - CHP manages data and reports to managing physician, DDEH and CDPHE lead program;
    - Vouchers provided to target families via various contact methods;
    - Multiple vouchers available for children to allow repeat testing when needed.

3. Open-clinic setting.

    - The CHP sponsors a clinic where a nurse is available to perform blood-lead tests on specified, well-publicized dates (e.g., annually);
    - CHP funds nurse position and associated testing costs;
    - CHP manages all data and reports to DDEH and CDPHE lead program;
    - CHP provides referrals to medical providers for case management;

4. Cooperative agreement with public health agency.

    - The CHP funds a local public health agency (e.g., DDEH) to hire nursing staff and provide testing services for site residents;

- CHP funds nurse position and associated testing and administrative costs through annual budget from fund;
- Public agency manages data and reports to EPA and CDPHE.

For any of the above options, the CHP refers families to DDEH for case management and, when blood-lead levels are greater than or equal to 15 µg/dL for preliminary environmental investigation. For children with blood-lead levels greater than or equal to 10 µg/dL and less than 15 µg/dL, the CHP can provide an environmental investigation for lead at the child's home if requested to do so by DDEH or the family. All families with young children will be referred to the NDHC for lead-based paint testing and abatement services, regardless of the blood-lead levels of their children.

The blood-lead program will initially screen most children, and especially children under 36 months old, by collecting a capillary blood sample. Capillary samples can be collected in the field (at home or office setting) using either a finger-stick method and a glass collection tube or a drop and filter-paper method. The advantage of the finger-stick method is that enough blood can be collected for both the blood-lead and hemoglobin tests. The advantage of the drop and filter paper method is that a smaller volume of blood is needed and can be readily collected from an earlobe or heel. When the child is very young, the CHP nurse will consult with the child's parent in identifying the most comfortable collection method for that child. The CHP nurse may also recommend collecting an initial venous-blood sample, using the venipuncture method, if the child is strongly suspected of having a blood-lead level above 10 µg/dL (e.g., sibling or close friend has an elevated blood-lead level). Whenever possible, the participant will also have their hemoglobin checked when the blood-lead sample is collected. All adult participants (i.e., pregnant and nursing women) will have a venous sample collected and analyzed.

If a child's capillary-test blood-lead level is at or above 10 µg/dL, then a follow-up venous sample will be collected as soon as possible thereafter to confirm the initial result.

All blood-lead samples will be sent to a qualified, CDC-recognized laboratory that follows a documented quality assurance program. The laboratory will use CDC-approved methods for blood analysis, conform with CDC's recommended holding times for blood samples and participate in CDC's performance testing program for blood-lead analyses. Appendix E is the sample-analysis quality assurance plan that the CHP will use for blood-lead testing.

6.3.2 Urinary-Arsenic Testing

For urinary-arsenic testing, CHP outreach and awareness programs will inform residents about the availability of this testing service for young children suspected of unusually high soil consumption (soil-pica behavior) or of exposure to other sources of arsenic in and around their homes. Urine tests will be offered on an annual basis, in conjunction with the blood-lead screening, but can also be provided at other times of the year if warranted due to a young child's recent, and known, exposure to a potential source of arsenic. The urine test will be provided by the Biomonitoring Nurse services, which will provide instructions to a parent or guardian on collection of urine for testing. Urine samples can then be dropped off by the child's family at the CHP's local office for submission to a laboratory for arsenic analysis.

All urinary-arsenic samples will be sent to a qualified, CDC-recognized laboratory that follows a documented quality assurance program. The laboratory will use CDC-approved methods for urine analysis and report results for total non-dietary arsenic (inorganic arsenic plus methylated forms of inorganic arsenic). Appendix E is the sample-analysis quality assurance plan that the CHP will use for urinary-arsenic testing.

6.4 Case Management

When test results are received by the CHP from the laboratory, either the Program Administrator or Biomonitoring Nurse will provide those results, an explanation of their significance to the family of each tested child, and any recommendations for follow up testing directly to the family either by phone or in person. If the results are from a first screening-type test, then the CHP will strongly recommend a confirmation test be performed within 30 days of the original test. For elevated capillary blood-lead tests, the confirmation test is performed on a venous sample, collected using the venipuncture method. For elevated urinary-arsenic tests, the confirmation test is a repeat urine test.

At the same time that test results are reported to the family, either the Program Administrator or the Biomonitoring Nurse will complete the family interview questionnaire (Appendix A), to identify any risk factors for lead or arsenic exposure for young children, and then discuss those factors with the family. The questionnaire asks for family information and information on each child tested who is under 72 months old.

If the test result being reported to the family warrants medical management (as recommended by CDC), the CHP will request from the family permission to provide the test results to their family physician and will recommend that the family follow up with that physician. If the family does not have a regular physician/pediatrician for the subject child, then the CHP will coordinate with the Rocky Mountain Pediatric Environmental Health Specialty Unit (PEHSU), a collaborative of local, regional and national health and environmental agencies (including EPA), to identify an a pediatric environmental health specialist that the family can be referred to for additional case management or medical treatment services.

Reporting of blood-lead results to the child's family and, if warranted, a physician will be coordinated with the DDEH. As stated previously, all blood-lead test results collected by the CHP will be reported to the DDEH. This reporting will occur prior to contact with the family so that the appropriate case management services can be identified by and then coordinated between the CHP and DDEH.

The CHP will provide all families with information about lead and arsenic sources in and around the home, information to assist families in reducing their child's health risks and recognizing behaviors that may be related to a child's individual lead and arsenic exposure. The CHP may also recommend additional retesting within a specified timeframe. The CHP will provide the recommended follow-up testing, unless a family prefers to follow up with their own physician. If that is the case, then the CHP will send the physician information about the child along with previous CHP-test results.

If a child's blood-lead level is below 10 µg/dL the family will be encouraged to have their child re-tested annually until the child is 72 months old. If a child's blood-lead level is at or above 10 µg/dL, then the CDC's guidelines for retesting and clinical management will be followed. For all families with children having elevated blood-lead levels (greater than or equal to 10 µg/dL), the families will be strongly encouraged to participate in the environmental testing program either through follow up with the DDEH or through the CHP (refer to Section 7 for details on CHP environmental investigations).

All blood-lead and urinary-arsenic test results will also be reported to DDEH, and elevated blood-lead cases will be referred to the DDEH for follow-up case management. The DDEH will establish contact with the family to initiate an environmental investigation, in accordance with their own procedures, and set up a case-tracking file for the child. Although DDEH shall have primary responsibility for blood-lead case management, the CHP staff will be available to assist in working with the family to set up appointments, answer questions and provide any additional information needed to

respond to family concerns. The CHP can also assist DDEH in providing environmental investigations at homes of young children with elevated blood-lead levels, as described in Section 7. All case files maintained by DDEH shall remain confidential, in accordance with DDEH standard policy and procedures.

The CHP will have primary responsibility for managing cases of elevated urinary-arsenic levels. When a child has a confirmed elevated urinary-arsenic level, the CHP will report that result to the family and also provide information about potential sources of arsenic exposure, behaviors that increase a child's risk for acute arsenic exposure and the health effects of arsenic exposure. The CHP will also encourage the family to have their child's blood-lead tested, if not already done, and may refer the child to a local physician and will follow up with the family on a routine basis to track the child's health and progress in any environmental investigations or response actions.

6.5 Biomonitoring Result Reports

In order to keep participating agencies and community groups, as well as individuals within the community, informed about community-wide blood-lead and urinary-arsenic levels, the CHP will prepare an annual report of biomonitoring results. The report will summarize the program's activities for the previous year by including the following information:

- Number of children tested for lead, by age and by neighborhood;
- Number of children tested for arsenic, by age and by neighborhood;
- Range of blood-lead levels, geometric mean blood-lead level and percentage of children tested with blood-lead levels greater than or equal to 10 µg/dL (incidence of elevated blood-lead levels);
- Range of urinary-arsenic levels and percentage of children tested with urinary-arsenic levels greater than or equal to 30 µg/L; and
- Any neighborhood with higher than average incidence of either elevated blood-lead level or urinary-arsenic level.

These data will always be summarized in a manner that maintains the anonymity of biomonitoring participants and their families.

The annual report will be provided to the CHP work group, DDEH, NDHC, CDPHE and EPA. The report will also be available to the public and may be distributed through outreach efforts such as an internet website or remediation newsletter (refer to Section 5). The biomonitoring results will be evaluated annually by EPA and the CHP work group to identify any changes of concern or new information that may be used to increase the overall effectiveness of the CHP.

7.0 ENVIRONMENTAL TESTING AND EVALUATION PROGRAM

The CHP includes an environmental testing element that provides residents and property owners with investigation of sources of lead or arsenic around their homes.

7.1 Eligibility and Prioritization

Residents and property owners within the VB/I70 site will be able to request environmental investigation of their property for lead and arsenic through the CHP. The CHP will coordinate these requests with participating agencies, as follows:

- All properties within the site are eligible for EPA's Phase III soil sampling for lead and arsenic to determine whether yard soil concentrations exceed EPCs and will be removed as part of the soil remediation remedy component. The CHP will refer these requests to EPA, and the yard soils at these properties will be sampled in accordance with the *Soil Sampling and Remediation Design Work Plan;* EPA, 2003.

- Residential properties constructed prior to 1978, and home to a child with an elevated blood lead level, are eligible for lead-based paint testing by NDHC's Lead Safe Denver Program, which includes testing of interior and exterior paint, indoor dust and yard soil for lead. These services are offered to property owners meeting NDHC's income requirements (low to moderate income families). The CHP is to provide support to NDHC if needed to address priority requests (see below) in a timely manner.

- Families with a child with a confirmed blood-lead level greater than or equal to 10 µg/dL and less than 15 µg/dL are eligible for priority lead testing services from the CHP.

- Families with a child with a confirmed blood-lead level greater than or equal to 15 µg/dL are eligible for high-priority environmental lead investigation from DDEH; CHP to provide support to DDEH if needed to address high-priority cases in a timely manner.

7.2 Property Access for CHP Investigations

Before the CHP conducts an environmental investigation at an individual home, the property owner's consent for access must be obtained in writing. In the case of rental properties, access must be granted from the property owner and also from the current tenant. When requesting access for investigation, the CHP will explain the type of testing that will be performed and describe how these data

will be used. The access agreement (Appendix A) grants EPA permission to sample the property and use the data collected. EPA will not schedule any environmental investigation visit until receiving a signed access form, or forms, for the property to be tested.

7.3 Scheduling

Upon receiving a signed access agreement, the CHP will schedule a home visit with each of the participating families by phone. An CHP representative, either the Program Administrator or the Field Investigations Coordinator, will discuss the nature of the environmental testing, time required, any advance preparations needed for testing and the interview procedure to the residents by phone before setting up a time for the property visit. In the case of a family with a child having an elevated blood-lead level, CHP may also need to coordinate the schedule for the home visit with DDEH.

The investigation will be implemented in a manner that minimizes disruption and inconvenience at each residence investigated. The CHP will schedule sampling at times convenient to residents and request that an adult resident who has child-care responsibilities for the subject child (i.e., child with elevated blood-lead or urinary-arsenic result) be present for the duration of the home visit and the interview. If necessary, home visits may be scheduled during the evenings or weekends to accommodate residents' work schedules. Whenever possible, all sampling will be performed during a single visit. The collection of outdoor samples will be dependent on weather conditions.

7.4 Investigation Scope at Individual Properties

The scope of the CHP's environmental investigation in response to an elevated blood-lead level will include the family interview; exterior and interior paint testing and indoor dust sampling for lead analysis and focused soil sampling for lead analysis. When responding to a case of elevated urinary-arsenic in a child, the CHP's environmental investigation will include the family interview and Phase III soil sampling for arsenic, if Phase III soil sampling results are not already available for the property. Focused exterior dust sampling may also be included if an exterior dust source is indicated as a possible source of arsenic exposure.

7.4.1 Family Interview and Questionnaire

Information about the home environment and exposure-related behaviors of children with elevated blood-lead or urinary-arsenic levels will be collected through a face-to-face interview with a family member. The family interview will be performed immediately prior to the in-home environmental testing. The purpose of the interview is to collect information about the family, their children and their residence, but the interview will also be used as a means to explain the environmental investigation elements to the family and provide them with educational information about potential sources of lead and arsenic and prevention of exposure to levels of lead and arsenic considered hazardous to children's health.

The interview will be performed by a representative from either the CHP or DDEH using the Family Interview Questionnaire included in Appendix A. DDEH will be given the first opportunity to conduct the interview at homes of children with elevated blood-lead levels. If DDEH declines, the interview will be conducted by a CHP representative instead. The Family Interview Questionnaire includes questions about housing age and condition, remodeling activities, cleaning habits, occupation and hobbies of family members, individual children's mouthing behaviors, play behaviors and play areas.

7.5 Environmental Testing for Lead

The CHP's environmental investigation for lead will collect data to describe lead levels in interior and exterior paint, indoor dust and bare-area yard soils at residential properties. Environmental testing for lead (paint, dust and soil sampling) will be performed by a State-certified risk assessor for lead-based paint hazards using the procedures described below and detailed in Appendix C.

7.5.1 Paint Testing

The paint inspection and testing protocols presented in this plan have been developed to identify lead-based paint in poor condition and locate potential sources of direct lead exposure and lead in house dust and yard soil. The procedures for testing exterior and interior paint are based on HUD's *Guidelines for Evaluation and Control of Lead-Based Paint Hazards in Housing* (HUD, 1995). Paint testing will be performed by a lead-based-paint risk assessor who is trained and certified in accordance with requirements of the Colorado Air Quality Control Division's Regulation 19. All paint testing for lead will be performed in accordance with the Standard Operating Procedure (SOP) for Paint Testing (MFG-VBI70-02) (Appendix C).

At each property investigated, the paint investigation begins with the Family Interview Questionnaire, which provides the risk assessor with information regarding potential sources of lead exposure within and outside of the home. A visual assessment of paint conditions is then performed using the visual inspection procedures included in HUD's *Guidelines for Evaluation and Control of Lead-Based Paint Hazards in Housing* (HUD, 1995) and detailed in the SOP for Paint Testing (Appendix C). After the questionnaire and visual assessment have been completed, interior and exterior paint testing will be performed.

The lead content of interior and exterior paint will be tested *in situ* using a portable X-ray fluorescence (XRF) spectrometer. The paint testing method is non-destructive to paint and will not damage painted surfaces or underlying substrates. Detailed procedures for operating and maintaining the XRF instrument are provided in the SOP for Paint Testing and Assessment (Appendix C).

7.5.1.1 Interior Paint Testing Plan

The condition of interior paint will be assessed using the procedures detailed in the Paint Testing SOP (Appendix C). The visual assessment will be used to identify areas of the home for paint testing.

Interior paint will be tested in areas of the home frequented by young children (e.g., main living areas, children's bedrooms, kitchen, etc.) where deteriorated paint is present. As such, the areas of the home to be tested will depend on the results of the visual assessment and family interview. Deteriorated paint present on any painted furniture, cribs, toy closets or other areas that a young child may routinely and frequently come into contact with may also be tested. This approach will allow for identification of lead-based paint hazards throughout the home.

The lead content of deteriorated paint on walls, window and door components and moldings will be determined. In single rooms with walls that show deteriorated paint but distinct painting history for the various walls, each wall may be tested. For window components with deteriorated paint, paint on the window casing, sash and interior sill will be tested. When multiple windows with the same painting history are present, paint testing will focus on the oldest appearing painted working window in the room. If none of the windows in the room are in working condition, either the oldest appearing window or a window selected at random will be tested. For door assemblies with deteriorated paint, the lead content will be measured on the casing, the jamb (a possible friction surface) and the door. When multiple doors with the same painting history are present, testing may focus on the door likely to receive the most use.

Molding or decorative trim that is accessible to young children (less than 4 feet above the floor level) will be tested if deteriorated paint is present. The lead content of deteriorated paint on molding will be measured for each type of molding in the room, such as baseboard and chair rail types, which may have distinct painting history. If the paint on crown molding is in poor condition, it will also be tested. Other painted areas that may represent a source of exposure for young children, such as painted cabinets, may also be tested.

7.5.1.2 Exterior Paint Testing Plan

Paint on the exterior of the home and other structures (e.g., garage, storage shed) on the same property will also be visually assessed and tested when necessary.

The visual assessment will be performed first to identify any areas of deteriorated paint. If deteriorated paint is present, it will be tested for lead content. Testing may include exterior walls, entry doors and jambs, window assemblies and the horizontal or vertical trim components on the home. For windows, measurements will be obtained from the sill, casing, jamb and sash. For doors, the casing, jamb and door will be tested. Horizontal and/or vertical trim components will be tested on the side of the house where the paint is in the poorest condition. In addition, painted fences and painted storage sheds or other outbuildings on the property will be tested if the paint is in poor condition.

7.5.2 Dust Sampling

Sources of lead to interior house dust include outside sources such as soil and air emissions and also lead-based paint. The amount of dust and the lead concentration in dust may vary throughout a house. For this reason, dust will be collected from at least three areas of the home, including (1) heavy traffic areas such as main entries where tracking from outdoors may result in elevated lead levels in dust, (2) areas that are most accessible to children such as play areas and (3) areas where the paint is in poor condition (if any). The risk assessor will always select locations for dust sampling based on the results of visual paint assessment, family interview and family use patterns. A State-certified risk assessor will select sampling locations and collect the dust samples.

Dust samples will be collected from window sills and window troughs and from both carpeted and hard-surface floors. At each home, dust samples will be collected from a minimum of three windows

and three floor areas. Typically, the floor areas sampled will include high-traffic and high-use areas of the home such as the main entry, the primary entry to the main living area and the entry to a young child's bedroom. Dust samples may also be collected from other areas of the home frequented by that child and areas where paint is in poor condition.

Indoor house-dust samples will be collected for analysis of lead in accordance with the Dust Wipe Sampling SOP (MFG-VBI70-03) unless all of the floors are carpeted in which case the Vacuum Dust Sampling SOP (MFG-VBI70-04) will be used to collect the floor dust samples. Dust wipe samples will be collected from hard-surface floors and from window components. One dust wipe sample will be from an area of hard-surface flooring in each room where dust sampling is performed. One dust wipe sample will also be collected from one window sill and one window trough in the same rooms. Wipe samples from window components will be collected from a working window (i.e., window opens and closes). If there are no working windows in the room, then another area of the home may be selected for dust wipe sampling of window components.

The methods for collecting dust wipe samples are described in the SOP for Wipe Dust Sampling included in Appendix C. The dust wipes will be analyzed for lead, and results will be reported as a lead load per unit area (e.g., mg/ft^2).

When dust samples are collected using the vacuum method, floor dust will be collected from a carpeted area using a battery-operated air pump to collect dust in a pre-weighed filter cartridge. If there are two separate carpets in a room, such as an area rug overlying wall-to-wall carpeting, the area rug will be sampled since it is the most likely source of exposure for a young child. Using a sampling template, a one-square-foot area will be completely vacuumed using the air pump to collect the dust present. This procedure is documented in EPA's *Residential Sampling for Lead: Protocols for Dust and Soil Sampling* (EPA, 1995) and included in the SOP for Vacuum Dust Sampling (Appendix C). Dust samples will be shipped to an offsite laboratory for analysis of lead by flame atomic absorption spectrometry (EPA SW-846 Method 7420), as described by the Quality Assurance Project Plan (QAPP) in Appendix C. Results from lead analysis will be reported in mass of lead per unit mass of dust (e.g., mg/Kg), and the mass of dust collected will also be reported. These results will then be used to compute the lead load as the mass of lead per unit area (e.g., milligrams per square feet [mg/ft^2]).

For all dust samples, the exact location and type (wipe/vacuum, carpeted/uncarpeted) of sample will be described in field notes and recorded with other sample information.

7.5.3 Soil Sampling

Yard soil samples will be collected in accordance with the Soil Sampling SOP (MFG-VBI70-01) (Appendix C) to identify potential lead exposure hazards in residential yards. Before initiating soil sampling to identify potential lead-exposure hazards, the CHP will review all existing records of measured lead levels in yard soils at the property. EPA has already collected grab samples at a number of the properties sampled during the Phase III investigation. If such samples have already been collected, then those results will be used to assist samplers in selecting areas for sampling to support the lead-exposure evaluation.

The soil sampling performed to identify potential lead-exposure hazards will focus on areas of the yard where bare soil is present and readily accessible to young children. Examples of yard areas where bare soil is likely to be present include the foundation area or dripline around the home, play areas, garden areas or pet areas. The lead results for soils collected from these targeted bare areas will be provided to NDHC for their use in performing a lead-based paint risk assessment to evaluate potential sources of lead exposure for young resident children.

The sampling methods used at properties where a lead investigation is performed are consistent with those included in HUD's guidelines for evaluation of lead-based paint hazards. For each bare area, a composite sample from the top half-inch of bare soil will be collected for lead analysis. A detailed description of the hazard investigation soil-sampling procedure for lead is included in the Soil Sampling SOP (Appendix C).

All surface soil samples collected for lead analysis will be shipped to an offsite laboratory for analysis. Soil analyses for lead will be performed in accordance with EPA's SW-846 Method 6010B, inductively coupled plasma-atomic emission spectrometry (ICP) analysis. The entire sample volume submitted will be disaggregated, dried and sieved by the laboratory to homogenize prior to analysis. The less than 2-mm size fraction (passing 10-mesh sieve) will be used for analysis. Soil samples will be digested prior to ICP analysis using EPA's Method 3052 (microwave-assisted acid digestion using hydrofluoric acid). Quality control methods for laboratory analyses of soil samples are provided in the QAPP (Appendix C).

7.6 Environmental Testing for Arsenic

CHP's environmental investigation for arsenic will involve soil sampling to describe arsenic levels in yard soil. The soil sampling performed will be EPA's Phase III soil sampling methodology, as described in the Soil Removal and Replacement Design Work Plan (EPA, 2003a) and the Soil Sampling SOP in Appendix C. The CHP will also complete the family interview questionnaire (Appendix A) to identify risk factors for arsenic exposure and to assist with longer term case management for the child.

Before the CHP samples soil at the home of a child with an elevated urinary arsenic level, the program will check EPA's database for previous records of Phase III soil sampling. If the Phase III soil sampling has already been completed, the results will be reviewed and also reported to the current residents.

If there are no Phase III soil sampling results for the subject property, the CHP will perform the soil sampling as soon as practicable depending on weather conditions (i.e., within 3 months during winter months and within 30 days during summer months). The sampling will be performed in accordance with EPA's Phase III soil sampling methodology (refer to Soil Sampling SOP, Appendix C), and the Phase III soil samples will be analyzed for both lead and arsenic. The Phase III results will be reported to the child's family, a landlord, and the DDEH; Phase III sampling results obtained by the CHP will also be incorporated into the EPA database for use by the soil remediation program.

If the Phase III soil sample data demonstrate that the arsenic concentration in yard soil is above the removal action level, then the family will be informed of this, and the soil remediation program will be notified of the need to prioritize yard soil remediation at the property. If possible, the soil remediation program will remediate yard soil at the property within 6 months of notification. The family will be informed about ways to prevent soil ingestion by their child and reduce soil pica behavior, if such behavior has been exhibited by the child.

7.7 Environmental Data Management and Reporting

Detailed records of environmental testing data and family interview responses will be maintained for each property investigated by the CHP. Data management and documentation will begin at the home visit but will also entail addition of laboratory analysis results and compilation of data into property-

specific result reports. Requirements for on-site documentation of environmental testing results are included in the SOPs for each testing or sampling procedure.

Data collected at each of the participating properties will be recorded on field data forms but also entered into a central electronic database. Property-specific information will be tracked using a unique identification number assigned to each property. All hard-copy records for an individual property will be maintained in a single file, cross referenced by the property identification number. Those records shall include: signed access forms, release forms (if biomonitoring participants), field forms and data sheets, field notes and maps, family interview questionnaire, laboratory analysis results, data quality review results, and released blood-lead or urinary-arsenic data for children residing at the property, if provided by the resident.

For each of the participating properties, a final report will be compiled to summarize the environmental testing results. That report will describe the results for each type of testing performed in and around the home. For example, all lead and/or arsenic data for soil samples collected on the property will be reported along with descriptions of the sample locations. For all elevated blood-lead and elevated urinary-arsenic cases, the property report will be provided to DDEH for their records. CHP staff, typically the Program Administrator, will also present the property report, in person, to a family representative in order to provide a property-specific explanation of the results. If appropriate, the CHP will recommend that the family contact either the NDHC or DDEH for follow-up services and will provide names and phone numbers for contacts at both of these agencies, as described in greater detail in Section 8.

8.0 INTER-AGENCY COORDINATION OF RESPONSE ACTIONS

The CHP will obtain information about children's blood-lead and urinary-arsenic levels at residential properties where the CHP performs environmental investigations, and levels of lead and arsenic in potential exposure sources. This section describes the plan for responding to elevated blood-lead or urinary-arsenic levels and coordinating responses that address sources of lead and/or arsenic exposure at residential properties. These responses will be coordinated with the affiliated agencies, currently DDEH and NDHC, and health care providers such as Denver Health Medical Center.

8.1 Response to Elevated Blood-lead Level

The CHP response to a child with an elevated blood-lead level is described by the flow diagram in Figure 8-1. The CHP will report all elevated blood-lead test results to DDEH and CDPHE.

The DDEH's current policy regarding response to elevated blood-lead levels is to conduct an environmental investigation at homes of children with a confirmed blood-lead test result (i.e., by venipuncture test) greater than or equal to 20 µg/dL or two confirmed blood-lead test results greater than or equal to 15 µg/dL or upon special request from a health care provider or agency.

For venous test results less than 15 µg/dL but greater than or equal to 10 µg/dL or one venous test result less than 20 µg/dL, CHP will respond by offering an environmental investigation and case management services to the child's family. The CHP's response actions will be coordinated with DDEH so that they are informed of the child's case status and, if an environmental investigation is performed, findings at the child's residence. Alternatively, the DDEH may elect to manage specific cases upon notification of blood-lead level less than 15µg/dL (e.g., child is sibling of a DDEH-case child).

The case management response offered by the CHP is described with the biomonitoring program in Section 6, and the environmental investigation response is described in Section 7.

8.2 Response to Elevated Urinary-Arsenic Level

The CHP's response to a child with an elevated urinary-arsenic level is described by the flow diagram in Figure 8-7. The CHP will report all urinary-arsenic results to DDEH.

For test results greater than or equal to 30 µg/L, the CHP will respond by offering Phase III soil testing and case management services to the child's family. The CHP's response actions will be coordinated with DDEH so that they are informed of the child's case status and, if soil sampling is performed, the arsenic EPCs for yard soils at the child's residence. Alternatively, the DDEH may elect to manage specific cases upon notification of the urinary-arsenic level (e.g., child also has an elevated blood-lead level).

The case management response offered by the CHP is described with the biomonitoring program in Section 6, and the environmental investigation response is described in Section 7.

8.3 Response to Findings of Environmental Investigations at Residential Properties

The CHP will report all environmental investigation results to DDEH, NDHC and the work group. When the CHP identifies lead-based paint hazards, this information is passed along to NDHC, and NDHC responds those findings, either through additional lead-based paint risk assessment or development of a lead abatement plan. These activities are partially funded by NDHC's HUD grant, but in order for property owners to receive lead-abatement services at no cost, the owner must agree to the conditions of NDHC's "forgivable loan" program.

When the CHP identifies potentially hazardous levels of lead or arsenic in child-accessible yard soils, the individual property investigation results will be reviewed with the work group to determine appropriate response action for soil-lead or soil-arsenic hazards. If exterior lead-based paint hazards are also present, then the NDHC will likely complete a response action for soil hazards as well. If only soil lead or arsenic hazards are present, then the CHP will identify the property as "high priority" for soil remediation, and EPA's soil remediation program will address the potential hazards in soil.

9.0 DATA MANAGEMENT, RECORD KEEPING AND REPORTING

Data collected by the CHP's biomonitoring and environmental investigation programs will be managed to assist in coordinating response actions and for future use in evaluating the overall approach of the remedy selected for the VB/I70 site in addressing health risks from environmental sources of lead and arsenic. Both hard-copy record keeping and electronic data management systems will be operated and maintained as part of the CHP. Biomonitoring data management will require coordination with the DDEH and CDPHE. In addition, the CHP will have primary responsibility for maintenance of records describing the results of CHP environmental investigations and response actions at individual properties and to document work group meetings and recommendations and implementation of the program's outreach, awareness and education programs.

An electronic database will be the primary tool for data management and will have the following functions:

- Store blood-lead data for numerous children and for multiple test results for the same child;
- Store urinary-arsenic test data for numerous children and for multiple tests results from the same child;
- Document and report environmental test results for individual properties;
- Link paired blood-lead or urinary-arsenic and environmental test results for individual residents;
- Maintain confidentiality and integrity of data for future data uses;
- Allow generation of output reports in usable formats;
- Provide for accurate and efficient import or input of data;
- Provide a tool to summarize findings for analysis and evaluation by the work group and review panel members and assist in ongoing evaluation of the program;
- Allow flexibility in data export and retrieval; and
- Provide readily accessible data for reference by EPA, DDEH and CDPHE.

The primary function of the electronic database will be to efficiently store data collected by the CHP and to maintain that data in a readily accessible and usable format.

The electronic database will include the following minimum information for properties within the VB/I70 site: address; dates and results of all environmental testing, including results of EPA's Phase III soil testing methodology; status regarding the need for soil remediation as part of VB/I70 remedy and

date soil remediation completed, if appropriate; dates of referral to NDHC for lead-based paint response actions; other response actions taken, responsible party and date action(s) completed. For all families participating in the CHP's biomonitoring program the electronic database will include, at a minimum: family name and current residence, number and birth dates of children in family; date of entry into program, dates of tests for each child tested, methods and results for each test and address of child's primary residence at date of each test.

The electronic database will include a unique identification number for each participating property and family. The CHP will use these identification numbers to track field, laboratory and interview records. In addition, all reports generated by the CHP will also use these identification numbers when referring to participants. The database will contain links from the unique identifiers to the real property address and children's and family names, but those names will not be included in the study reports issued to the work group, EPA or the public.

In addition to the data stored in an electronic database, property files will also be maintained in hard-copy format at the CHP's local office. The property files will include all of the information stored electronically but will also manage other records such as laboratory data reports and quality assurance documentation; relevant correspondence with property owners, residents and participating agencies; and documentation of property investigations performed by the CHP including, family questionnaires, photographs of the property, field notes and sampling maps; final investigation result reports; and records of work group discussion of and recommendations for response actions. The hard-copy property files will be maintained for the life span of the CHP and will either be stored in perpetuity thereafter or otherwise recorded, with appropriate technology (e.g., microfilm, scan to CD, etc.), for perpetual storage.

9.1 Electronic Data Entry and Export

New information will be entered into the database on an ongoing basis using a combination of methods. New blood-lead and urinary-arsenic test results, environmental sampling results and questionnaire responses will generally be input by hand using a series of data entry screens designed to facilitate efficient, accurate and consistent data entry and include pull-down lists of valid entries for many of the data fields. All manual data entries will be reviewed and checked to ensure accuracy. Entries that have been checked will be distinguished from those that have not and only those entries that have been reviewed and verified will be considered usable.

Data stored in the electronic database may be retrieved using pre-designed retrieval forms and reports or through custom queries and reports developed by a data user. Using the data retrieval forms developed for the database, a user may generate reports for specific properties or specific time frames in response to requests for information from the DDEH, CDPHE, NDHC and the work group.

9.2 Database Reports

A number of reports will be routinely generated from the electronic database to assist in reviewing results, managing various CHP elements and tracking progress at individual properties or for individual participants. For each property with environmental investigation results, a summary report will be generated to provide the results to the work group, property owner and residents.

The database will also be used to periodically generate the annual biomonitoring result report, periodically review results from various areas within the VB/I70 site and track retest schedules and results for children who require ongoing monitoring.

10.0 PERFORMANCE MEASURES

Performance measures are being established for the CHP to ensure that this element of the VB/I70 site remedy is implemented in a manner that will be effective in addressing the community's needs for environmental health services.

10.1 Performance Measures

Certain program activities will be tracked for evaluation of the program's performance relative to the remedy's objectives.

1. Biomonitoring Participation

Participation in the biomonitoring program will be used to evaluate the effectiveness of the program's outreach and awareness efforts in each neighborhood. The performance goal for the CHP will be to increase the percentage of children that receive blood-lead testing over that currently provided through existing services (excluding the one-time Kids at Play study services). Performance will be demonstrated through consistent year-to-year participation numbers in the biomonitoring program.

If participation in the biomonitoring program, as demonstrated through numbers of children receiving blood-lead tests in accordance with CDPHE's goals for the neighborhoods within the site, is low or diminishes over time, then the CHP will seek community input regarding ways to improve participation and incorporate new recruitment strategies into its outreach program. Community input may be provided through participation of community members in the work group.

2. Lead-Paint Referrals

The number of referrals to the NDHC for lead-based paint risk assessment or abatement services will be tracked to evaluate the program's utility as a clearing house for lead-risk-reduction information for the entire community, not just families with young children.

If the number of referrals of families residing in the VB/I70 neighborhoods to NDHC does not improve over current numbers or if the number of referrals diminishes over time, then the CHP will seek

community input regarding ways to improve community awareness of the NDHC's services and potential health risks to young children from lead-based paint. Community input may be provided through participation of community members in the work group.

3. Community Involvement

CHP staff contacts with residents and property owners will be recorded by the program's staff and tracked by the work group to demonstrate that CHP staff persons are accessible to and involved in the community.

4. Environmental Investigation and Response

CHP environmental investigations will be tracked along with other investigations performed by DDEH, NDHC, or others, in response to elevated blood-lead or urinary-arsenic levels. The performance goal is contact of 100% of case families for environmental investigation and 75% completion rate for the investigation response.

10.2 Duration of the Community Health Program Component of Remedy

The CHP will operate under EPA management until soil remediation is completed (duration currently anticipated is 4 years). Thereafter, the CHP will operate by utilizing the established management structure and programmatic plans, procedures and materials and with the support of affiliated agencies and community groups.

10.3 Annual Reports and EPA Review

The Program Administrator will be responsible for compiling and reporting the following information to the work group and to EPA on an annual basis;

- Annual biomonitoring result report;
- Annual outreach, awareness and education programs activity report;
- Annual environmental investigation activities report; and
- Annual evaluation of program performance relative to the performance measures identified above.

11.0 SCHEDULE

The CHP will be implemented in accordance with this design work plan within 120 days of EPA's final ROD announcement for OU1 of the VB/I70 site. Table 11-1 identifies several separate tasks and their schedule for implementation.

Table 11-1. Community Health Program Implementation Schedule

Schedule Item	Description	Start	End
1	Community input and involvement on final design for outreach, awareness and education programs	Within 120 days of ROD	6 to 8 months
2	Completion of neighborhood- or site-specific outreach, awareness and education plans and final Biomonitoring Services Plan in coordination with participating agencies	Within 120 days of ROD	Within 9 months of ROD
3	Implement all elements of CHP, including availability of biotesting and environmental investigation services	Within 9 months of ROD	Minimum 5 years from start date or until soil remediation complete
4	Annual blood-lead screening initiative	Within 12 months of ROD	Annually for as long as program operates
5	Coordinate response actions with participating agencies	Within 12 months of ROD	For as long as program operates
6	Complete EPA-managed phase of CHP	----	Completion of soil remediation/construction completion

12.0 PRELIMINARY COST ESTIMATE

The preliminary cost estimate for the CHP is based on the general scope described in this design work plan. The actual scope of certain components of the CHP, such as the biomonitoring program and outreach and education programs, will be developed following EPA's ROD and more detailed coordination among the local agencies participating in the CHP.

Assuming the staffing requirements described in Section 4, costs to develop, manage and implement the CHP average approximately $495,000 per year (Table 12-1). The total costs estimated for the CHP, assuming a 4-year duration for the program, are approximately $2 million.

Table 12-1. Preliminary Cost Estimate for Annual Operating Expenses
Community Health Program
Vasquez Boulevard/Interstate 70 Superfund Site

		Labor		Materials	Services	
Task	**Community Health Program Annual Costs**	Hours	Cost			**Annual Total**
1	Program Management and Administration	2280	$189,000	$18,000		$207,000
2	Outreach/Awareness/Education	720	$46,800	$5,000	$15,200	$67,000
3	Biomonitoring	1000	$57,800	$20,000	$71,000	$148,800
4	Environmental Investigations	320	$27,200	$6,000	$6,750	$39,950
	Annual Subtotal	**4320**	**$320,800**	**$49,000**	**$92,950**	**$462,750**
	Health & Safety (5% of labor)		$16,040			+ $16,040
	Project Management (5% of labor)		$16,040			+ $16,040
Annual Total			**$352,880**	**$49,000**	**$92,950**	**$494,830**

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FIGURES

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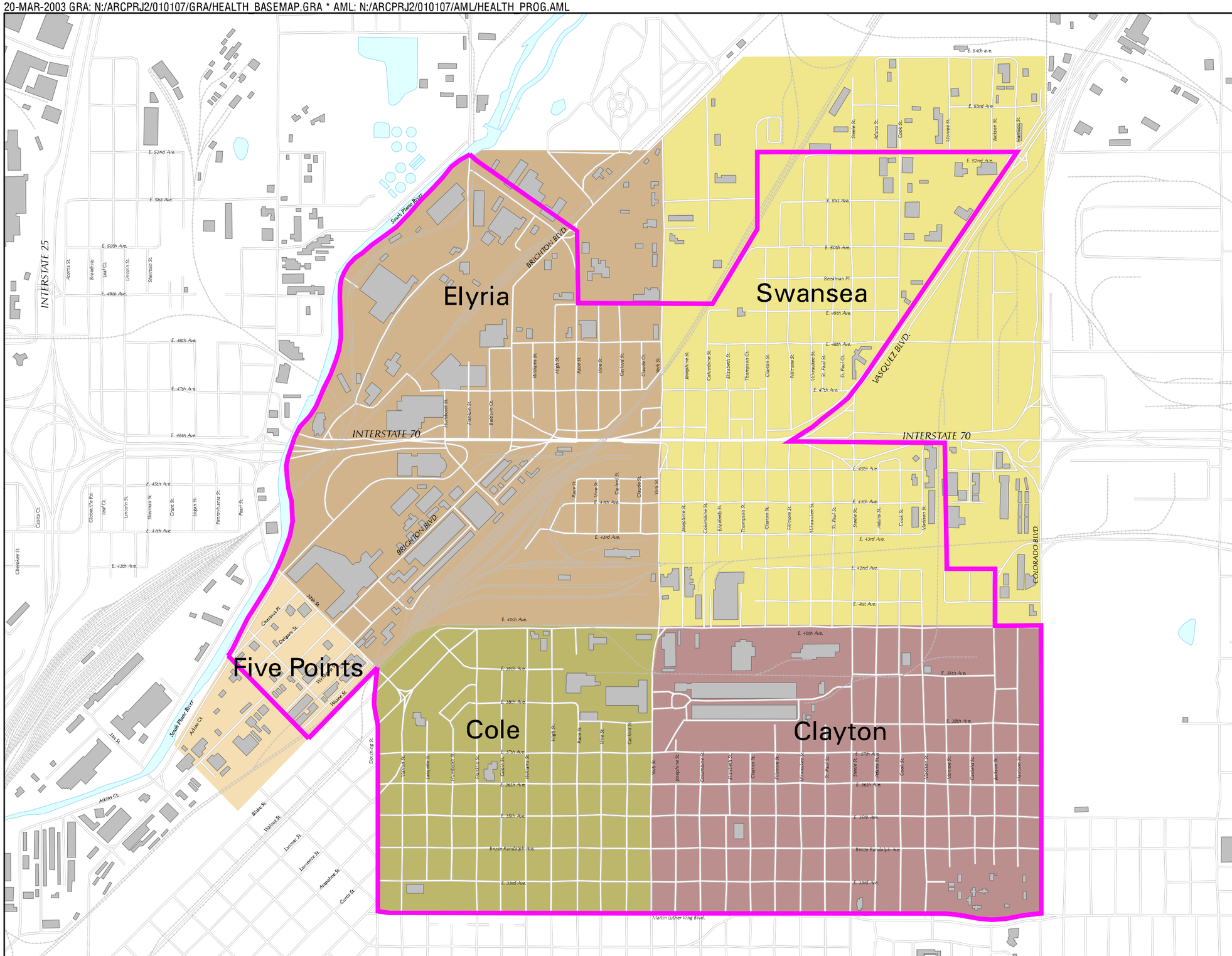

EXPLANATION

Hydrography

- Water

Transportation

- Roads
- Railroad

Other Features

- Buildings
- OU1 Site Boundary

Neighborhoods

- Clayton
- Cole
- Elyria
- Five Points
- Swansea

N

SCALE IN MILES

0.25 0 0.25

COMMUNITY HEALTH PROGRAM
DESIGN WORK PLAN

VASQUEZ BOULEVARD/
INTERSTATE 70 SUPERFUND SITE

FIGURE 1- 1
VASQUEZ BOULEVARD/I- 70 SITE,
OPERABLE UNIT 1, OFF- FACILITY SOILS
SITE BOUNDARY AND NEIGHBORHOODS

PROJECT: 01- 0107x- 11	DATE: MAR 20, 2003	
REV: 0	BY: ALB	CHECKED: KJT

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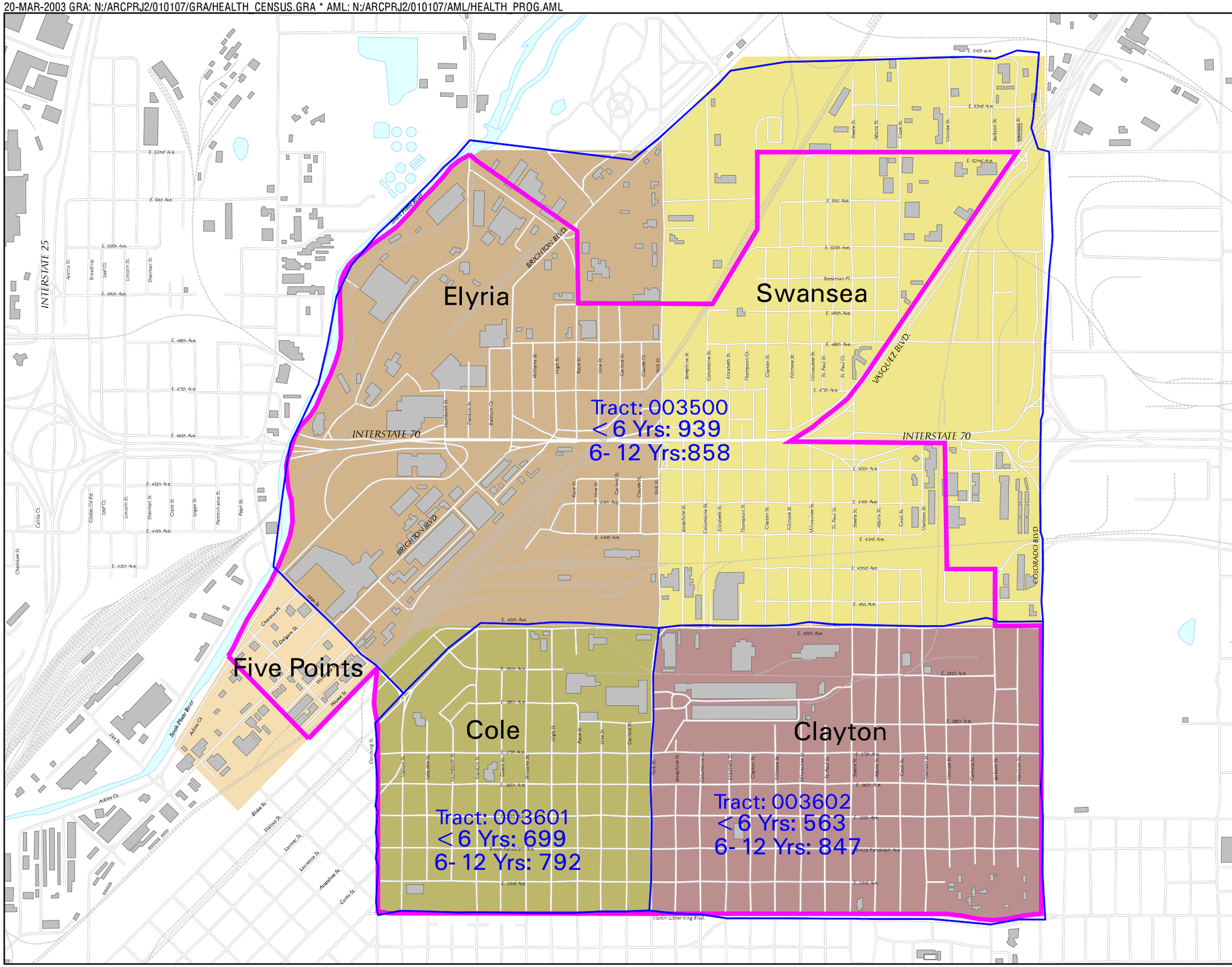

EXPLANATION

Hydrography

Water

Transportation

Roads
Railroad

Other Features

Buildings
OU1 Site Boundary
2000 Census Tract

Tract: Tract Number
< 6Yrs: Number of resident children less than 6 years old
6- 12 Yrs: Number of resident children between 6 and 12 years old

Neighborhoods

Clayton
Cole
Elyria
Five Points
Swansea

N

SCALE IN MILES

0.25 0 0.25

COMMUNITY HEALTH PROGRAM DESIGN WORK PLAN

VASQUEZ BOULEVARD/ INTERSTATE 70 SUPERFUND SITE

FIGURE 2- 1

2000 CENSUS RESULTS FOR RESIDENT CHILDREN

PROJECT: 01- 0107x- 11	DATE: MAR 20, 2003	
REV: 0	BY: ALB	CHECKED: KJT

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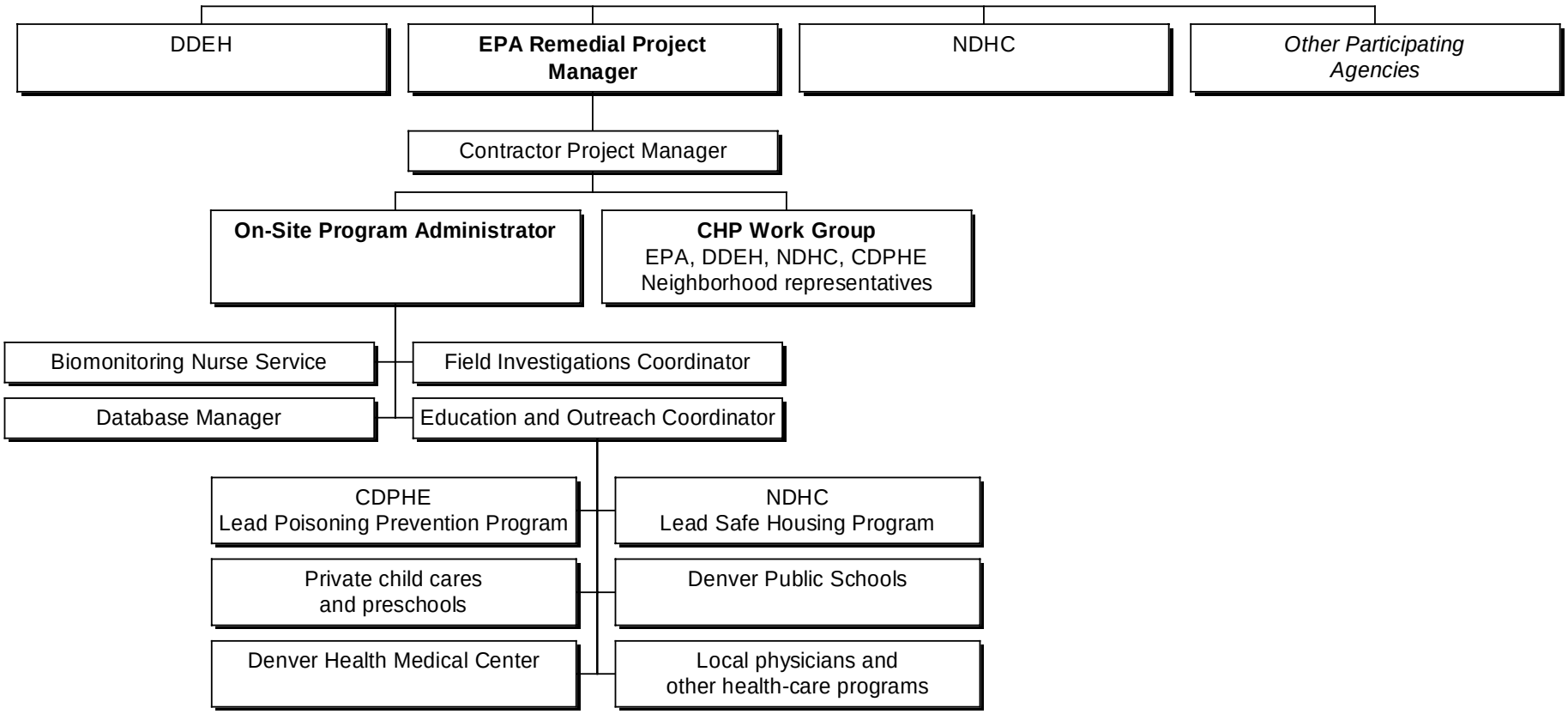
VB/I70 Site Community Health Program Organization



COMMUNITY HEALTH PROGRAM DESIGN WORK PLAN

VASQUEZ BOULEVARD/ INTERSTATE 70 SUPERFUND SITE

FIGURE 4-1

COMMUNITY HEALTH PROGRAM ORGANIZATION CHART

PROJ: 01-0107x.11	DATE: FEB 19, 2003	
REV: 0	BY: KJT	CHK:

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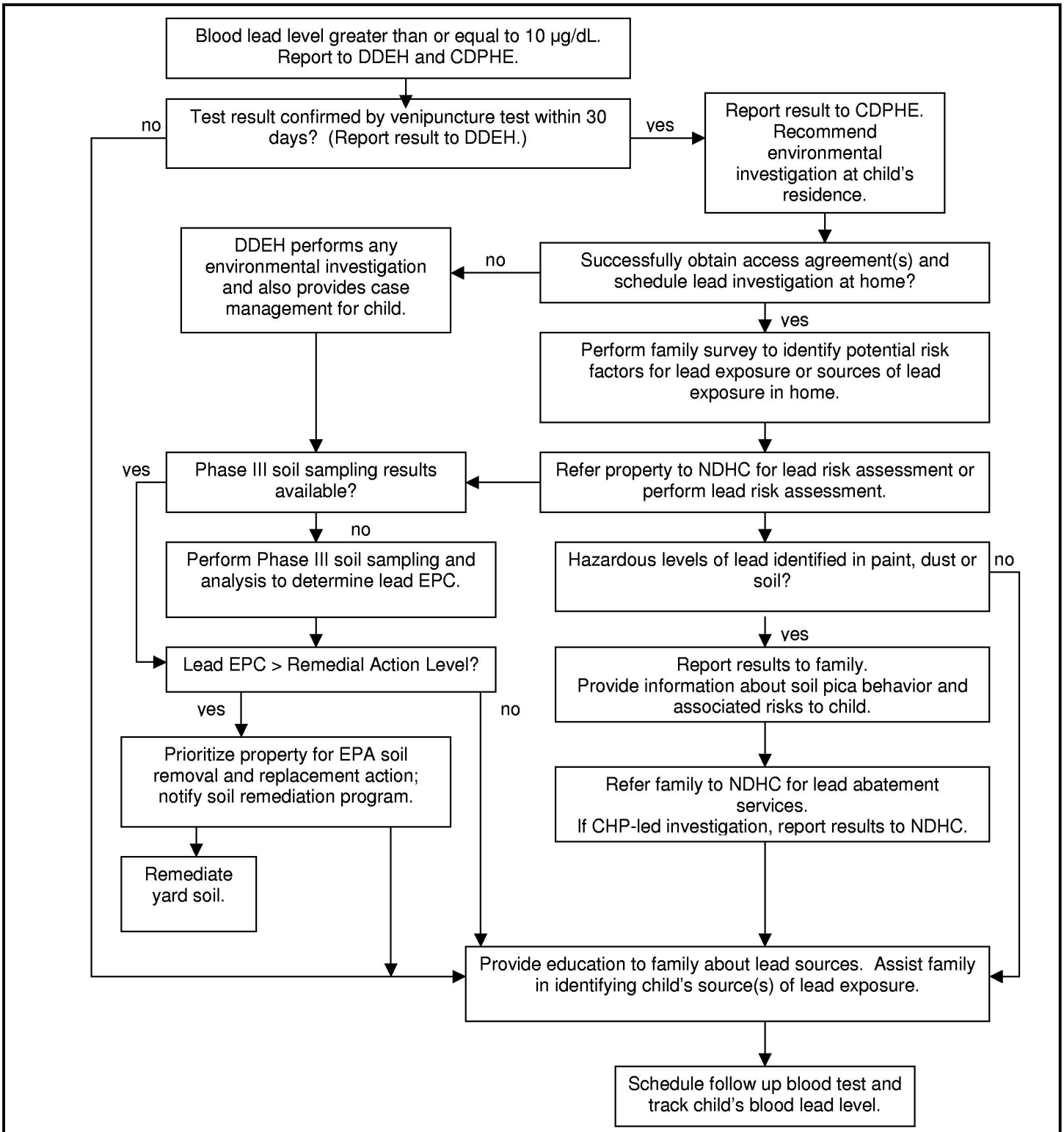

COMMUNITY HEALTH PROGRAM DESIGN WORK PLAN

VASQUEZ BOULEVARD/ INTERSTATE 70 SUPERFUND SITE

FIGURE 8-1
Response to Elevated Blood Lead Level (for children under 6 years old)

PROJ: 01-0107x	DATE: MAR 20, 2003	
REV: 0	BY: CRL	CHK: KJT

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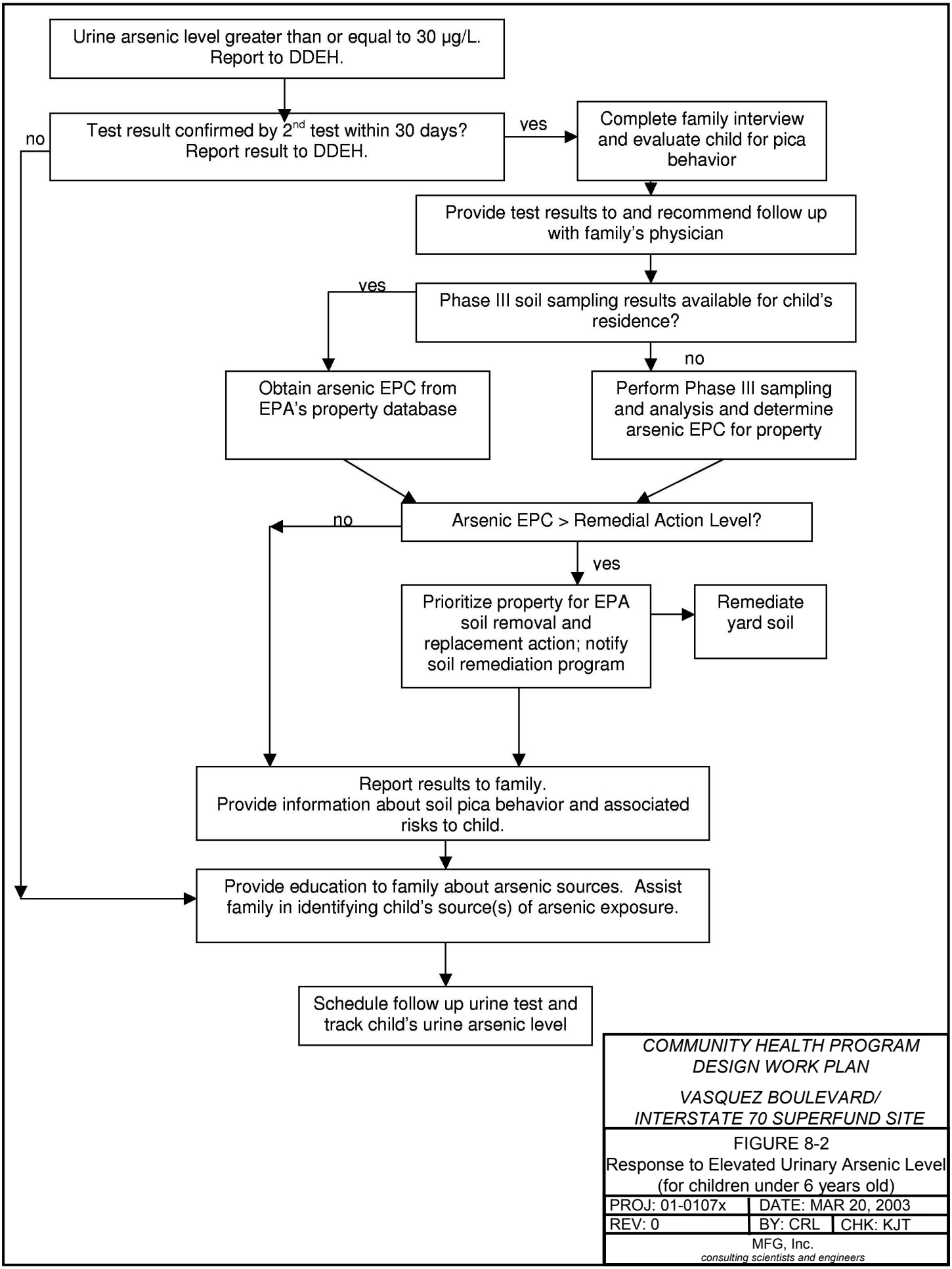

COMMUNITY HEALTH PROGRAM DESIGN WORK PLAN

VASQUEZ BOULEVARD/ INTERSTATE 70 SUPERFUND SITE

FIGURE 8-2
Response to Elevated Urinary Arsenic Level (for children under 6 years old)

PROJ: 01-0107x	DATE: MAR 20, 2003	
REV: 0	BY: CRL	CHK: KJT

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APPENDICES

APPENDIX A

FORMS

Medical Release Form
Access Agreement Form
Family Interview Questionnaire

DRAFT PENDING DDEH REVIEW

ACCESS AGREEMENT FORM
VASQUEZ BOULEVARD/I-70 SITE
COMMUNITY HEALTH PROGRAM - ENVIRONMENTAL INVESTIGATION

Resident Name: _____

Property Address: _____

_____

_____

Resident Phone No.: _____

Property Owner Name and Address (if different than resident): _____

_____

_____

Property Owner Phone No.: _____

The U.S. Environmental Protection Agency's (EPA) Community Health Program is requesting your voluntary participation in an investigation of the potential sources of lead and arsenic exposure in and around your home, and permission to access the property for soil sampling, paint testing and dust sampling. An interview will also be conducted to record additional information about your home and your family. None of these activities causes any damage to the property and all are performed while you are at home. The investigation activities are described in more detail in the Community Health Program Design Work Plan (copies of the work plan are available upon request).

The specific date that your property will be investigated has not been set. We will call you to arrange for an appropriate time to sample your property.

The Community Health Program will report the results of the property investigation to you and also provide an explanation of those results. If requested, the Community Health Program can also provide you with splits of samples so that you can have them tested independently. If lead-based paint is identified in or outside of your home, then this information will also be provided to the Northeast Denver Housing Center. The results may also be provided to the City and County of Denver's Department of Environmental Health so that their staff can provide follow-up case-management services to your family.

Note that by investigating a property, EPA is not confirming that a risk to human health is known to be present or that any response is necessary.

If you are willing to grant access to EPA, and their contractors, and release of the resultant sampling results as described above, please complete all information below, sign on the signature line and include today's date.

Should you have any questions about the pilot study or your participation in the study, please contact _____, EPA, at 303-____-_____.

I hereby grant access to the property described above to EPA and/or its contractor(s) for the above-mentioned activities.

Resident Signature Date

Owner Signature Date

1 copy: Resident
Owner
EPA

DRAFT PENDING DDEH REVIEW

DATA RELEASE FORM
VASQUEZ BOULEVARD/I-70 SITE
COMMUNITY HEALTH PROGRAM – BIOMONITORING PROGRAM

Resident Name:_____

Property Address: _____

_____

_____

Resident Phone No.: _____

The U.S. Environmental Protection Agency (EPA) is requesting your voluntary participation in the Community Health Program in order to have your child tested for blood lead level or urinary arsenic level (or both). If you choose to participate by having your child tested, EPA is requesting that you allow us to use your name, address, and telephone number and the test results for your child to coordinate any needed response action with public health agencies such as the City and County of Denver Department of Environmental Health and Denver Health Medical Center.

We are asking you to sign this release form so that we may pass this information and your child's test results on to the City and County of Denver Department of Environmental Health for their use in tracking environmental health of Denver children.

EPA also requests that you provide the Community Health Program with results of any recent blood lead and urine arsenic tests performed on persons residing at this property if they are available to you, or that you grant EPA permission to request these data from either the City and County of Denver Department of Environmental Health or your physician or medical-care provider if you do not have the test results available. Provision of these medical test results is not required for participation in the Community Health Program or to receive blood lead or urinary arsenic testing. However, it will be helpful for EPA to have these data when reviewing the results from your child's most recent tests.

All data released to EPA will be used to evaluate possible health risks that may be present for individual children. These data will also contribute to EPA's overall understanding of the causes for elevated blood lead and urine arsenic levels in young children in your neighborhood. These results will be available for review and use by EPA and its contractor(s), but they will be used in confidence. Names and/or addresses associated with the medical test results will not be used in any records that may be made available to the public through EPA's administrative record for the Superfund Site.

If you agree to the release of information associated with your child's medical tests, as described above, please complete all information below, sign on the signature line and include today's date.

Should you have any questions about the Community Health Program, your participation or use of the released information, please contact the Program Administrator, _____, at 303-___-____.

I hereby authorize EPA to receive blood lead and urinary arsenic test results for my child (or children), and provide this information to the Denver Department of Environmental Health for the previously described uses.

_____

Signature Date

1 copy: Resident
DDEH
EPA

Community Health Program
Family Survey Questionnaire

Property ID No.

Date: _____ DEH EBL Case# _____

Interviewer _____ Other _____

Translator _____

Home Address _____ Zip _____

Mailing Address (if different) _____

Primary Adult Contacts (Parents, Guardians, Grandparents, etc.)

Name(s)	Relationship to EBL Child Mother/Father/other (specify)	Primary Survey Respondent? (Yes/No)

Survey Respondent (if different than above) _____ Relationship _____

Telephone #s (for primary contacts) _____ Home _____ Work

_____ Cellular

If we need to contact you, what language should we use? English Spanish Other _____

Are you the owner of this residence? **Yes** **No**

If no, who is the owner? (name, address, phone#) _____ Relation to Family? (Yes / No)

_____

_____

Year of Construction: _____ Estimated ☐ Confirmed c/ assessor record ☐

If rental, is it OK to contact the landlord if we find problems with the house? **Yes** **No**

Property ID No.

Child EBL Case-Management Information

Note: information requested on next two pages may be provided to City and County of Denver Department of Environmental Health only with valid/signed medical release form from parent or legal guardian.

Name: _____
First Middle Last

Date of Birth: _____/_____/_____ Gender: F / M

Blood Lead Results

Date	Blood Lead Results	Venous/Cap /Unknown	Source/Clinic (DHMC, etc.)

Why was child tested for lead? Routine Exam Parent request (e.g., pica behavior)

Other (specify) _____

1. Was the child tested for anemia or iron levels? Yes / No
2. If so, what was the result? Anemic / "OK" / Don't know
3. Were you told to give the child iron supplements? Yes / No / Don't Know
4. Where did you get your LEAD blood test done? Were there other previous lead tests? Where? / by Whom?
   (Note if additional tests or different info than above)

Approx Date	Clinic Name	Address	Clinician Name	Phone

5. Does child have insurance? What kind? None Medicaid CHP+ Private _____ Other
6. Do you know anyone else (relative, neighbor, playmate/close friend of child) who has had a high blood lead test?
   (name, relationship, address, etc.)

Property ID No.

List children under six years old living in your home:

First Name	Last Name	Gender	DOB (young children only)	Age	Lives in house at least 3 months/year	Had a PbB Test? (List result if known)
		M / F			Y / N	Y / N
		M / F			Y / N	Y / N
		M / F			Y / N	Y / N
		M / F			Y / N	Y / N
		M / F			Y / N	Y / N
		M / F			Y / N	Y / N

How many children 6 years old or older live in your home? **0 1 2 3 4 5 6**

Notes:

List young children that frequently visit the home (neighbors, friends, cousins, etc.):

First Name	Last Name	Gender	Age (approx.)	Describe how often they visit your home: (e.g., how many hours per week)	Do you know if they had a lead test? (result if known)
		M / F			Y / N
		M / F			Y / N
		M / F			Y / N
		M / F			Y / N
		M / F			Y / N

Notes:

Property ID No.

Housing Questionnaire

1. When did you move into your home? _____ **month** _____ **year**

2. Has there been any remodeling or painting at your residence? **Yes** **No** Don't know
If yes, when? _____
what was done?_____

If YES to painting, Did you sand before you painted? **Yes** **No**

3. Are you aware of any pipes or faucets being replaced in the house? **Yes** **No**
If yes, when_____

Where? _____

4. Do you have a wood deck, outdoor furniture or a play area made from pressure-treated wood?
Yes **No** **Don't Know** If yes, how old is it?_____

Have you ever applied wood-sealer to the deck? **Yes** **No** **Don't Know** **If yes, When?**_____

5. Do you have a fireplace/wood stove? **Yes** **No**
If yes, do you burn painted wood in the fireplace/wood stove? **Yes** **No**
do you burn pressure-treated wood in the fireplace/woodstove? **Yes** **No**

6. How do you clean the floor in the: (Vacuum, sweep, mop, list other)
(circle one)
Main living area _____ **How often** _____(per week/month)

Kitchen _____ **How often** _____(per week/month)

Bedrooms_____ **How often** _____(per week/month)

7. Do you have plastic (vinyl) mini blinds? **Yes** **No**
Where? _____
Does the child play with the mini-blinds or touch them? **Yes** **No**

8. Do you have any dogs and/or cats that go in and out of the house? **Yes** **No**
If yes, where do they sleep?_____

9. How many smokers are there in your home? **0** **1** **2** **more**

10. Do any of your children have asthma? **Yes** **No**
If yes, how many?_____

Property ID No.

11. Do you have a sandbox? **Yes** **No**

12. Do you have a flower garden? **Yes** **No**

13. Do you have a vegetable garden? **Yes** **No**

14. Do you use ant killers or other pesticides inside the home? **Yes** **No**
If yes, describe products and dates of use_____
_____

15. Do you use weed killers or pesticides outside in your yard? **Yes** **No**
If yes, describe products and dates of use_____

16. What's the source of your drinking water? City water system ☐ purchased ☐ other _____
If use City water from tap, do you use a water filter before drinking/cooking? **Yes** **No**

17. Is your child on any special diet or does he/she eat any foods that you get from places other than the grocery store?
Yes **No**
If yes, please explain: _____

18. Do you use any clay pottery or ceramics to cook or store food, especially if handmade or imported from Mexico (e.g., bean pots, tamarindo jam pots, agua frescas, etc.)? **Yes** **No**

If YES, describe how/when used:

Property ID No.

Child Exposure Questionnaire

(Complete one form for each subject child under 6 years old)

Child's Name _____

1. Has your child ever traveled or lived outside of the United States? **Yes** **No**

   If yes, where _____

   when _____

2. Has your child lived at any other address since they were born? **Yes** **No**

   If yes, where? (list below)

Address, City, State	Months at address	Possible Pb or As exposure (remodeling, adults with lead occupations/hobbies, close to an industrial area or highway)	Was the home older than 1960?

3. Does your child spend time at a daycare, preschool, relative's or babysitter's home? **Yes** **No**

   If yes, where (list address): _____

   _____

   How many hours per day, _____ days per week? _____

4. Does your child often visit a building where there is peeling paint? **Yes** **No**

   If yes, estimate the age of the building: **1800's** **Before 1960** **After 1960**

5. Does your child often visit a building where there has been recent or ongoing remodeling? **Yes** **No**

   If yes, estimate the age of the building: **1800's** **Before 1960** **After 1960**

6. Please tell me the number of times your child's hands are washed per day. _____
   Are the child's hands usually washed before they eat? **Yes** **No**
   Before they nap or go to bed? **Yes** **No**

Property ID No.

7. Is your child bottle fed? **Yes** **No**

8. Is your child nursing? **Yes** **No**

9. Do you have any concerns with the child's eating habits? **Yes** **No**

Notes:

10. Does your child take vitamins? **Yes** **No**

11. Does your child have any special play areas in the house (e.g., in their bedroom, in open windows)?

_____

Any special play areas outside? _____

12. Does your child use a pacifier? **Yes** **No**

13. Does your child bite his/her fingernails? **Yes** **No**

14. Does your child put their fingers in their mouth? **Yes** **No**

15. Does your child regularly take food, a bottle, or a pacifier outside in warm weather? **Yes** **No**

16. How often does your child put in their mouth non-food items such as toys, sticks, rocks, mini-blinds, etc.?

1 = very little
2 = once or twice a day
3 = more than twice per day
4 = many times per day

17. Does your child eat things that are not food, like dirt and crayons? **Yes** **No**
If YES, What? How much? _____

Can you show me the item? Dirt from Where? _____

18. Have you ever given your child home remedies from another country, such as azarcon or greta, or remedies/medicines not from a drugstore or grocery store? **Yes** **No**

If yes, what remedies?_____
What color was it?_____ Why was it given? _____
How often? Approximately how much? When was the last time it was given?

Property ID No.

19. Have you ever seen them eat paint chips or chew on painted wood? **Yes** **No**
Describe: _____

Property ID No.

20. Have you ever seen your child play with OR put any of the following things in their mouth: **Yes** **No**

fishing sinkers	curtain weights	keys/keychains	solder/pipes/wires
grass	pool cue chalk	anything made of metal	candy wrappers (especially if Mexican candy)
pottery			

If yes, describe:

21. How often does your child suck his/her thumb, fist or fingers?

1 = very little
2 = once or twice a day
3 = more than twice per day
4 = many times per day

22. How often does your child eat fish, shellfish or other seafood?

Never
___ times per day
___ times per week
___ times per month

23. Where do you think your child may be exposed to lead or arsenic?

24. The following question is asked only for statistical reasons. What is your child's ethnic/racial background? (please check one)

☐ **White,** non Hispanic
☐ **Black,** African American, Negro
☐ **White Hispanic** (includes Spanish, Mexican, Mexican American, Chicano, Latino, Puerto Rican, Cuban)
☐ **Native American/**Alaska native
☐ **Asian** (includes Asian Indian, Chinese, Filipino, Japanese, Korean, Vietnamese, Native Hawaiian, Guamanian or Chamorro, Samoan, Other Pacific Islander, Other Asian)

Property ID No.

Family Information

The following question is asked because we wish to use appropriate educational materials.
What is the highest grade in school completed by the person who cares for the child (e.g., parent(s), grandparents, etc.)

Person _____ Grade/years _____

_____ _____

Please list the names and occupations of all adults living in this house.

Name	Occupation	Length of employment	Child contact before cleanup/laundering?

Notes:

(Tally up number of children and adults provided as responses to above questions, verify this number.)
"So, the total number of people living in the house is _____".

Property ID No.

Please think of all the adults and children who have lived with you in the past two years. Has anyone done the following activities as a hobby or at work?

Activities	Y/N (check if yes)	If yes, Hobby (H) or Work (W)	How often in the past two years?	Where activity done? (e.g., in garage, in backyard, etc.)
Sanded or stripped paint or varnish from furniture		H W		
Painted cars, bicycles, boats		H W		
Repaired radiators in cars		H W		
Soldered pipes, repaired plumbing		H W		
Soldered electronic parts, such as computers or TVs		H W		
Worked with stained glass		H W		
Used artist's paint that might contain lead such as oils		H W		
Made ceramic pottery		H W		
Made or repaired metal jewelry		H W		
Made lead shot for hunting or hand loads		H W		
Did hunting/target shooting or visited a shooting range		H W		
Melted lead sinkers for fishing		H W		
Mined or milled metals		H W		
Painted houses (interior/exterior)		H W		
Welded, cutting, or torch work on metals		H W		
Sanded, stripped, painted industrial equipment such as machinery, bridges, or metal structures		H W		
Worked with lead acid batteries		H W		
Worked with Salvaged or recycled metals		H W		
Did construction work on houses or buildings built before 1980		H W		
Other lead-related hobbies or work activities in the past two years		H W		

Property ID No.

If YES to above questions, Was child contact likely? **Yes** **No**

Thank you for answering our questions today.

Now we need to tour the house to draw a diagram for the sampling team. We then need to go outside and take photographs of your home.

Property ID No.

Home Characterization (to be filled out by the interviewer)

1. Is the bathtub old/antique? **Yes** **No** Leadcheck. **Positive** **Negative**
If positive, inquire frequency of child contact. _____

2. Does house have forced-air heating? **Yes** **No**

3. Are there bare soil areas in the yard? **Yes** **No**
   Where? _____
   (e.g., front, back, child play area, etc.)
   How much (approx. percent)? _____

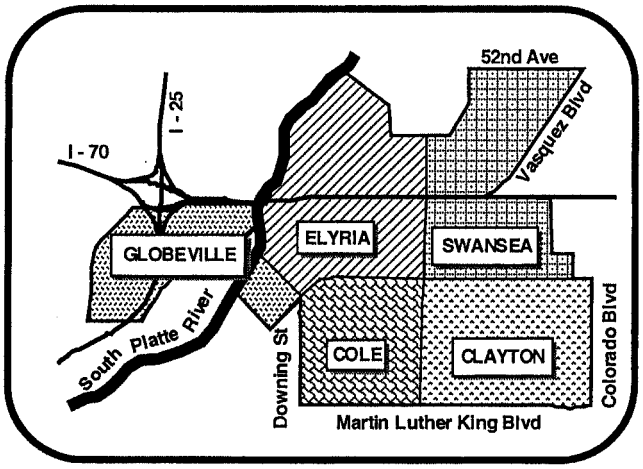
4. Does the house appear to be cleaned regularly? (Circle one)

1 = meticulous
2 = typical
3 = dust appears regularly throughout the house

APPENDIX B

EDUCATIONAL MATERIALS

Facts About Lead



- Lead is a naturally occurring metal commonly found in the environment.
- Lead has no known nutritional value, but all people have some level of lead in their bodies
- Elevated levels of lead in the body can cause harmful health effects. Lead toxicity can affect the central nervous system including learning ability and development, blood systems, reproductive system and kidneys.
- Young children and fetuses are most sensitive to toxic effects of lead because their bodies are still developing.
- Lead poisoning can be prevented.

How are people exposed to lead?

Lead is found in many places in the environment. Some lead exists naturally in soils. Increased concentrations of lead are found in soils close to highways due to auto exhaust from leaded gas, in tailings from mining operations, emissions from metals refineries and waste incinerators, and from battery recycling operations. Lead may also be present in paint, water from lead-soldered plumbing, food from lead-soldered cans, some ceramic and pottery dishes, some folk remedy medications such as azarcon, greta, pay-loo-ah and kohl, and some hobbies such as making jewelry, bullets, fishing sinkers, stained glass and pottery with lead glazes.

Lead enters the body primarily through ingestion and inhalation. Children are more likely to put their hands and toys in their mouths, so are more likely to swallow lead from soil, dust and paint. Children and adults may be exposed to airborne lead from blowing dust or emissions from industrial activities such as smelting operations or waste incinerators.

What levels of exposure to lead have resulted in harmful health effects?

The type and severity of health problems associated with lead are dependent on several conditions:

- Amount of lead exposure;
- Length of the exposure;
- Age of the individual. Children may absorb up to 50% of the lead they ingest, while adults typically absorb only 10%. The nervous systems of children are also more sensitive to damage from lead.
- General health and nutrition of the exposed individual including iron, calcium or vitamin deficiency and use of alcohol and tobacco.

The average person in the U.S. today has less than 10 micrograms of lead per deciliter (µg/dL) of blood. In adults, levels over 25 µg/dL of lead must be reported to the state health department, and can cause problems such as abdominal pain, anemia, damage to the kidney, and reporductive problems. Children and pregnant women are more sensitive to the effects of lead. At low levels of exposure (10-19 µg/dL), children often have no symptoms but may be at increased risk for behavioral problems and learning disabilities. Children born to mothers with blood lead levels exceeding 10 µg/dL are at greater risk for lower birth weights, slower growth, decreased size and learning difficulties.

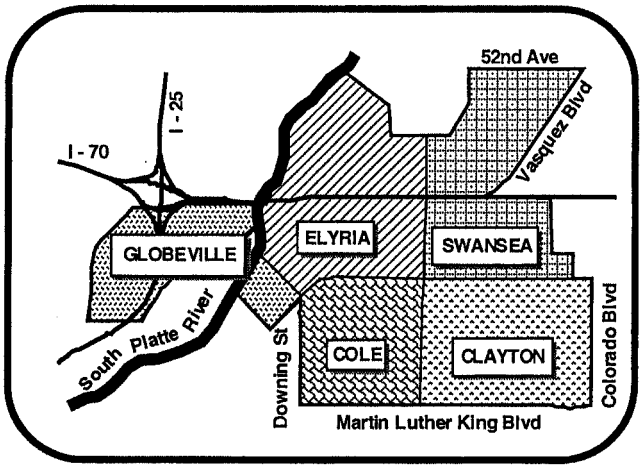
How can I prevent lead poisoning?

You can minimize exposure to lead by:

- washing your hands and your children's hands and toys frequently;
- wet mopping and dusting your home regularly;
- avoiding heating and storing food in open cans or ceramic pottery dishes;
- using caution when working with hobby supplies that contain lead;
- discouraging your child from playing in bare dirt and bringing dirt in from outside; and
- discouraging your child from putting non-food items (dirt, toys, paint chips) in their mouths.

You can also help decrease your body's absorption of lead by eating regular meals and a balanced, low-fat diet with plenty of iron, calcium and vitamin C.

Hoja de Datos Sobre el Plomo



Datos sobre el Plomo

- ✓ El plomo es un metal que ocurre naturalmente que se encuentra conmúnmente en el medio ambiente.
- ✓ El plomo no tiene valor nutritivo conocido, pero todas las personas tienen algún nivel de plomo en sus cuerpos.
- ✓ Altos niveles de plomo en el cuerpo pueden ser dañinos a la salud. El envenenamiento del plomo puede afectar al sistema neurológico central, incluyendo la capacidad y el desarrollo de aprendizaje, a la sangre, al sistema reproductivo, y a los riñones.
- ✓ Los niños jóvenes y los fetos son los más sensibles a los efectos tóxicos del plomo ya que sus cuerpos todavía están en desarrollo.
- ✓ Se puede prevenir el envenenamiento por el plomo.

¿Cómo se expone la gente al plomo?

El plomo se encuentra en muchos lugares en el medio ambiente. Existen algunas cantidades de plomo natural en el suelo. Existen concentraciones elevadas de plomo en los suelos que bordan las carreteras, las cuales vienen de los escapes de automóviles usando gasolina con plomo, en los desechos de la minería, en las emisiones de la refinería de metales e incineración de desechos, y del reciclaje de baterías. El plomo también puede estar presente en la pintura, agua de tubería con soldadura a base de plomo, y en alimentos de latas con soldadura a base de plomo. Se encuentra en ciertos tipos de cerámica y loza de barro vidriado, remedios folklóricos tal como azarcón, greta, pay-loo-ah, y kohl, y en ciertos pasatiempos tales como joyería, hacer balas, plomadas, teñido de vidrio, y cerámica con vidriado a base de plomo.

El plomo entra al cuerpo primariamente al comerlo e inhalarlo. Los niños tienden meter las manos y los juguetes en sus bocas, así que tienen mayor probabilidad de tragar el plomo del suelo, polvo, y pintura. Los niños y los adultos pueden estar expuestos al plomo aéreo en polvo fugitivo o en emisiones de actividades industriales tales como las fundidoras o los incineradores de desechos.

¿Cuáles son los niveles de exposición al plomo que tienen efectos dañinos a la salud?

El tipo y severidad de los problemas de salud asociados con plomo pueden ser afectados por varias condiciones:

- ✓ Cantidad de exposición al plomo;
- ✓ Período de exposición;
- ✓ Edad del individuo. Los niños pueden absorber hasta el 50 por ciento del plomo ingerido, mientras que los adultos típicamente absorben sólo el 10 por ciento. El sistema nervioso de los niños está también más sensible al daño que causa el plomo.
- ✓ Salud general y la nutrición del individuo expuesto, incluyendo hierro, cálcio, o deficiencia de vitaminas, y el uso de alcohol y tabaco.

Una persona típica en los EEUU hoy en día tiene menos de 19 microgramos de plomo por decilitro (µg/dL) de sangre. En los adultos, niveles superiores de 25 µg/dL de plomo sanguíneo tienen que reportarse al departamento estatal de salud pública, y pueden incitar problemas tales como dolor estomacal, anemia, daño a los riñones, y problemas reproductivos. Los niños y las mujeres embarazadas son más sensibles a los efectos del plomo. Con la exposición al plomo a niveles bajos (10 a 19 µg/dL), los niños muchas veces no muestran síntomas particulares; sin embargo, se arriesgan de problemas de conducto y de capacidad de aprendizaje. Niños nacidos de madres con más de 10 µg/dL de plomo en la sangre se arriesgan de bajo peso, pobre crecimiento, menor tamaño, y dificultades de aprendizaje.

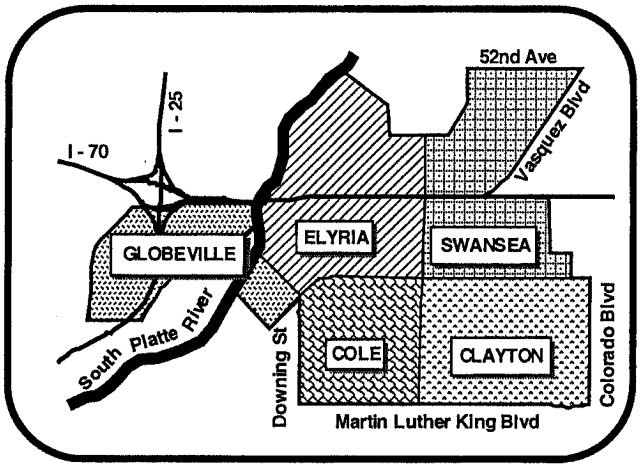
¿Cómo puedo prevenir envenenamiento por el plomo?

Usted puede reducir la exposición al plomo al:

- ✓ lavarse las manos y las de sus niños y sus juguetes frecuentemente;
- ✓ trapear (mojado) y sacudir el polvo de su hogar a menudo;
- ✓ dejar de calentar y almacenar alimentos en latas abiertas o platos cerámicos;
- ✓ protégese cuando se usa materiales a base de plomo en su pasatiempo;
- ✓ no permite a que sus niños jueguen en la tierra ni que traigan el suelo de afuera dentro de la casa; y
- ✓ no deje a que sus niños metan artículos que no son comida (suelo, juguetes, pintura) en la boca.

También puede reducir la absorción de plomo en el cuerpo al alimentarse frecuentemente, y con una dieta balanceada con poca grasa, y con bastante hierro, calcio, y vitamina C.

Facts About Arsenic



Arsenic facts:

- Arsenic is a naturally occurring metal commonly found in air, food, water and soil.
- All people have some level of arsenic in their bodies, with food such as fish, shellfish and red wine the most common sources of arsenic intake.
- Arsenic occurs in both organic and inorganic forms, which have major differences in toxicity.
- High levels of exposure to organic arsenic, commonly present in seafood, are not known to cause harmful health effects.
- High levels of exposure to inorganic arsenic can cause harmful health effects, including lung and skin cancer, irritation of the digestive tract, skin abnormalities, and damage to the peripheral nervous system.
- You can minimize your exposure to arsenic in the environment.

How are people exposed to arsenic?

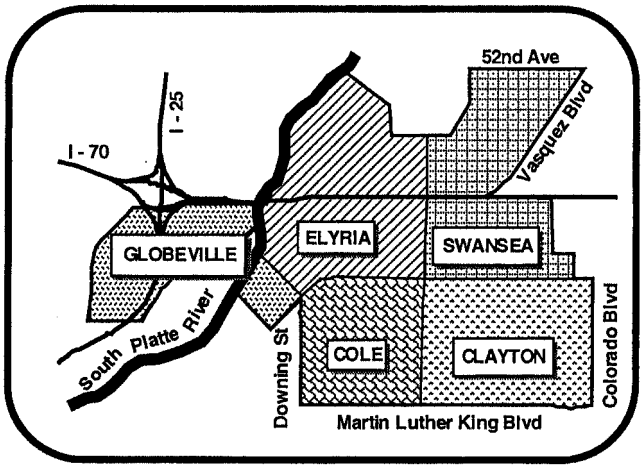
Arsenic is found in many places in the environment. Some arsenic exists naturally in air, food, water and soil. Arsenic may naturally be present in soil or ground water, particularly in the western U.S. In the past, some household product such as paints, dyes, and ant and rat poisons were made with inorganic arsenic. The main use of arsenic in this country today is for pesticides and herbicides. Wood preservatives, tobacco, some folk remedies such as the “Asiatic pill,” cushtay, yellow root, and health foods with kelp also may contain arsenic. In medicine, arsenic was used in drugs to treat many diseases, and is still used in antiparasitic drugs for humans. Industrial processes such as purifying gases, manufacturing electronics, hardening metal alloys, preserving animal hides, clarifying glass and ceramics and bronze plating are also potential sources of exposure to inorganic arsenic. People working in mining, smelting and pesticide or wood treating industries may be exposed to inorganic arsenic. Red wine can also contain high levels of inorganic arsenic.

Arsenic enters the body primarily through eating food or drinking water. Arsenic can also be inhaled, and small amounts of arsenic may enter the body through the skin. Arsenic does not tend to accumulate in the body. Most arsenic that is absorbed into the body is efficiently passed in the urine.

Is there a medical test to determine if someone has been exposed to arsenic?

Most arsenic is cleared from the blood within a few hours, so measurements of blood arsenic can measure only very recent exposures. Since most absorbed arsenic is quickly eliminated in the urine, tests of urinary arsenic levels are useful as indicators of recent exposure, within the last one or two days.

Hoja de Datos sobre el Arsénico



Datos sobre el Arsénico

- ✓ El arsénico es un metal que ocurre naturalmente y se encuentra comúnmente en el aire, alimentos, agua, y el suelo.
- ✓ Todas las personas tienen algún nivel de arsénico en sus cuerpos. Alimentos tales como pescado, mariscos, y vino tinto son las fuentes más comunes del consumo de arsénico.
- ✓ El arsénico ocurre en forma orgánica e inorgánica, las cuales varian mucho en cuanto a toxicidad.
- ✓ Altos niveles de exposición al arsénico orgánico, comúnmente presente en alimentos productos del mar, no se conocen como dañinos a la salud.
- ✓ Altos niveles de exposición al arsénico inorgánico pueden tener efectos dañinos a la salud, inclusivos el cáncer de pulmón y piel, irritación del sistema gastrointestinal, irregularidades de la piel, y daño al sistema nervioso periférico.
- ✓ Usted puede disminuir la exposición al arsénico en el medio ambiente.

¿Existe alguna prueba para determinar si alguien se haya expuesto al arsénico?

La mayoría del arsénico se elimina de la sangre dentro de pocas horas, así que las medidas de niveles de arsénico sanguíneo solo miden exposiciones muy recientes. Ya que la mayoría del arsénico se elimina rápidamente en la orina, las pruebas de niveles de arsénico en la orina son indicadores valiosos de la exposición a corto plazo, dentro de los últimos uno o dos días.

¿ Cómo se expone la gente al arsénico?

El arsénico se encuentra en muchos lugares en el medio ambiente. Existen cantidades de arsénico natural en el aire, alimentos, agua, y el suelo. El arsénico está presente naturalmente en el suelo o agua subterránea, particularmente en la los EEUU occidental. Históricamente, varios productos del hogar, tales como la pintura, tintes, y plaguicidas se formularon con arsénico inorgánico. El mayor uso del arsénico en este país hoy en día es en pesticidas y herbicidas. Los productos químicos empleados para preservar la madera, el tabaco, los remedios folklóricos, tales como la "pastilla asiática", kushtay, raiz amarilla, y los alimentos que tienen alga marina, también pueden contener arsénico. En la medicina, el arsénico se empleaba en fármacos para el tratamiento de muchas enfermedades, y se usa todavía en fármacos antiparasíticos. Los procesos industriales, tales como la purificación de gases, fabricación de electrónica, endurecimiento de aleaciones de metal, preservación de cueros, clarificación de vidrio y cerámica, y plateado de bronce, también son fuentes potenciales de la exposición al arsénico inorgánico.

El arsénico entra en el cuerpo primariamente por alimentarse. El arsénico también se puede inhalar, y pequeñas cantidades de arsénico pueden entrar el cuerpo a través de absorción de la piel. El arsénico no se acumula en el cuerpo. La mayoría del arsénico que se absorbe al cuerpo se elimina eficientemente en la orina.

¿Cómo puedo disminuir mi exposición al arsénico?

Usted puede minimizar la exposición al arsénico en el suelo contaminado y polvo aéreo por:

- ✓ lavarse las manos y las de sus niños y sus juguetes,
- ✓ trapear (mojado) y sacudir el polvo de su hogar a menudo, y
- ✓ no permite a que sus niños jueguen en el suelo ni que traigan el suelo de afuera dentro la casa.

Usted también puede ayudar en disminuir la absorción de arsénico en el cuerpo al alimentarse frecuentemente, y tener una dieta balanceada alta en proteína, y por evitar el humo del tabaco.

¿Cuáles son los niveles de exposición al arsénico dañinos a la salud?

Es difícil determinar a qué nivel el arsénico causa efectos dañinos específicos. El tipo y la severidad de problemas de salud asociados con arsénico pueden variarse por las siguientes condiciones:

- ✓ Cantidad de exposición al arsénico;
- ✓ Período de exposición;
- ✓ Vía de exposición, o sea, si la exposición ocurre por comer, tomar, contacto dermal con, o inhalar el arsénico;
- ✓ Edad, sexo, peso, y factores genéticos;
- ✓ Salud general, nutrición, y hábitos personales del individuo expuesto, tales como uso de remedios o fumar; y
- ✓ La reacción particular por individuo a la exposición química.

Los niveles de exposición al arsénico en los humanos varían mucho, con muchos factores que influyen los niveles de arsénico absorbido por el cuerpo. No hay una correlación fuerte entre los niveles de arsénico específicos y los efectos tóxicos medidos, entonces se puede considerar como "normal", una gama de niveles de arsénico en el cuerpo de entre 5 a 50 microgramos por litro de orina (µg/L). El nivel de arsénico en la orina, además, se ve afectado por la dieta a corto plazo; los alimentos productos del mar, en particular, pueden elevar los niveles de arsénico en la orina. Fumar o la exposición a humo, también pueden elevar el nivel.
La exposición al arsénico a niveles bajos hasta medianos a largo plazo puede dañar el hígado, los riñones, o venas, causar anormalidades en la piel, y aumentar el riesgo de cáncer de la vejiga, riñones, pulmones, y piel.

La exposición al arsénico a niveles más altos, más típicos de la exposición ocupacional, puede causar irritación del sistema gastrointestinal, menor producción de glóbulos de la sangre, anemia, y función nerviosa debilitada (una sensación de “agujas” en las manos y los pies).

Busque el consejo de un médico si usted padece de cualquier síntoma que se sospecha que viene asociado a la exposición al arsénico.

Simple Steps To Protect Your Family From Lead Hazards

If you think your home has high levels of lead:

- Get your young children tested for lead, even if they seem healthy.
- Wash children's hands, bottles, pacifiers, and toys often.
- Make sure children eat healthy, low-fat foods.
- Get your home checked for lead hazards.
- Regularly clean floors, window sills, and other surfaces.
- Wipe soil off shoes before entering house.
- Talk to your landlord about fixing surfaces with peeling or chipping paint.
- Take precautions to avoid exposure to lead dust when remodeling or renovating (call 1-800-424-LEAD for guidelines).
- Don't use a belt-sander, propane torch, heat gun, dry scraper, or dry sandpaper on painted surfaces that may contain lead.
- Don't try to remove lead-based paint yourself.

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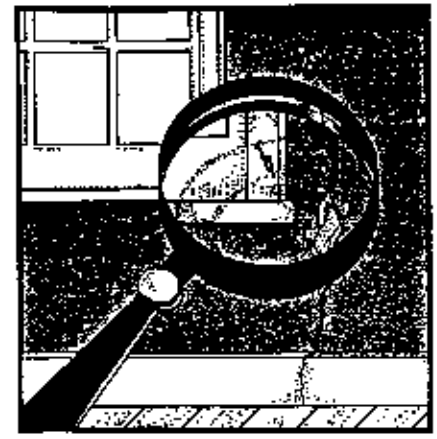

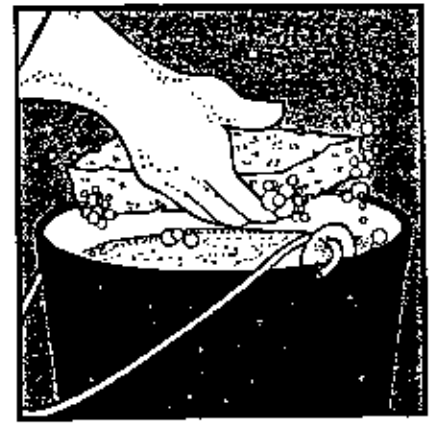

Protect Your Family From Lead In Your Home

EPA United States Environmental Protection Agency

United States Consumer Product Safety Commission

United States Department of Housing and Urban Development

U.S. EPA Washington DC 20460
U.S. CPSC Washington DC 20207
U.S. HUD Washington DC 20410

EPA747-K-99-001
April 1999

Are You Planning To Buy, Rent, or Renovate a Home Built Before 1978?

Many houses and apartments built before 1978 have paint that contains lead (called lead-based paint). Lead from paint, chips, and dust can pose serious health hazards if not taken care of properly.

Federal law requires that individuals receive certain information before renting, buying, or renovating pre-1978 housing:

LANDLORDS have to disclose known information on lead-based paint and lead-based paint hazards before leases take effect. Leases must include a disclosure form about lead-based paint.

SELLERS have to disclose known information on lead-based paint and lead-based paint hazards before selling a house. Sales contracts must include a disclosure form about lead-based paint. Buyers have up to 10 days to check for lead hazards.

RENOVATORS have to give you this pamphlet before starting work. (After June 1, 1999.)

IF YOU WANT MORE INFORMATION on these requirements, call the National Lead Information Clearinghouse at **1-800-424-LEAD.**

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CPSC Regional Offices

Your Regional CPSC Office can provide further information regarding regulations and consumer product safety.

Eastern Regional Center
6 World Trade Center
Vesey Street, Room 350
New York, NY 10048
(212) 466-1612

Western Regional Center
600 Harrison Street, Room 245
San Francisco, CA 94107
(415) 744-2966

Central Regional Center
230 South Dearborn Street
Room 2944
Chicago, IL 60604-1601
(312) 353-8260

HUD Lead Office

Please contact HUD's Office of Lead Hazard Control for information on lead regulations, outreach efforts, and lead hazard control and research grant programs.

U.S. Department of Housing and Urban Development
Office of Lead Hazard Control
451 Seventh Street, SW, P-3206
Washington, DC 20410
(202) 755-1785

EPA Regional Offices

Your Regional EPA Office can provide further information regarding regulations and lead protection programs.

EPA Regional Offices

Region 1 (Connecticut, Massachusetts, Maine, New Hampshire, Rhode Island, Vermont)

Regional Lead Contact
U.S. EPA Region 1
Suite 1100 (CPT)
One Congress Street
Boston, MA 02114-2023
1 (888) 372-7341

Region 2 (New Jersey, New York, Puerto Rico, Virgin Islands)

Regional Lead Contact
U.S. EPA Region 2
2890 Woodbridge Avenue
Building 209, Mail Stop 225
Edison, NJ 08837-3679
(732) 321-6671

Region 3 (Delaware, Washington DC, Maryland, Pennsylvania, Virginia, West Virginia)

Regional Lead Contact
U.S. EPA Region 3 (3WC33)
1650 Arch Street
Philadelphia, PA 19103
(215) 814-5000

Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee)

Regional Lead Contact
U.S. EPA Region 4
61 Forsyth Street, SW
Atlanta, GA 30303
(404) 562-8998

Region 5 (Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin)

Regional Lead Contact
U.S. EPA Region 5 (DT-8J)
77 West Jackson Boulevard
Chicago, IL 60604-3666
(312) 886-6003

Region 6 (Arkansas, Louisiana, New Mexico, Oklahoma, Texas)

Regional Lead Contact
U.S. EPA Region 6
1445 Ross Avenue, 12th Floor
Dallas, TX 75202-2733
(214) 665-7577

Region 7 (Iowa, Kansas, Missouri, Nebraska)

Regional Lead Contact
U.S. EPA Region 7
(ARTD-RALI)
901 N. 5th Street
Kansas City, KS 66101
(913) 551-7020

Region 8 (Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming)

Regional Lead Contact
U.S. EPA Region 8
999 18th Street, Suite 500
Denver, CO 80202-2466
(303) 312-6021

Region 9 (Arizona, California, Hawaii, Nevada)

Regional Lead Contact
U.S. Region 9
75 Hawthorne Street
San Francisco, CA 94105
(415) 744-1124

Region 10 (Idaho, Oregon, Washington, Alaska)

Regional Lead Contact
U.S. EPA Region 10
Toxics Section WCM-128
1200 Sixth Avenue
Seattle, WA 98101-1128
(206) 553-1985

IMPORTANT!

Lead From Paint, Dust, and Soil Can Be Dangerous If Not Managed Properly

FACT: Lead exposure can harm young children and babies even before they are born.

FACT: Even children who seem healthy can have high levels of lead in their bodies.

FACT: People can get lead in their bodies by breathing or swallowing lead dust, or by eating soil or paint chips containing lead.

FACT: People have many options for reducing lead hazards. In most cases, lead-based paint that is in good condition is not a hazard.

FACT: Removing lead-based paint improperly can increase the danger to your family.

If you think your home might have lead hazards, read this pamphlet to learn some simple steps to protect your family.

Lead Gets in the Body in Many Ways

In the United States, about 900,000 children ages 1 to 5 have a blood-lead level above the level of concern.

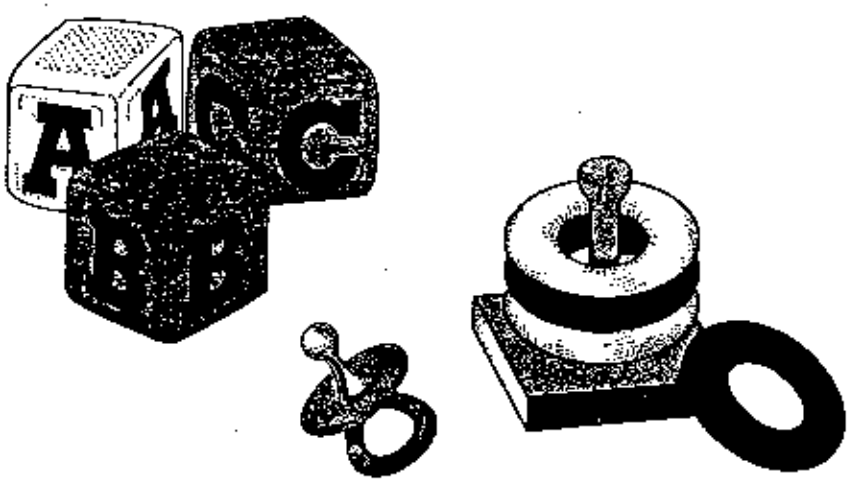
Even children who appear healthy can have dangerous levels of lead in their bodies.

People can get lead in their body if they:

- Put their hands or other objects covered with lead dust in their mouths.
- Eat paint chips or soil that contains lead.
- Breathe in lead dust (especially during renovations that disturb painted surfaces).

Lead is even more dangerous to children than adults because:

- Babies and young children often put their hands and other objects in their mouths. These objects can have lead dust on them.
- Children's growing bodies absorb more lead.
- Children's brains and nervous systems are more sensitive to the damaging effects of lead.



For More Information

The National Lead Information Center

Call **1-800-424-LEAD** to learn how to protect children from lead poisoning and for other information on lead hazards. (Internet: **www.epa.gov/lead** and **www.hud.gov/lea**).

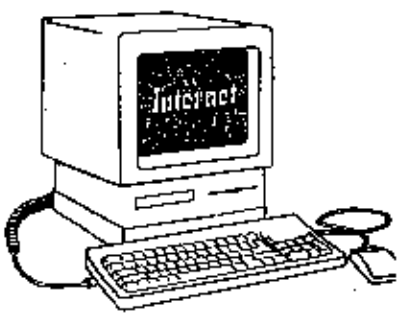
For the hearing impaired, call the Federal Information Relay Service at **1-800-877-8339** and ask for the National Lead Information Center at **1-800-424-LEAD.**

EPA's Safe Drinking Water Hotline

Call **1-800-426-4791** for information about lead in drinking water.

Consumer Product Safety Commission Hotline

To request information on lead in consumer products, or to report an unsafe consumer product or a product-related injury call **1-800-638-2772.** (Internet: www@cpsc.gov). For the hearing impaired, call **TDD 1-800-638-8270.**



State Health and Environmental Agencies

Some cities and states have their own rules for lead-based paint activities. Check with your state agency to see if state or local laws apply to you. Most state agencies can also provide information on finding a lead abatement firm in your area, and on possible sources of financial aid for reducing lead hazards. Receive up-to-date address and phone information for state and local contacts on the Internet at **www.epa.gov/lead** or contact the National Lead Information Center at **1-800-424-LEAD.**

Other Sources of Lead

While paint, dust, and soil are the most common lead hazards, other lead sources also exist.

- **Drinking water.** Your home might have plumbing with lead or lead solder. Call your local health department or water supplier to find out about testing your water. You cannot see, smell, or taste lead, and boiling your water will not get rid of lead. If you think your plumbing might have lead in it:
  - Use only cold water for drinking and cooking.
  - Run water for 15 to 30 seconds before drinking it, especially if you have not used your water for a few hours.
- **The job.** If you work with lead, you could bring it home on your hands or clothes. Shower and change clothes before coming home. Launder your work clothes separately from the rest of your family's clothes.
- Old painted **toys** and **furniture.**
- Food and liquids stored in **lead crystal** or **lead-glazed pottery or porcelain.**
- **Lead smelters** or other industries that release lead into the air.
- **Hobbies** that use lead, such as making pottery or stained glass, or refinishing furniture.
- **Folk remedies** that contain lead, such as "greta" and "azarcon" used to treat an upset stomach.

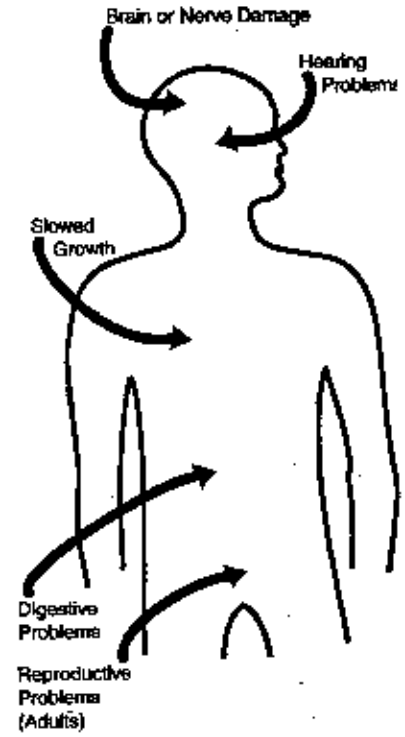
Lead's Effects

If not detected early, children with high levels of lead in their bodies can suffer from:

- Damage to the brain and nervous system
- Behavior and learning problems (such as hyperactivity)
- Slowed growth
- Hearing problems
- Headaches

Lead is also harmful to adults. Adults can suffer from:

- Difficulties during pregnancy
- Other reproductive problems (in both men and women)
- High blood pressure
- Digestive problems
- Nerve disorders
- Memory and concentration problems
- Muscle and joint pain



Lead affects the body in many ways.

Where Lead-Based Paint Is Found

In general, the older your home, the more likely it has lead-based paint.

Many homes built before 1978 have lead-based paint. The federal government banned lead-based paint from housing in 1978. Some states stopped its use even earlier. Lead can be found:

- In homes in the city, country, or suburbs.
- In apartments, single-family homes, and both private and public housing.
- Inside *and* outside of the house.
- In soil around a home. (Soil can pick up lead from exterior paint or other sources such as past use of leaded gas in cars.)

Checking Your Family for Lead

Get your children and home tested if you think your home has high levels of lead.

To reduce your child's exposure to lead, get your child checked, have your home tested (especially if your home has paint in poor condition and was built before 1978), and fix any hazards you may have. Children's blood lead levels tend to increase rapidly from 6 to 12 months of age, and tend to peak at 18 to 24 months of age.

Consult your doctor for advice on testing your children. A simple blood test can detect high levels of lead. Blood tests are usually recommended for:

- Children at ages 1 and 2.
- Children or other family members who have been exposed to high levels of lead.
- Children who should be tested under your state or local health screening plan.

Your doctor can explain what the test results mean and if more testing will be needed.

Remodeling or Renovating a Home With Lead-Based Paint

Take precautions before your contractor or you begin remodeling or renovations that disturb painted surfaces (such as scraping off paint or tearing out walls):

- **Have the area tested for lead-based paint.**
- **Do not use a belt-sander, propane torch, heat gun, dry scraper, or dry sandpaper** to remove lead-based paint. These actions create large amounts of lead dust and fumes. Lead dust can remain in your home long after the work is done.
- **Temporarily move your family** (especially children and pregnant women) out of the apartment or house until the work is done and the area is properly cleaned. If you can't move your family, at least completely seal off the work area.
- **Follow other safety measures to reduce lead hazards.** You can find out about other safety measures by calling 1-800-424-LEAD. Ask for the brochure "Reducing Lead Hazards When Remodeling Your Home." This brochure explains what to do before, during, and after renovations.

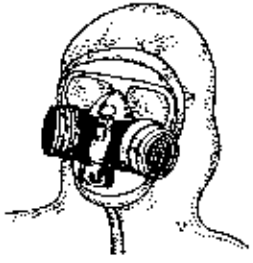
If not conducted properly, certain types of renovations can release lead from paint and dust into the air.

If you have already completed renovations or remodeling that could have released lead-based paint or dust, get your young children tested and follow the steps outlined on page 7 of this brochure.

How To Significantly Reduce Lead Hazards

Removing lead improperly can increase the hazard to your family by spreading even more lead dust around the house.

Always use a professional who is trained to remove lead hazards safely.



In addition to day-to-day cleaning and good nutrition:

- You can **temporarily** reduce lead hazards by taking actions such as repairing damaged painted surfaces and planting grass to cover soil with high lead levels. These actions (called "interim controls") are not permanent solutions and will need ongoing attention.
- To **permanently** remove lead hazards, you must hire a certified lead "abatement" contractor. Abatement (or permanent hazard elimination) methods include removing, sealing, or enclosing lead-based paint with special materials. Just painting over the hazard with regular paint is not enough.

Always hire a person with special training for correcting lead problems—someone who knows how to do this work safely and has the proper equipment to clean up thoroughly. Certified contractors will employ qualified workers and follow strict safety rules as set by their state or by the federal government.

Call your state agency (see page 11) for help with locating certified contractors in your area and to see if financial assistance is available.

Where Lead Is Likely To Be a Hazard

Lead from paint chips, which you can see, and lead dust, which you can't always see, can both be serious hazards.

Lead-based paint that is in good condition is usually not a hazard.

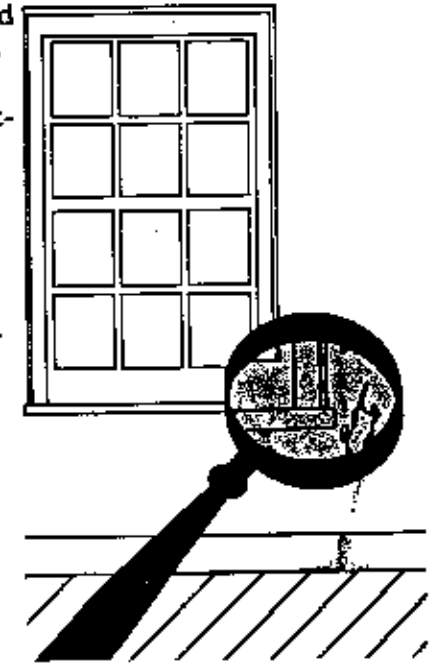
Peeling, chipping, chalking, or cracking lead-based paint is a hazard and needs immediate attention.

Lead-based paint may also be a hazard when found on surfaces that children can chew or that get a lot of wear-and-tear. These areas include:

- Windows and window sills.
- Doors and door frames.
- Stairs, railings, and banisters.
- Porches and fences.

Lead dust can form when lead-based paint is dry scraped, dry sanded, or heated. Dust also forms when painted surfaces bump or rub together. Lead chips and dust can get on surfaces and objects that people touch. Settled lead dust can re-enter the air when people vacuum, sweep, or walk through it.

Lead in soil can be a hazard when children play in bare soil or when people bring soil into the house on their shoes. Call your state agency (see page 11) to find out about testing soil for lead.



Checking Your Home for Lead Hazards

Just knowing that a home has lead-based paint may not tell you if there is a hazard.

You can get your home checked for lead hazards in one of two ways, or both:

- A paint **inspection** tells you the lead content of every different type of painted surface in your home. It won't tell you whether the paint is a hazard or how you should deal with it.
- A **risk assessment** tells you if there are any sources of serious lead exposure (such as peeling paint and lead dust). It also tells you what actions to take to address these hazards.

Have qualified professionals do the work. *There are standards in place for certifying lead-based paint professionals to ensure the work is done safely, reliably, and effectively.* Contact your state lead poisoning prevention program for more information. Call 1-800-424-LEAD for a list of contacts in your area.

Trained professionals use a range of methods when checking your home, including:

- Visual inspection of paint condition and location.
- A portable x-ray fluorescence (XRF) machine.
- Lab tests of paint samples.
- Surface dust tests.

Home test kits for lead are available, but studies suggest that they are not always accurate. Consumers should not rely on these tests before doing renovations or to assure safety.

What You Can Do Now To Protect Your Family

If you suspect that your house has lead hazards, you can take some immediate steps to reduce your family's risk:

- **If you rent, notify your landlord of peeling or chipping paint.**
- **Clean up paint chips immediately.**
- **Clean floors, window frames, window sills, and other surfaces weekly.** Use a mop or sponge with warm water and a general all-purpose cleaner or a cleaner made specifically for lead. REMEMBER: NEVER MIX AMMONIA AND BLEACH PRODUCTS TOGETHER SINCE THEY CAN FORM A DANGEROUS GAS.

- **Thoroughly rinse sponges and mop heads after cleaning dirty or dusty areas.**
- **Wash children's hands often, especially before they eat and before nap time and bed time.**
- **Keep play areas clean.** Wash bottles, pacifiers, toys, and stuffed animals regularly.
- **Keep children from chewing window sills or other painted surfaces.**
- **Clean or remove shoes before entering your home to avoid tracking in lead from soil.**
- **Make sure children eat nutritious, low-fat meals high in iron and calcium,** such as spinach and dairy products. Children with good diets absorb less lead.

PROTECTING YOUR CHILD FROM LEAD-BASED PAINT

Is lead paint harmful to children?

A. Lead in paint is toxic and harmful to children. It can cause permanent problems to a child's brain, causing learning disabilities and behavioral problems.
B. Children under the age of six are most at risk.
C. When a pregnant woman is exposed to lead, it can harm her unborn baby.

Where is lead paint found?

A. Most homes built before 1978 have some lead paint. But, homes built before 1960 have the most lead paint.
B. Lead dust comes from damaged paint or scraping/sanding paint in older homes. Eventually, lead dust spreads throughout the home attaching to most surfaces.
C. Dirt or bare soil can also contain lead from paint that has peeled from the outside walls.

How are children poisoned from lead paint?

A. Children become exposed to paint chips and lead dust that settle on floors, windowsills, and other surfaces. It gets on their hands, on their toys, and in their mouths.
B. Playing in soil containing lead paint that has peeled from the outside walls can also poison children.
C. Most children exposed to lead don't have symptoms. The only way to know if a child has lead exposure is to get their blood tested.

What should I do if my child has been poisoned from lead paint?

A. First, locate any hazards in your home and learn how to eliminate them safely. **Never try to remove lead paint yourself.**
B. **Get your child tested.**
C. Talk to your health department about what else you can do to protect your children's health or call 1-888-LEADLIST for a list of lead service providers

How can you protect your children from lead paint exposure?

A. Keep your home free from lead dust! Clean floors and windowsills often with soap and water, and then rinse with fresh water.
B. Make sure children wash their hands before eating, after playing outside and at bedtime. Use soap and water.
C. Watch where your children play. Areas with grass or pavement are best. Exposed dirt near buildings may be contaminated with small paint chips.
D. Keep paint in good shape. Check for peeling and water damage and re-paint surfaces that have flaking paint.
E. Try never to remove lead paint yourself. But, if there is a situation where you have no choice, please work safely around it. Seal off the work area by covering furniture, floors, doors, windows and vents with heavy plastic, and keep women and children away from the work area. Remove flaking paint by sanding or scraping before re-painting. Wet down paint before you sand or scrape. Avoid creating lead dust and paint chips. Dispose of paint chips and dust in plastic bags place in trash bins immediately. Completely clean the work area with soap and water when done.

Should I worry about lead if I repaint or remodel?

A. Yes. Scraping, sanding or disturbing old paint can release large amounts of toxic lead dust. Learn to work safely with lead paint and make sure any contractor you hire follows lead-safe guidelines. For more information on "Reducing lead exposure when remodeling your home booklet," please call 1-800-424-LEAD, or call your local health department.

How can I protect my family from lead paint if I rent my home?

A. It is your landlord's responsibility to keep paint in good shape. If your landlord will not fix peeling or damaged paint, call your county health department. (health dept. number here) Landlords are required by law to give you information about lead paint before you sign the lease and at any time your rent is raised.
B. If your landlord fixes the flaking paint, make sure it is done properly, as described above. Make sure the workers who fix the paint do not spread lead paint chips or dust. Workers should clean up well before leaving.

Additional resources!

Denver Department of Environmental Health (720) 865-5452
Colorado Department of Public Health and Environment (303) 692-2700

PROTEJA A SUS NIÑO DEL PLOMO EN LA PINTURA!

¿Es el plomo en la pintura peligroso para los niños?

A. El plomo en la pintura es toxico y peligroso para los niños. Puede causar problemas permanentes al cerebro por ejemplo problemas de aprendisaje y comportamiento.
B. Niños menores seis años son los que están en mayor riesgo .
C. Cuando mujeres embarazas están expuestas a el plomo, esto puede dañar el niño que haím no a nacido.mes

¿Donde se encuentra pintura que contiene plomo?

Muchas casas construidas antes de el año1978 fueron pintas con pintura que tiene un poco de plomo. Pero, casas construidas antes de el año 1960 fueron pintadas con pintura que contenia una cantidad considerable de plomo.

A. Polvo del plomo proviene de pintura dañada, / raspada o lijada en casas que fueron construidas antes de las fechas mencianadas arriba. El polvo que contiene arsenico se desplasa en todas las superficies de la casa.
B. La tierra también puede tener plomo de pintura que está quebrada

¿Como los niños se exponen a contraer arsenico de la pintura?

A. Los niños han tenido contacto con restos de pintura que se desprende de la pared y la tierra que se encuentra en el piso, ventanas y alguna otra superficie llega a sus manos a los juguetes y a su boca.

B. La tierra puede contener arsenico de pintura que se haiga desprendido de los afuras de la pared.

C. Muchos de los niños que están expuestos a arsenico no tienen sintomas.

¿Que debo hacer si mi hijo/a ha sido contaminado de arsenico de la pintura?

A. Primero localize un lugar donde se encuentre muy dañado de pedasos de pintura desprendiendose de paredes. **Nunca trate de remover la pintura usted mismo**
B. **Haga pruebas a sus niños.**
C. **Hable con el departamento de salud de como protejer a su niño/a o llame al 1-888 leadlist para que le proporcionen informacion.**

¿Como puede usted protejer a sus hijos del plomo?

A. Mantanga su casa limpia. Limpie los pisos y ventas frecuentamente con agua y jabón. Luego enguagelos con agua limpia.
B. Asegurese que sus niños se laven las manos antes de comer, despues de jugar afuera, y antes de irse a dormir. Use jabon y agua.
C. Figese donde juegan sus niños. Las mejores areas para que sus niños juegen son el zacate y padimento.
D. Mantenga la pintura de su casa en buenas condiciones. Lije las superficies que tienen pintura dañada.
E. Nunca trate de remover la pintura usted mismo. Pero si usted no tubiera otra obción más qus que hacerlo usted mismo, por favor trabaje con much precuación. MOJE bién la pintura antes de empesar a raspar o lijar. Mantega su muebles, pisos, y ventanos tapados con un plastico. No permita que nadie se acerque a la area que usted está trabajando. Evite que se formen pastitas de pintura o polvo. Limpie completamente la area con agua y jabon. Ponga todo en la basura imediatamente.

¿Debo precuparme haún por plomo su repinto or remodelo mi casa?

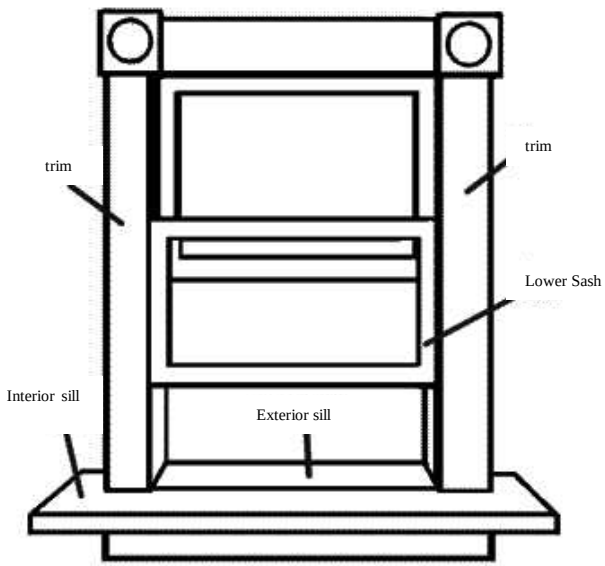
A. ¡SI! Raspando, lijando o pérturbando la pintura vieja puede desprender grandes cantidades de plomo toxico. Aprenda como trabajar sanamente la pintura y asegurese de que cualquier persona que usted contrate para limpiar la pintura de plomo, siga las reglas de seguridad. Para mas imformación de como reducir la exposición de plomo, mientras remodela la casa, llame al 1-800-424-PLOMO, o llame a su departamento de salud local.

¿Como puedo proteger a mu familia contra exposición de plomo si estoy rentando?

A. Es la responsablilidad del dueño mantener la pintura en buenas condiciones. Si el dueño no quiere arreglar la pintura dañada, llame a su departamento de salud local. La persona que le renta la casa tiene las resposabilidad de darle imformación acerca de el plomo en la pintura al momento en que usted firma su contrato o le suben la renta.
B. Si, su rentero arregla la pintura dañada, aseguerese que lo haga apropiadamente, como se le indica arriba. Asegurese que las personas encargadas de limpiar la pintura no despersen cascaras de pinturas o plovo. Ellos deben de limpiar muy bien antes de irse.

Adicionales:
Departamento de la salud Ambiental de Denver (720) 865-5452
Departamento de la salud publica y ambiental de Colorado (303) 692-2700

KEEP YOUR CHILDREN SAFE FROM LEAD



Keep Your Kids Safe From Lead!

Windows are a major source of lead paint chips and dust. If your children are exposed to contaminated windows, they could be lead poisoned. By following some simple steps, you can reduce the risk of lead hazards and keep your kids safe.

Here's How:

1. **Raise and secure the lower sash** (as seen in the diagram) of each window. This will expose the exterior sill, the flat portion of the window frame shown in the picture.

2. **Remove and wash any toys** found in the windowsills with soapy water.

3. **Remove paint chips and dirt from windows with wet paper towels** or rags and dispose of them immediately in a secure trash bag.

4. Use a bucket full of soapy water and rags or paper towels to **clean out all remaining dirt, paint, and debris from all exterior sills.** Repeat until all areas are completely clean. Dispose of rags or paper towels in a secure trash bag.

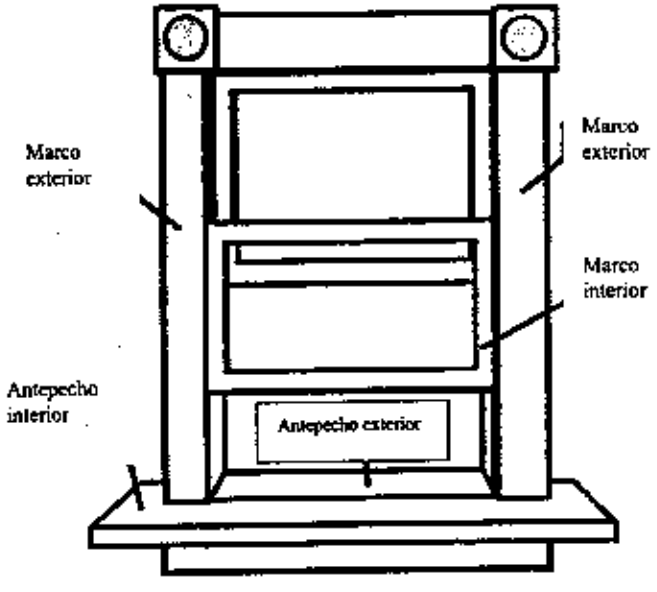
5. Use clean rags and water to **wipe down the trim and interior sill of each window.** These are the decorative portions of the window facing the inside of the house (as seen in the picture). Wash the trim and sill from top to bottom and dispose of rags in a secure trash bag.

6. When you are done cleaning all the windows in your home, **flush the soap water down the toilet.**

7. **Repeat these steps every two weeks.** It may be necessary to clean the windows more often in warm weather, or at windows that your children are in greater contact with.

8. **Make sure to wash your hands thoroughly** with soap and water when you are finished cleaning.

Mantenga a Sus Niños a Salvo de Contraer Arsenico en su Sistema!



Mantenga a Sus Niños a Salvo de Contraer Arsenico en sus Sistemas!

Las ventanas son las mejores lugares en que los niños se encuentran expuestos a contraer contaminaciones de arsenico y plomo con más frequencia. Estas contaminaciones pueden ser de cuidado. Siguiendo estos sencillos pasos puede lograr que sus hijos esten fuera de peligro.

Sugerencias para mantener las ventanas en buenos condicion.

1. Lave y asegure la parte exterior de cada una de sus ventanas como se le muestra en el diagrama .

2. Remueba y lave cualquier jugete que haya encontrado en la ventana.

3. Remueba las pedasos de pintura en las ventanas con toallas mojadas y tirelas a la basura de imidiato.

4. Use una cubeta con agua, bastante jabon y toallas de papel para limpiar la tierra, pintura y restos del exterior de la ventana. Repite esto en todas sus ventanas hasta que queden completamente limpias. Deposite los trapos o toallas de papel en la basura.

5. Use trapos y agua para limpiar los restos de tierra o pintura que se este despredíendose de la parte interior de la ventana. Esta es la parte de adentro como muestra la imagen.

6. Cuando haiga termina limpiar todas las ventanas de su casa, vacie la agua que utilizo para limpiar en la taza del baño.

7. Repita estos pasos cada dos semanas. Probablemente sea necesario limpiar las ventanas mas frecuentemente durante el verano o limpiar las ventas a las cuales sus hijos tienen mas contacto.

8. lave sus manos perfectamente con agua y jabón cuando haya acabado de limpiar.

ARSENIC IN SOIL

Soil and Your Health

Doctors and scientists from the Agency for Toxic Substances and Disease Registry (ATSDR) have looked at test results from soil collected in you neighborhood to see whether the amount of arsenic is high enough to cause health problems for people who live in the area. ATSDR found that the amount of arsenic in some yards might be a health concern for some children and adults.

How Can Arsenic Get into the Body?

Soil that contains arsenic can get into your body:

- While playing
- While gardening
- While working in your yard

We sometimes touch things that have dirt or dust on them and the put our hands or other items into our mouths. When this happens, small amounts of arsenic can get into our bodies along with the dirt or dust.

Swallowing these small amounts of soil with arsenic usually will not cause health problems. But if arsenic in soil is too high, children and adults might become sick.

Adults and Arsenic

Arsenic levels and cancer are a concern for people who grew up in a house with high levels of arsenic in soil and who continued to live in the house as adults. These people could have a higher chance of getting certain types of cancer, such as skin cancer and cancer of the lung, bladder, kidney, and liver.

Children and Arsenic

Soil-Pica

Some preschool children eat large amounts of soil (1 teaspoon or more) while playing and exploring their world. This is called soil-pica behavior.

Soil-pica behavior is especially a concern for children who live in areas with high arsenic levels in soil. After eating large amounts of soil with high levels of arsenic, these children could have health problems, such as:

- Nausea or upset stomach
- Stomach cramps
- Vomiting
- Diarrhea
- Swelling of the face (especially around the eyes)
- Headaches

You Can Protect Yourself

Here are a few things that you can do to protect your family from arsenic in the soil. These tips are especially important if you live in an area with high arsenic levels in soil. These tips are good steps for everyone to follow:

- Watch your preschool children when they are playing outside. Keep them from eating dirt or mud and from putting toys in their mouths.
- Talk to older children about the possible danger of eating soil.
- Encourage preschool children to play in areas of the yard that are covered by grass.
- Talk to adults about not eating soil or mud from their yards.
- Wash child's hands at least 5 times per day and always before eating and taking naps
- Wash toys frequently

Kids at Play

Health Survey

Where Can I Get More Information About Exposure to Arsenic in Soil and Soil-Pica Behavior?

Chris Poulet, ATSDR Denver @ 303-312-7012

OR

Margaret Schonbeck, Colorado Department of Public Health and Environment @ 303-692-2636

Arsénico en la Tierra

El suelo y su salud

Doctores y científicos de la Agencia para las Sustancias Tóxicas y el Registro de Enfermedades (ATSDR) han revisado los resultados de las muestras de suelo recolectadas en su vecindario para ver si la cantidad de arsénico presente pudiera causar problemas de salud a las personas que viven en el area. ATSDR encontró que la cantidad de arsénico en algunos jardines podria ser de preocupación para la salud para algunos niños y adultos.

¿Cómo puede el arsénico entrar en el cuerpo? El suelo que contiene arsénico puede entrar a su cuerpo?

- Mientras juega
- Mientras trabaja en horticultura y
- Mientras trabaja en su jardín

A veces tocamos las cosas que están sucias o tienen polvo sobre ellas y ponemos nuestras manos u otros articulos en nuestras bocas. Cuando esto pasa, pequeñas cantidades de arsénico pueden entrar a nuestros cuerpos con la suciedad o el polvo.

Tragar pequeñas cantidades de tierra con arsénico por lo general no causa problemas de salud, pero si el arsénico en el suelo es demasiado alto, niños y adultos podrían enfermarse.

Los adultos y el Arsénico

Niveles de arsénico y el cáncer son una preocupación para la gente que creció en una casa con los niveles altos de arsénico en el suelo y quien siguió viviendo en la misma casa como adultos. Esta gente podría tener una posibilidad más alta de conseguir ciertos tipos de cáncer, como el cáncer de la piel, cáncer de pulmón, de vejiga, de riñón y del hígado.

Los niños y el Arsénico

Comportamiento pica

Algunos niños en edad preescolar comen grandes cantidades de tierra (1 cucharadita o más) ya sea jugando o explorando su mundo. Esto se llama comportamiento pica.

El comportamiento pica es especialmente una preocupación para los niños quien viven en áreas con niveles altos de arsénico en el suelo. Después de comer grandes cantidades de tierra con niveles altos de arsénico, estos niños podrían tener problemas de salud, como:

- Nausea o molestia de estómago
- Cólicos
- Vómitos
- Diarrea
- Hinchazón de la cara (especialmente alrededor de los ojos)
- Dolores de cabeza

Usted Puede Protegerse

Hay algunas cosas que usted puede hacer para proteger a su familia del arsénico en el suelo. Estos consejos son sobre todo importantes si usted vive en un área con niveles de arsénico altos en el suelo. Estos consejos son buenos para que todas las personas los usen:

- Observe a sus niños en edad preescolar cuando jueguen fuera. Impídales comer cosas sucias o lodo y a poner juguetes en sus bocas.
- Hable con niños mayores sobre los peligros de comer tierra.
- Anime a niños preescolares a jugar en las áreas del jardín que tienen pasto.
- Háblele a los adultos sobre el no comer tierra o lodo de sus jardines.

¿Dónde puedo conseguir más información sobre la exposición a arsénico en el suelo y sobre el comportamiento pica?

Chris Poulet, ATSDR Denver @ 303-312-7012

OR

Margaret Schonbeck, Colorado Department of Public Health and Environment @ 303-692-2636

LEAD IN SOIL

Soil and Your Health

Doctors and scientists from the Agency for Toxic Substances and Disease Registry (ATSDR) have looked at test results from soil collected in you neighborhood to see whether the amount of lead is high enough to cause health problems for people who live in the area. ATSDR found that the amount of lead in some yards is at levels that are of concern for some children.

Common Sources of Lead

- Soil
- Old house paint (especially houses built before 1960)
- Household dust
- Plastic window blinds
- Imported pottery/dishes
- Home remedies (Azarcon, Greta)
- Drinking water

How Can Lead Get into the Body?

Soil that contains lead can get into the body in many ways. When children play, they sometimes touch things that have dirt or dust on them and then put their hands or other items into their mouths. When this happens, small amounts of lead can get into their bodies along with the dirt or dust.

Swallowing small amounts of soil with lead usually will not cause health problems. But if the amount of lead in soil is too high, children might become sick.

Possible Health Effects from Lead

Most children with lead poisoning don't have symptoms. The only way to know if a child has lead poisoning is to get their blood tested. However, when children have high levels of lead in their bodies, they might have health problems, such as:

- Hearing problems
- Speech, language, and behavior problems
- Lowered intelligence scores
- Delays in development
- Trouble sleeping
- Poor muscle coordination
- Loss of appetite
- Headache

Ways to Prevent Children from Getting Lead Poisoning

- Wash child's hands at least 5 times per day and always before eating and taking naps
- Wash toys frequently
- Give them foods rich in Vitamin C, calcium, and iron
- Clean floors and window sills with detergent and water
- Wipe up any paint chips with a wet sponge, rag, or paper towels. If you suspect the paint has lead, throw the sponge, rage, or paper towels away after cleaning
- If you are remodeling an older home, NEVER dry sand or scrape lead based paint
- Encourage your children to play in grassy areas instead of on dirt.

Kids at Play
Health Survey

Where Can I Get More Information About Exposures to Lead in Soil?

If you think your child has been exposed to lead, you may contact:
Mishelle Macias, Colorado Department of Public Health and Environment
@ 303-692-2622 or 303-692-2700
OR
Gene Hook, City and County of Denver, @ 720-865-5452

Plomo en la Tierra

El suelo y su salud

Doctores y científicos de la Agencia para las Sustancias Tóxicas y el Registro de Enfermedades (ATSDR) han revisado los resultados de los exámenes de muestras recolectadas del suelo de su vecindario para ver si la cantidad de plomo es suficientemente alta como para causar problemas de salud para la gente quien vive en el área. La ATSDR encontraró que la cantidad de plomo en algunos jardines está en los niveles que son de preocupación para algunos niños.

Las fuentes Comunes de Plomo son:

- Tierra
- Pintura de casas viejas (especialmente casas construídas antes de 1960)
- Polvo
- Cotinas de plástico para ventanas
- Cerámica / platos Importados
- Remedios caseros (Azarcon, Greta)
- Agua potable

¿Cómo Puede Entrar el Plomo en el Cuerpo?
El suelo que contiene plomo puede entrar en cuerpo de muchas maneras. Cuando los niños juegan, a veces tocan las cosas que tienen la suciedad o el polvo sobre ellos y luego pouen sus manos u otros artículos en sus bocas. Cuando esto pasa, pequeñas cantidades de plomo pueden entrar en sus cuerpos con la suciedad o el polvo.

Comer pequeñas cantidades de tierra con plomo por lo general no causa problemas de salud. Pero si la cantidad de plomo en el suelo es demasiado alta, los niños podrían enfermarse.

Posibles Efectos sobre la Salud por el Plomo

La mayor parte niños con envenenamiento por plomo no tienen síntomas. El único modo de saber si un niño tiene el envenenamiento por plomo es mediante un examen de sangre. Sin embargo, cuando los niños tienen niveles altos de plomo en sus cuerpos, ellos podrían tener problemas de salud, como:

- Problemas del oido
- Problemas de lenguaje, habla y de comportamiento
- Baja los niveles de inteligencia
- Retrasos el desarrollo
- Problemas para dormir
- Coordinación pobre de los músculos
- Pérdida de apetito

Modos de Impedir que los Niños se Envenenen por Plomo

- Lave las manos del niño al menos 5 veces por el día y siempre antes del comer y antes de tomar siestas
- Lave los juguetes con frecuencia. Déles alimentos ricos en Vitamina C, calcio y hierro
- Limpie los pisos y ventanas con detergente y agua
- Limpie la pintura vieja levantada con una esponja mojada, trapo o toallas de papel. Si Ud sospecha que la pintura tiene plomo, tire la esponja, el trapo o toallas de papel después de la limpieza
- Si Usted está remodelando una casa vieja, NUNCA lije o pele la pintura que contiene plomo.
- Anime a sus niños a jugar en áreas con pasto en vez de áreas con tierra.

¿Donde puedo conseguir más información sobre la exposición al suelo con plomo?
Si piensa que su hijo ha estado expuesto a plomo, usted puede llamar a:
(Se habla Espanol) *Mishelle Macias*, Colorado Department of Public Health and Environment, 303-692-2622 Or 303-692-2700
Or
Gene Hook, City and County of Denver, 720-865-5452

APPENDIX C

STANDARD OPERATING PROCEDURES
AND
QUALITY ASSURANCE PROJECT PLAN FOR
ENVIRONMENTAL DATA COLLECTION

TECHNICAL STANDARD OPERATING PROCEDURE

Date: March 21, 2003 SOP No. MFG-VBI70-01

Title: **Soil Sampling**

APPROVALS:

MFG, Inc.

Author: K. Tegtmeyer Date: 3/24/03

SYNOPSIS: Provides procedures and instructions for the location and collection of soil samples for laboratory analysis.

REVIEWS:

TEAM MEMBER	SIGNATURE/TITLE	DATE
EPA Region 8	Bonnie Lobb / RPM	3/25/03
MFG, Inc.	[illegible]	3/25/03

REV.	DATE	REVISION DESCRIPTION
1	8/16/02	Clarification of sample preparation procedures. Phase III - change to bulk sample analysis with grinding prior to analysis. Hazard Identification for lead – add drying and sieving to bulk fraction prior to analysis.
2	3/21/03	Removed section on focused soil sampling for arsenic analyses.

VASQUEZ BOULEVARD & INTERSTATE 70 SITE
COMMUNITY HEALTH PROGRAM

STANDARD OPERATING PROCEDURE FOR RESIDENTIAL SOIL SAMPLING

1.0 PURPOSE AND SCOPE

These procedures apply to investigation soil sampling performed at the Vasquez Boulevard and Interstate 70 (VB/I-70) Superfund Site during the community health program. The soil samples will be collected for analysis of lead and arsenic.

2.0 TRAINING AND QUALIFICATIONS

All personnel performing these procedures will be trained in their use, have significant relevant sampling experience, as approved by the MFG project manager, and be experienced in sample handling, documentation and shipping. Personnel implementing the "Hazard Identification, Lead Investigation Sampling" procedure (Section 4.2.1 below) must also have current certification from the Colorado Department of Public Health and Environment's Air Quality Control Division as a lead-based paint risk assessor.

3.0 EQUIPMENT AND SUPPLIES

- Soil augers/coring tools – Various models of soil augers are acceptable and selection of the specific brand and make of tool will be recommended by the contractor implementing the field work. Augers are usually made of stainless steel, and should be capable of retrieving a cylindrical plug of soil 2 inches in diameter and 2 inches long. In all cases the procedures recommended by the manufacturers should be followed with regard to use of the auger. Augers with disposable plastic sleeves may be employed to minimize the decontamination effort.

- Collection containers – plastic zip-lock bags

- Trowels – for extruding the soil from the auger. May be plastic or stainless steel.

- Composting Bowl – for collecting the grab samples for compositing. Samples will be coarsely mixed in this bowl. May be plastic or stainless steel.

- Gloves – for personal protection and to prevent cross-contamination of samples. May be plastic or latex. Disposable, powderless.

- Field clothing and Personal Protective Equipment – as specified in the Health and Safety Plan.

- Sampling flags – three different colors or numbers. Used for identifying yard soil sampling locations. Each color or number represents a different composite sample.

- Wipes – disposable, paper or baby wipes. Used to clean and decontaminate marker flags.

- Field notebook – a bound book used to record progress of sampling effort and record any problems and field observations during sampling.

- Three-ring binder book – to store necessary forms used to record and track samples collected at the VB/I-70 site. Binders will contain the Surface Soil Data Sheet, Site Diagram, and sample labels for each day. Example forms are provided in Attachment 1.

- Permanent marking pen – used as needed during sampling and for documentation of field logbooks and data sheets.

- Measuring tape or wheel – used to measure each property.

- Measuring tape or pocket ruler – used to measure the length of soil core in the soil coring device.

- Water Sample Bottle, preserved with Nitric Acid – used to collect equipment rinsate QC samples each day.

- Trash Bag – used to dispose of gloves and wipes.

4.0 SAMPLE TYPES AND SAMPLING PATTERNS

This procedure may be used to collect two types of soil samples: (1) Phase III Field Investigation (EPA, 1999) soil samples at residential properties, schools, day-care facilities and parks and (2) soil samples to identify lead hazards in soil at residential properties in accordance with guidance from the U.S. Department of Housing and Urban Development (HUD) (HUD, 1995).

Phase III investigations will be performed only if a property has not been previously sampled using those procedures. Sampling for lead hazard identification will be performed at all properties participating in Community Health Program lead investigations. Separate procedures are provided below for collecting these two types of samples.

4.1 PHASE III SOIL INVESTIGATION

The sampling pattern and sampling methods described in this section were originally developed by EPA for their Phase III Field Investigation (EPA, 1999) and are consistent with those used during the Phase III work.

The sampling patterns for residential yard, school or park soils are designed to identify and collect samples to support human health risk assessment. Idealized sampling patterns for residential soils are presented in the attached figures, but possible deviations from these sampling patterns could occur based on buildings or other obstructions found at each property. However, sample locations will be identified on a property-by-property basis.

4.1.1 RESIDENTIAL YARD SOIL

Residential yard soil samples will be composited, which requires soil collection from multiple (sub-sample) points. These soils are then mixed and used as a measure of the concentration averaged over the entire area (property). Surficial yard soil samples (0-2 inch depth) will be collected.

Soil Sample Location Identification

The surficial sampling locations within a yard will be based on a 30-point sampling grid. Because of the large number of properties that require sampling during this project, an independent chemical analysis will not be performed for each of the sub-samples collected from each property. Rather, at least three composite samples will be collected per residence, each

consisting of 10-sub-samples that are identified by marker flags of the same color or number. Although numbers may be used for identification of sample locations, for the purposes of this SOP, all procedural descriptions will be illustrated using colored marker flags, (e.g., 10 red, 10 blue, and 10 yellow). The number of total sample points may be reduced from 30 to 15 (three 5-point composites) at properties with very limited sample area, for example, the sample points would result in points being less than five feet apart (total sample area is less than 750 square feet). Identification of individual grab sample locations will be performed using the following general steps.

The sampling technician will be trained in this procedure in order to ensure replicable sample location assignment. The following steps will be followed (in order) prior to any sample collection:

a. Measure each yard
b. Pace off each building or permanent obstruction
c. Identify major sampleable areas
d. Determine the number of sample points in each sub area
e. Record sample locations
f. Mark sample locations
g. Collect the sample

Measure each yard

The sampling technician will measure the property dimensions with a measuring tape, measuring wheel or laser measuring device (± 0.5 feet). Draw a sketch of the property and record property dimensions, north orientation, and adjacent streets and alleyways on the site diagram.

Pace off each building or permanent obstruction

The sampling technician will then pace off the major permanent structures of the residence (e.g., dimensions of the property boundary, house garage, driveway, etc.) and prepare a site diagram to approximate scale ± 3 feet on each measurement). The goal is not have a drawing to scale, but instead to have an estimate of the total sampleable area in the residential yard. The total sampleable area is defined as any area on the property that is free of permanent obstructions. Temporary obstructions such as automobiles or trailers parked on unpaved property locations, picnic tables, plastic or other materials covering the property are not permanent structures and will be considered “sampleable.” Therefore, areas that could be used in the future if the temporary obstructions were removed, should be identified on the field diagram and must be considered in sample location identification. Figure 2 and Figure 3 provide examples of a typical residence at the VB/I-70 site that has been drawn on a grid.

Identify major sampleable areas

For each residence, the sampleable area will be divided into rectangular sub areas, using natural boundaries such as the house, garage, sidewalk or gardens as division markers (See Figure 3). A minimum of three and a maximum of eight sub areas will be identified to the nearest pace (± 3 feet). For convenience, it is recommended that the number of sub areas identified is minimized. Draw the sub areas on the site diagram sheet. Count the number of squares in each sub area and record this information on the field data sheet.

Determine the number of sample points in each sub area

Add the total number of squares contained in each of the sub areas, and record in the appropriate space on the surface soil data sheet. Divide this number by 30 to determine the grid area per sample point, and record in the appropriate space on the data sheet (Attachment 1). To determine the number of sample points in each sub area, divide the number of squares in each sub area by the grid area per sample point. Using standard analytical rounding procedures, round each number to the nearest whole number to determine the number of sample points in each sub area. (See Figure 3 for example). The number of total sample points may be reduced from 30 to 15 (three 5-point composites) at properties with very limited sample area, for example, the sample points would result in points being less than five feet apart (total sample area is less than 750 square feet).

Record sample locations

Before placing flags into the yard, mark their planned location on the site diagram. Marking flag locations on the site diagram before actually placing them will give the sampling technician a chance to check that sample locations are evenly distributed within each sub area, and that all sub-sample locations are documented and recorded. In addition, if an error has occurred in the calculation of sub-sample locations, it will be discovered before any flags have been staked. Because property sizes and obstacles present at each residence may vary significantly, actual sample locations will be identified using a diagram that will be drawn for each individual property sampled. If either permanent obstructions, temporary obstructions, or bare areas are present at the intended sampling locations (e.g., sidewalk, shed, garden, etc.), the sample point should be offset so that a surficial yard soil may be collected, then the actual sample location must be correctly documented on the field diagram. If the sampling technician identifies an error in the sample location identification procedures that compromise the readability of the document, a new, revised diagram may be necessary. After recording all of the sample points, the sampling technician should check the site diagram to make sure that sub-sample locations are not clustered in any area (unless clustering is a result of offsetting sample locations due to obstructions). The sampling technician should also verify that sample points are approximately equidistant throughout the property.

Mark sample locations

Starting at one corner of the property, stake sub-sample locations using a repeated sequence of three distinct flag types (i.e., Yellow, Blue, Red, Yellow, Blue, Red, etc.) in alternating sequence across sub areas. Do not place the same flag types next to each other, so that there is an even distribution of flags in each sub area (Figure 3). As seen in Figure 3, the location of each marker flag should be approximately equidistant from the other flags within each subsection. Additionally, each color flag should be alternately placed so that the same color marker flags are not clustered. A sample location or flag may be reassigned if clustering is observed.

Surface Soil Collection

The first composite will be collected by combining the samples at flags of similar color (e.g. red). Grab samples will be collected from the 0-2 inch soil horizon adjacent to each marker flag. Each sample will be collected using a clean coring tool (2-inch diameter). Grab samples marked by a red flag will be placed into a stainless steel bowl and homogenized (see Section 4.1.3). The homogenized composite sample will be placed into a single zip-lock bag and labeled in accord with the Sample Handling SOP. The second and third composite samples will be collected in identical fashion but by sampling next to the blue and yellow flags, respectively.

4.1.2 SCHOOLS AND PARK SOIL

Surface soil samples at schools and parks will be collected using the same sampling strategy as discussed for the residential soil sampling (Section 4.1.1). The number of grab samples collected at an individual school or park may vary, but 3 composite samples will be collected at minimum. Each individual grab sample will be identified using marker flags on any three different colors (e.g., red, blue, and yellow). The exact sampling pattern will be unique to the individual school or park and will be documented thoroughly in the sampling technician's field records. At minimum, each marker flag will be approximately equidistant from the other flags and each color flag should be alternately placed so that the same color marker flags are not clustered.

4.1.3 COLLECTION OF COMPOSITE SAMPLES USING A CORING TOOL

Locate the sub-sample point as specified by the sampling technician and clean the area free of twigs, leaves, and other vegetative material that can be easily be removed by hand. If the specified sub-sample point is occupied by a rock, cobble or other hard object of sufficient size to be incapable of easy removal by hand, move the sub-sample point to a location closest to the original point.

Place the coring tool on the ground and position it vertically. Holding the tool handle with both hands, apply pressure sufficient to drive the tool approximately two inches into the ground while applying a slight twisting force to the coring tool. Remove the tool by pulling up on the handle while simultaneously applying a twisting force. If the sample was retrieved successfully, a plug of soil approximately two inches long should have been removed with the coring tool. If turf-like vegetation (lawn) is present at the sample location, the sod will be cut and removed prior to advancing the coring tool. The coring tool will then be driven into the newly exposed soil to the measured two-inch interval as marked on the outside of the auger.

Hold the coring tool horizontally or place it on the ground. Using a clean spatula or knife, remove the soil collected at depth greater than two inches from the end of the sampling tool. Excess soil material will be replaced at the sampling point. Use a trowel to extrude the soil from the auger, pushing the two-inch soil plug from the coring tool so that it falls directly into the stainless steel compositing bowl. If sod material was removed, scrape the loose soil from the turf plug and allow it to fall into the compositing bowl. Repeat the steps outlined above until all of the sub-samples for a composite have been collected and homogenized in the compositing bowl. After homogenization the sample will be transferred to a large zip-lock bag. Repeat the steps outlined above for collection of the second and third composite samples.

All samples will undergo further sample preparation homogenization by the analytical laboratory prior to performing analyses in accordance with Phase III SOP titled “Sample Preparation” (MK-VBI70-05). Samples will be dried and sieved (<2 mm, 10 mesh sieve) by the laboratory prior to analysis.

If sampling equipment is to be re-used, follow the decontamination procedures outlined in Section 9.0 before collecting the next composite sample. There is no need to decontaminate between locations for subsamples collected for a single composite sample.

4.2 HAZARD IDENTIFICATION

Soil samples will be collected from targeted areas that represent increased risk of children’s exposure to lead in soils. Such areas include any play areas, driplines or building foundations, pet areas, gardens or flowerbeds where bare soil is present. Each distinct bare area with dimensions of at least 9-square feet will be sampled. If there is no bare soil present, then no sampling shall be necessary. However, in most cases, there will be at least small bare areas across the yard that should be sampled.

The procedures for soil sampling at properties where lead hazards may be present, is the same as the procedure recommended by the U.S. Department of Housing and Urban Development (HUD) for performing lead-based paint investigations at residential properties where children with elevated blood lead levels reside (HUD, 1995). Sampler will refer to HUD guidelines for soil sampling for additional details regarding soil sampling for lead (Appendix 13.3, HUD, 1995).

For each target bare area, a single composite sample will be obtained by combining a minimum of three sub-samples. Samples will be collected using a coring tool, stainless steel scoop or sampling container to acquire the **top half-inch** of soil. Selection of sampling equipment appropriate to the soil conditions will be at the discretion of the sampling technician.

Each composite sample will include approximately equal mass of soil from each sub-sample collected from 5 to 10 distinct locations roughly equidistant from each other along an axis that covers the target bare area (HUD, 1995). For samples collected along the foundation drip line, sub-samples should be collected at least 2 to 6 feet away from each other. At other sampling locations, samples should be collected at roughly equidistant points along each axis of an “x” shaped grid.

If paint chips are present in the soil, they should be included as part of the soil sample. However, there should be no special attempt to over sample paint chips. If paint chips are large, they may be disaggregated (i.e., broken up) by the sampling technician during homogenization of the composite sample. Although paint chips should not be over sampled, they should also not be excluded from the soil sample, since they are part of the soil matrix that is accessible to children.

The procedures to collect individual subsamples from the target bare areas are as follows:

1. At each subsample location, begin by clearing a circular area approximately 6 inches in diameter of loose debris or sparse vegetation.

2. Using a decontaminated scoop or core sampler remove the soil from the top half inch of the soil profile and contain in a new, resealable plastic bag labeled with the target area description and sample number.

3. Fill resulting hole with loose soil to the ground surface level, tamp down fill to match surrounding surface grade.

These steps will be repeated at each of the subsampling locations for each target bare area sampled. For each target area, the subsamples from each depth interval will be combined into a single plastic bag, sealed, manually disaggregated and labeled. If any large rock fragments or

large foreign materials (e.g., paper or plastic trash, nails, etc.) are present, these may be removed before sealing the bag.

The composite soil samples will undergo further homogenization by the analytical laboratory prior to performing analyses. Samples will be dried and then sieved (<2 mm, 10 mesh sieve), and only the <2 mm fraction (bulk soil) will be analyzed for lead.

Decontaminate sampling equipment after completing subsampling within each target bare area. Decontamination procedures are provided in the SOP for Soil Sampling Decontamination.

4.2.1 Arsenic Investigation Samples

The sampling procedure for arsenic investigations is based on the HUD recommendations for lead hazard identification but it provides sample types that are directly comparable to those used in baseline human health risk assessments performed for the Vasquez Boulevard/I-70 Site, and does not include samples around the drip line.

For each target bare area, a single composite sample will be obtained by combining a minimum of three sub-samples. Samples will be collected using a coring tool or stainless steel scoop to acquire the **top 2 inches** of soil. Selection of sampling equipment appropriate to the soil conditions will be at the discretion of the sampling technician.

Each composite sample will include approximately equal mass of soil from each sub-sample collected from 5 to 10 distinct locations roughly equidistant from each other along an axis that covers the target bare area. Samples should be collected at roughly equidistant points along each axis of an “x” shaped grid.

The procedures to collect individual subsamples from the target bare areas are as follows:

1. At each subsample location, begin by clearing a circular area approximately 6 inches in diameter of loose debris or sparse vegetation (if present).

2. Using a decontaminated scoop or coring tool (2-inch diameter and 4-inch length) collect soil from the top 2 inches and contain in a new, resealable plastic bag labeled with the target area description and sample number.

3. Fill resulting hole with loose soil to the ground surface level, tamp down fill to match surrounding surface grade.

These steps will be repeated at each of the subsampling locations for each target bare area sampled. For each target area, the subsamples from each depth interval will be combined into a single plastic bag, sealed, manually disaggregated and labeled. If any large rock fragments or large foreign materials (e.g., paper or plastic trash, nails, etc.) are present, these may be removed before sealing the bag.

The composite soil samples will undergo further homogenization by the analytical laboratory prior to performing analyses for arsenic. Samples will be dried and sieved (<2 mm, 10 mesh sieve), and only the <2 mm fraction (bulk soil) will be analyzed for arsenic.

Decontaminate sampling equipment after completing subsampling within each target bare area. Decontamination procedures are provided in the SOP for Soil Sampling Decontamination.

5.0 SAMPLE CONTAINERS AND LABELING

Following the procedures outlined in Section 4.0, grab samples will be composited and then placed into sample containers (quart-sized plastic zip lock bags or larger). For each composite sample, two sample identification labels are required. One label is placed on the Soil Collection Data Sheet (Attachment 1), the other label is affixed to the quart-sized bag containing the sample. Sample identification will adhere to procedures detailed in the Sample Handling and SOP.

Soil sampling equipment will be thoroughly cleaned after each sampling day and inspected for damage or wear. Worn or unusable equipment will be replaced immediately.

6.0 FIELD QUALITY CONTROL SAMPLES

Equipment rinsates and field duplicates will be collected with investigation soil samples. Equipment rinsates associated with soil samples will be collected by pouring reagent water through the decontaminated re-usable equipment used to obtain soil samples (e.g., soil scoops and mixing bowls). Field duplicate samples will be collected at the same location as the soil samples, and will be splits of the homogenized samples. The duplicate sample will be assigned a separate sample identification number and will be a blind duplicate to the laboratory. One equipment rinsate and one field duplicate will be collected each day of sampling and submitted for laboratory analysis for lead.

7.0 SITE CLEAN-UP

Each hole made in the yard using the coring tool must be backfilled with clean topsoil and tamped down lightly. If sod was removed to obtain the soil sample, the hole should be backfilled and then the grass plug be replaced by the field personnel. Wherever possible, sod and soil (not collected and retained as part of the composite sample) should be replaced in the same hole.

All flags (if reused) should be decontaminated by wiping off with towels and/or baby wipes before re-use.

Throw all used wipes and gloves into the trash bags for off-site disposal.

8.0 RECORD KEEPING AND QUALITY CONTROL

Each field crew will carry a three-ring binder book that contains the surface soil data sheet, site diagram, and sample labels. In addition, a field notebook should be maintained by each individual or team that is collecting samples. At the end of each day, the field crews will finalize and photocopy site sketches and data sheets and place the originals on file in a field office or other secure location. For the Phase III investigation properties, each property must have site sketches with sub areas and grab sample locations needed for the sub-samples. Also note any deviations from the Phase III sampling plan in the field notebook.

For each property, the notebook information must include:

a. Project name
b. Sampling procedure used (SOP section reference)
c. Date
d. Time
e. Personnel
f. Weather conditions
g. Sample identification numbers with time of collection
h. List of sample areas or target areas
i. Locations of composite samples and sub-samples collected
j. Descriptions of any deviations from the sampling plans in this procedure and the reason for the deviation.
k. Signature of the field technician collecting samples and recording sample information

Samples taken from soils with visible staining or other indications for non-homogeneous conditions should also be noted. Field personnel will collect the proper type and quantity of quality control samples as prescribed in Section 6.0 above.

9.0 DECONTAMINATION

All sampling equipment must be decontaminated prior to reuse as prescribed in the Soil Sampling Decontamination SOP.

10.0 EQUIPMENT CALIBRATION AND MAINTENANCE

Soil sampling equipment will be thoroughly cleaned after each sampling day and inspected for damage or wear before storing. Worn or unusable equipment will be replaced immediately.

11.0 GLOSSARY

Sample point – The actual location at which the sample is taken. The dimensions of a sample Point are 2” in diameter and 2” deep (core technique) or 2” across by 2” deep (spoon/scoop technique).

Composite sampling – A sample program in which multiple sub-sample points are compiled together and submitted for analysis as a single sample.

Sample zone – A unit of surface area subjected to a given sample program. A given zone usually is thought to contain similar metals concentrations or to be defined by a single set of exposure parameters.

Targeted area – Those areas identified by the sampling technician as posing an increased risk of exposure due to bare soils lacking dense, year-round vegetation. Typical bare areas include gardens, flowerbeds, bare play areas, bare driplines and bare areas near building foundations.

12.0 REFERENCES

ASTM (American Society for Testing and Materials), 1995. Standard Practice for Field Collection of Soil Samples for Lead Determination by Atomic Spectrometer Techniques, ASTM Designation: E 1727-95, October 1995, 3 p.

EPA (U.S. Environmental Protection Agency), 1999. Project Plan for the Vasquez Boulevard & I-70 Site Phase III Field Investigation. Prepared by ISSI Consulting Group, Inc., August 4, 1999.

EPA, 1995. Residential Sampling for Lead: Protocols for Dust and Soil Sampling, EPA Doc. No. 747-R-95-001, March, 38 p.

HUD (U.S. Department of Housing and Human Services), 1995. Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing, Washington, D.C., June 1995.

Surface Soil Data Sheet

Medium: Surface Soil

Date: _____

Location: _____ _____ **Property #:**_____
(House #) (Street Name)

Building Type: Residential (circle one): Single Multifamily Apartment

School (name): _____

Park (name): _____

Phase III Samples

Sample Number	Sample Time	Sample Depth
		0-2”
		0-2”
		0-2”

Lead Hazard Screen Samples

Sample Number / Location	Sample Time	Sample Depth

Notes: _____

_____

_____

_____

Samplers’ Signatures:

_____ Date: _____

_____ Date: _____

TECHNICAL STANDARD OPERATING PROCEDURE

Date: March 21, 2003 SOP No. MFG-VBI70-02

Title: **Paint Sampling**

APPROVALS:

MFG, Inc.

Author: K. Tegtmeyer Date: 3/24/03

SYNOPSIS: Provides procedures and instructions for the location and analysis of paint samples for in-situ analysis.

REVIEWS:

TEAM MEMBER	**SIGNATURE/TITLE**	**DATE**
EPA Region 8	[signature] /RPM	3/25/03
MFG, Inc.	[signature]	3/25/03

REV.	DATE	REVISION DESCRIPTION
1	3/21/03	Update for use by Community Health Program

VASQUEZ BOULEVARD & INTERSTATE 70 SITE COMMUNITY HEALTH PROGRAM STANDARD OPERATING PROCEDURE FOR PAINT TESTING AND ASSESSMENT

1.0 PURPOSE AND SCOPE

These procedures apply to investigation paint sampling performed at the Vasquez Boulevard and Interstate 70 (VB/I-70) Superfund Site as part of the community health program. The procedures may be used for both interior and exterior paint investigations. Methods for in-situ paint testing for lead content and visual evaluation of paint condition are provided.

2.0 TRAINING AND QUALIFICATIONS

Personnel implementing these procedures must be trained, Colorado-certified risk assessors for lead-based paint hazards, in accordance with Colorado's Air Pollution Prevention and Control Act, Regulation 19 – Requirements for Lead-Based Paint Abatement. Personnel operating x-ray fluorescence (XRF) spectrometers to test the lead content of paint must also be trained by the instrument manufacturer in the proper use and maintenance of that equipment.

The risk assessor shall be familiar with the guidelines for paint testing and assessment including in Section 4.1.2 of the work plan before implementing this procedure.

3.0 PROCEDURES

A visual assessment of paint condition throughout the home will be performed followed by paint testing on surfaces where paint is deteriorated in areas selected by the risk assessor. Details regarding the paint-testing plan are provided in the Community Health Program Design Work Plan.

The first step for evaluation of lead-based paint at any property is the visual assessment, described in Section 3.2 of this procedure. The risk assessor performs the visual assessment and then prepares a plan for paint testing to focus on areas of the home where paint is deteriorated and where children may encounter deteriorated paint on a frequent basis.

The lead content of paint will be tested in situ using a portable XRF instrument. The instrument will be appropriate for use on painted surfaces and for a range of painted substrates

(wood, metal, plastic, etc.). The paint testing method is non-destructive to paint and will not damage painted surfaces or underlying substrates. Procedures for testing paint are detailed in Section 3.3.

3.1 Equipment

A portable XRF spectrometer will be used to test paint for lead content. Equipment specifications are listed below:

- Niton XL-300 or –700 Series Spectrum Analyzer: a field portable XRF spectrometer to process signals from which elemental concentrations in a sample may be calculated (refer to Attachment C for Performance Characteristic Sheet).
- Sealed cadmium (Cd)-109 source

Other equipment needed to follow this procedure include:

- Site plan of property including structures on property, exterior walls and interior rooms of the main residence.
- Field forms - Paint Testing and Assessment Worksheet, Evaluation of Paint Condition, Diagram of Property Interior, Diagram of Property Exterior (Attachment A)
- Clipboard

3.2 Visual Inspection Procedures

A visual assessment is conducted throughout the house. The State-certified risk assessor will inspect painted surfaces and the dust reservoirs in each room. Paint conditions will be inspected in living areas. Areas such as attics, crawl spaces, cellars or other locations that are inaccessible to young children will not be inspected. When assessing the paint the risk assessor will note the condition of the paint, identify friction or impact surfaces and determine whether painted surfaces show evidence of chew marks.

3.2.1 Condition of Painted Surfaces

When evaluating the condition of the paint the risk assessor will rate the paint condition as "good," "fair," or "poor." Fair and poor condition surfaces are indicators of deteriorated paint

and considered to be a potential source of lead exposure, or a lead hazard. Intact paint or "good" condition surfaces should be monitored for signs of deterioration. The following is based on the HUD guidelines.

Categories of Paint Film Quality

Type of Building Component[1]	Good	Fair[2]	Poor[2]
Exterior components with large surface areas	Entire surface is intact	<10 sq feet are deteriorated	>10 sq feet are deteriorated
Interior components with large surface areas (walls, ceilings, floors, doors)	Entire surface is intact	<2 sq feet are deteriorated	>2 sq feet are deteriorated
Interior and exterior components with small surface areas (window sills, baseboards, soffits, trim)	Entire surface is intact	<10 percent is deteriorated	>10 percent is deteriorated

[1] A building component refers to each *individual* component or side of building, *not* the combined surface area of all similar components in a room (e.g., a wall with 1 square foot of deteriorated paint is in "fair" condition, even if the other three walls in a room are intact).
[2] Surfaces with deteriorated lead-based paint (in "fair" or "poor" condition) are considered to be lead-based paint hazards and should be addressed through abatement or interim controls.

The risk assessor will use professional judgment when evaluating the condition of painted surfaces but will follow HUD's assessment guidelines and use their definitions for good, fair, and poor paint conditions. The size of an area of deteriorated paint need not be measured but simply estimated.

Paint conditions can be grouped into three general categories: surface deterioration, bulk deterioration, and layered deterioration (NDPA, 1990).

3.2.1.1 Surface Deterioration

Chalking = fine powder on the surface of a paint film usually caused by inadequate priming or sealing, over-thinning of paint or exposure to sunlight. Almost all exterior oil paints are designed to eventually chalk in order to wash dirt away in the rain and provide a good surface for repainting. When paint is lead based, the chalk may contain high levels of lead.

Mildew = microbial growth usually caused by excessive moisture. If unchecked, mildew formation can lead to extensive paint film failure. Mildew should be removed to decrease the

chance of paint film deterioration.

Worn Paint = worn or chipped due to friction or mechanical damage. Worn paint is often due to improperly hung doors, sticky window sashes, etc. The building component should be repaired so that it operates smoothly before it is recoated.

3.2.1.2 Bulk Deterioration

Checking = short, narrow breaks in the top layer of paint, usually caused by a loss of elasticity. Plywood substrates can often cause checking. The deteriorated paint should be removed if a new coating is to be applied.

Cracking and Flaking = advanced checking that usually occurs on surfaces with multiple layers of paint, including breaks that extend to the base substrate. The cracks usually form parallel to the grain of the wood. The damaged coating should be removed if a new coating is to be applied.

Alligatoring = reptilian scale patterns that are often caused by inadequate bond between the topcoat and underlying coats from paint films that are too thick, or the application of a brittle coating over a more flexible one. The old paint should be completely removed and the surface should be primed and repainted. Enclosure or component replacement will probably be the most effective and safe hazard control methods in this circumstance.

3.2.1.3 Layered Deterioration

Blistering = bubbles in the paint film caused by either heat or moisture. If bare substrate shows beneath the blister, then the likely cause is moisture. However, if another layer of paint shows instead of substrate, heat probably caused the blister. The risk assessor should endeavor to locate the moisture source if moisture is suspected. Control of the moisture source will lengthen the effective life span of many forms of lead-based paint hazard control, especially paint film stabilization.

Scaling or Flaking (peeling) = paint separation often found in those exterior areas of the building susceptible to condensation, such as under eaves. Salt deposits drawn to the paint film surface can cause scaling. The deteriorated paint should be removed, and the salts should be washed off if the surface is to be recoated. Enclosure may be the most effective and safe hazard control method for this type of deterioration.

Peeling from Metal = paint separation usually caused by improper priming of bare,

galvanized metal, or by rusting. The loose paint should be removed by wet scraping and the metal should be primed with a galvanizing primer or other primer made for metal before paint film stabilization. Industrial paints containing lead should not be used to prime metal surfaces. Component replacement and enclosure are likely to be most effective.

Peeling From Exterior Wood = paint separation usually resulting from wet wood swelling under paint, causing the paint film to loosen, crack, and dislodge. Moisture may come from the interior of the house (poor ventilation) or from exterior moisture penetrating the paint film. The risk assessor should recommend that the cause of the moisture problem be addressed before attempting paint film stabilization or any form of recoating.

Peeling From Plaster Walls = paint separation from insufficient wet troweling of the white coat when the plaster was applied, causing chalking of the surface. Both the use of glue size, which absorbs water and use of a primer with poor alkali resistance can also cause deterioration. The remedy for peeling paint is decided on a case-by-case basis.

Peeling From Masonry Surfaces = paint separation often caused by the alkaline condition of the surface. A coating system that is appropriate for alkaline surfaces should be used.

3.2.2 Condition of Friction and Impact Surfaces

Paint deterioration on friction and impact surfaces will be determined by operating several of the most frequently used windows and doors within the tested rooms. Windows that jamb and doors that bind or otherwise hit the frame are potential sources of leaded dust. A visual assessment of these areas will be performed and painted surfaces evaluated by rating their condition as good, fair or poor.

3.2.3 Chewed Surfaces

Surfaces with teeth marks are considered hazards if the paint is lead based. All chewed surfaces will be noted, and the paint lead content of all chewed surfaces will also be measured.

3.3 XRF Measurement Procedures

Interior and exterior paint will be analyzed for total lead using a portable XRF. Exterior

paint testing will not be performed in rain or snow or on surfaces that are wet. First refer to the paint-testing plans for interior and exterior paint, included in the Work Plan, for instruction on identifying the areas of the home where paint testing will be performed, and then follow the instructions below for testing paint in those areas.

At each test location, an XRF measurement will be collected in the following manner:

1. Place probe on a flat surface of intact paint.
2. Open the shutter via the spring-loaded trigger and analyze the test area for the appropriate count time (e.g., 10-20 seconds or until STD drops to within the acceptable range of ± 0.15 mg/cm^2).
3. Record test result and sample location on the Paint Analysis and Condition sheet.
4. Test results, including spectral analysis, are stored automatically and the screen is cleared to start next measurement.

More detailed information on the use of the Niton XRF is provided in Attachment B, which should be fully understood to prior to use of the instrument for implementing any portion of this SOP.

3.4 Documentation

3.4.1 Visual Assessment

The visual assessment will be documented by the risk assessor using a Paint Testing and Assessment Worksheet and/or Evaluation of Paint Condition form. This form will be completed at each property where an assessment is performed, and the form will be placed in the hard copy property file.

3.4.2 XRF Measurements

For each paint testing location, the risk assessor (or inspector) will record the following XRF measurement data on the Paint Analysis and Condition Form.

- Room or building component location (e.g., main living area or main entry door)
- Direction of the component in room or on building (e.g., east)
- Component being tested (e.g., window)

- Location on the component (e.g., sill)
- Color
- Substrate (e.g., wood)
- Condition of the paint
- Cause for deterioration, if known
- Measured (XRF) lead content in mg/cm^2
- Measurement standard deviation in mg/cm^2

4.0 EQUIPMENT CALIBRATION AND MAINTENANCE

Niton instruments are programmed with automatic calibration procedures and do not require manual calibration at any time. Manufacturer instructions (Attachment B) should be followed to ensure proper data quality assurance. Although calibration is automatic, periodic calibration checks and instrument maintenance should be performed as recommended by Niton for the model used.

4.1 Calibration Verification

Initial calibration is performed automatically when using the Niton XRF Analyzers. Follow manufacturer's instructions (Attachment B) to ensure proper instrument calibration

The correction for source decay, called normalization, is accomplished automatically in the Niton software on a predetermined, timed basis. This assures that the response of the instrument remains constant throughout the life of the source. However, the calibration will also be checked manually in order to ensure proper instrument response.

Instrument performance and calibration verification should be checked using pre-made lead-based paint standards. Standards are available from the National Institute of Standards and Technology (NIST). The NIST standards consist of a set of five mylar sheets that are coated with a single, uniform layer of paint containing lead levels. NIST does not manufacture standards with lead concentrations greater than 3.53 mg/cm^2.

The calibration of the XRF instrument should be checked using the paint film nearest 1.0 mg/cm^2 in the NIST Standard Reference Material (SRM) (e.g., for NIST SRM 2579, use the 1.02 mg/cm^2 film). Measurements should be bracketed by successful XRF calibration check readings. XRF calibration checks are performed at the beginning and end of the day's inspections or at extended delays in testing, and (at least) every four hours during inspections. If readings are

outside the acceptable calibration check range of 0.9-1.2 mg/cm², reanalyze the SRM. If readings continue to be outside of the acceptable range, the instrument must be sent to the manufacturer for troubleshooting. Measurements which are not bracketed by successful calibration checks should be considered suspect.

4.2 Maintenance

The instrument operator will provide routine maintenance at the end of each day of use. Routine maintenance will include cleaning to remove dust or dirt from the surface analysis probe, recharging and/or replacing batteries, and inspecting for damage to working components of the instrument or instrument casing. If any problems are identified through routine inspection, these problems will be reported to the manufacturer and the manufacturer's instructions for addressing those problems will be followed prior to further use of the instrument. The instrument operator will maintain records describing any repair or maintenance activities.

The XRF instrument will require annual maintenance. The instrument will be shipped to the manufacturer, according to their instructions, for routine cleaning, servicing and, if necessary, source replacement.

5.0 QUALITY ASSURANCE/QUALITY CONTROL OBJECTIVES

All lead-based paint testing will be performed in the field with the XL-300 or –700 series spectrometer manufactured by Niton, Inc. Precision for this instrument has been demonstrated to be better than 0.3 mg/cm^2 lead in the range of 0 to 1 mg/cm^2 (refer to Attachment C).

Precision for in situ paint analyses will be checked by collecting triplicate measurements of a sample paint surface at least once per property. Whenever possible the triplicate reading will be conducted at a location with a concentration level near 1 mg/cm$^{2.}$ The probe will remain in the same position for all three measurements. Each result will be recorded on the worksheet in the order in which it was made and in relation to the measurements of the routine samples. The standard deviation (STD) of these three measurements must be within +/– 0.15 mg/cm^2. If STD values do not meet these objectives, the surface will be examined for anomalies and the procedure will be performed again. If precision objectives are not met again, a "check-sample" procedure will be performed and the precision measurements will be repeated. If the measurements still do not meet the objective STD, the instrument will be returned to the manufacturer for troubleshooting.

6.0 REFERENCES

Colorado Air Pollution Prevention and Control Act, Regulation 19, Requirements for Lead-Based Paint Activities, 1998.

Niton, 1998. Niton 300 Series & 700 Series User's Guide.

U.S. Department of Housing and Urban Development, 1995 rev. 1997. Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing,

ATTACHMENT A

Field Forms

VB/I-70 Community Health Program

Paint Testing and Assessment Worksheet

Date: _____ Risk Assessor(s)/Technician(s) _____ _____

Property Address: _____ Property No. _____

Sample No.	Room Location	Direction	Component	Location	Paint Color	Substrate	Paint Condition (good, fair, poor)	If the paint is in poor condition why? (friction, impact, moisture, chew marks)	XRF Assay/ mg/cm²	Std. Dev mg/cm²

VB/I-70 Community Health Program

Exterior & Sample Location Map

Date: _____ Technician(s): _____

Property No.: _____

Property Address: _____

Notes: _____
_____
_____

Diagram of the Property Exterior

VB/I-70 Community Health Program

Interior & Sample Location Map

Date: _____ Technician(s): _____

Property No.: _____

Property Address: _____

Notes: _____
_____
_____

Diagram of the Property Interior

VB/I-70 Community Health Program

Evaluation of Paint Condition - Interior

Date: _____ Risk Assessor(s)/Technician(s) _____ _____

Property Address: _____ Property No. _____

Notes: _____

_____

_____

Location (specify if not listed)	**Building Component**	**Paint Condition** circle all that apply	**If the paint is in poor condition why?** circle all that apply	**Comments** (extent, direction, color)
Main Living Area	Ceilings	good fair poor not present	friction impact moisture chew marks	
	Walls	good fair poor not present	friction impact moisture chew marks	
	Floor	good fair poor not present	friction impact moisture chew marks	
	Windows	good fair poor not present	friction impact moisture chew marks	
	Doors	good fair poor not present	friction impact moisture chew marks	
	Trim	good fair poor not present	friction impact moisture chew marks	
		good fair poor not present	friction impact moisture chew marks	
Kitchen	Ceilings	good fair poor not present	friction impact moisture chew marks	
	Walls	good fair poor not present	friction impact moisture chew marks	
	Floor	good fair poor not present	friction impact moisture chew marks	
	Windows	good fair poor not present	friction impact moisture chew marks	
	Doors	good fair poor not present	friction impact moisture chew marks	
	Cabinets	good fair poor not present	friction impact moisture chew marks	
	Trim	good fair poor not present	friction impact moisture chew marks	
		good fair poor not present	friction impact moisture chew marks	
Bedroom	Ceilings	good fair poor not present	friction impact moisture chew marks	
	Walls	good fair poor not present	friction impact moisture chew marks	
	Floor	good fair poor not present	friction impact moisture chew marks	
	Windows	good fair poor not present	friction impact moisture chew marks	
	Doors	good fair poor not present	friction impact moisture chew marks	
	Trim	good fair poor not present	friction impact moisture chew marks	
		good fair poor not present	friction impact moisture chew marks	
Bedroom	Ceilings	good fair poor not present	friction impact moisture chew marks	
	Walls	good fair poor not present	friction impact moisture chew marks	
	Floor	good fair poor not present	friction impact moisture chew marks	
	Windows	good fair poor not present	friction impact moisture chew marks	
	Doors	good fair poor not present	friction impact moisture chew marks	
	Trim	good fair poor not present	friction impact moisture chew marks	
		good fair poor not present	friction impact moisture chew marks	
Stairway	Treads	good fair poor not present	friction impact moisture chew marks	
	Rise	good fair poor not present	friction impact moisture chew marks	
	Railing	good fair poor not present	friction impact moisture chew marks	
	Lower Trim	good fair poor not present	friction impact moisture chew marks	
		good fair poor not present	friction impact moisture chew marks	

Evaluation of Paint Condition - Interior

Bathroom	Ceilings	good fair poor not present	friction impact moisture chew marks	
	Walls	good fair poor not present	friction impact moisture chew marks	
	Floor	good fair poor not present	friction impact moisture chew marks	
	Windows	good fair poor not present	friction impact moisture chew marks	
	Doors	good fair poor not present	friction impact moisture chew marks	
	Cabinets	good fair poor not present	friction impact moisture chew marks	
	Trim	good fair poor not present	friction impact moisture chew marks	
	Ceilings	good fair poor not present	friction impact moisture chew marks	
	Walls	good fair poor not present	friction impact moisture chew marks	
	Floor	good fair poor not present	friction impact moisture chew marks	
	Windows	good fair poor not present	friction impact moisture chew marks	
	Doors	good fair poor not present	friction impact moisture chew marks	
	Trim	good fair poor not present	friction impact moisture chew marks	
		good fair poor not present	friction impact moisture chew marks	
	Ceilings	good fair poor not present	friction impact moisture chew marks	
	Walls	good fair poor not present	friction impact moisture chew marks	
	Floor	good fair poor not present	friction impact moisture chew marks	
	Windows	good fair poor not present	friction impact moisture chew marks	
	Doors	good fair poor not present	friction impact moisture chew marks	
	Trim	good fair poor not present	friction impact moisture chew marks	
		good fair poor not present	friction impact moisture chew marks	
	Ceilings	good fair poor not present	friction impact moisture chew marks	
	Walls	good fair poor not present	friction impact moisture chew marks	
	Floor	good fair poor not present	friction impact moisture chew marks	
	Windows	good fair poor not present	friction impact moisture chew marks	
	Doors	good fair poor not present	friction impact moisture chew marks	
	Trim	good fair poor not present	friction impact moisture chew marks	
		good fair poor not present	friction impact moisture chew marks	
	Ceilings	good fair poor not present	friction impact moisture chew marks	
	Walls	good fair poor not present	friction impact moisture chew marks	
	Floor	good fair poor not present	friction impact moisture chew marks	
	Windows	good fair poor not present	friction impact moisture chew marks	
	Doors	good fair poor not present	friction impact moisture chew marks	
	Trim	good fair poor not present	friction impact moisture chew marks	
		good fair poor not present	friction impact moisture chew marks	
	Ceilings	good fair poor not present	friction impact moisture chew marks	
	Walls	good fair poor not present	friction impact moisture chew marks	
	Floor	good fair poor not present	friction impact moisture chew marks	
	Windows	good fair poor not present	friction impact moisture chew marks	
	Doors	good fair poor not present	friction impact moisture chew marks	
	Trim	good fair poor not present	friction impact moisture chew marks	
		good fair poor not present	friction impact moisture chew marks	

Paint in poor condition will be tested using an XRF measurement. Not present includes non-painted components or the item is not present at this property.

VB/I-70 Community Health Program

Evaluation of Paint Condition - Exterior

Date: _____ Risk Assessor(s)/Technician(s) _____ _____

Property Address: _____ Property No. _____

Notes: _____

_____

_____

Building Component	**Paint Condition** circle all that apply	**If the paint is in poor condition why?** circle all that apply	**Comments** (extent, direction, color)
Wall (front)	good fair poor	friction impact moisture chew marks	
Wall (left side)	good fair poor	friction impact moisture chew marks	
Wall (back)	good fair poor	friction impact moisture chew marks	
Wall (right side)	good fair poor	friction impact moisture chew marks	
Windows	good fair poor not present	friction impact moisture chew marks	
Doors	good fair poor not present	friction impact moisture chew marks	
Horizontal Trim	good fair poor not present	friction impact moisture chew marks	
Vertical Trim	good fair poor not present	friction impact moisture chew marks	
Porch Floor	good fair poor not present	friction impact moisture chew marks	
Porch Railings	good fair poor not present	friction impact moisture chew marks	
Other Porch Surfaces	good fair poor not present	friction impact moisture chew marks	
Outbuildings	good fair poor not present	friction impact moisture chew marks	
Fence	good fair poor not present	friction impact moisture chew marks	
	good fair poor	friction impact moisture chew marks	
	good fair poor	friction impact moisture chew marks	
	good fair poor	friction impact moisture chew marks	
	good fair poor	friction impact moisture chew marks	
	good fair poor	friction impact moisture chew marks	

Paint in poor condition will be tested using an XRF measurement. Not present includes non-painted components or the item is not present at this property.

ATTACHMENT B

NITON 300 Series & 700 Series User's Guide

NITON

300series & 700series
User's Guide
Version 5.2

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NITON 300*Series* & 700*Series* User's Guide
Produced in the United States of America

Registration: NITON Corporation manufactures the 300*Series* and 700*Series* under the authority of the State of Rhode Island, *License #3A-105-01.* NITON 300*Series* and 700*Series* have been evaluated for safety in *Sealed Source and Device Evaluation Sheet RI-164-D-101-S.*

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Table of Contents--

Preface i
User's Guide Conventions ii
Chapter Summaries iii

Chapter 1: Getting Started 1-1
- Unpacking Your NITON 1-1
- Operation 1-2
- This is Your XRF Spectrum Analyzer 1-3
- Quick Start: Modes of Operation, by Mode 1-5
- Turning on Your NITON 1-5
- Control Panel Buttons 1-6
- Calibration & Testing 1-7
  - The Setup Menu 1-8
    - Checking and Updating Current Information 1-8
    - Setting Date and Time 1-9
    - Lighting the LCD Screen 1-10
  - Calibrating your NITON 1-12
    - Instrument Self-Calibration 1-12
    - The Ready to Test Screen 1-12
    - Re-calibrating Your NITON during testing 1-13
    - User Calibration on Standard Samples 1-14
- Soil and Thin Film Samples 1-15
- Overview of Test Modes 1-16
  - The Bulk Sample Mode 1-17
    - To Test in Bulk Sample Mode 1-17
  - Thin Sample Mode 1-18
    - To Test in Thin Sample Mode 1-19
  - The Paint Modes 1-20
    - Standard Paint Mode 1-20
    - Standard Mode + Spectra 1-21
    - K & L + Spectra 1-21
    - To Test in the Paint Modes 1-22
- SpectraView 1-23
  - Using SpectraView 1-23
  - Viewing the Information in SpectraView 1-23
  - SpectraView Zoom 1-24
  - To Exit from SpectraView 1-24

Downloading Data 1-25
Fast Data Dump 1-25
ASCII data Dump 1-26
Erasing Readings 1-26
Barcode Data Entry 1-28
Creating Custom Barcodes 1-30
Battery Packs and Battery Charger 1-33
General Information 1-33
Pre-charge Mode 1-34
Battery Pack Maintenance 1-34
Changing Battery Packs 1-34
Installing a Battery Pack 1-35
Recharging a Battery Pack 1-36
Discharge Cycle 1-37
Using Your Vehicle's 12v DC Outlet 1-38
Maintenance, Cleaning and Repairs 1-39
Storage, Transport and Shipping 1-40
Shipping and Transporting your NITON 1-40
Shipping Your NITON 1-40

Chapter 2: Radiation Safety 2-1
Typical Radiation Dosage Charts 2-2
How to Use Your NITON Safely 2-3
Shutter Safety 2-4
Monitoring Your Radiation Exposure 2-4
The Principles of Radiation Safety 2-6
Shielding 2-7
Instrument Radiation Profiles 2-8
Wipe Testing 2-17
If Your NITON is Lost, Damaged or Stolen 2-18

Chapter 3: Analyzing Bulk Samples 3-1
Before You Test 3-1
Testing in Bulk Sample Mode 3-2
The Summary Screen 3-4
In-Situ Surveys 3-4
Screening Techniques 3-5
The NITON Test Guard 3-5
Testing In-situ 3-6

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In-Situ Depth Profiling 3-8
Analysis of Bagged Bulk Samples 3-9
Taking Bagged Samples 3-9
Testing Samples in Bags 3-10
Analysis of Prepared Bulk Samples 3-10
Flow Chart of Prepared Sample Preparation Method 3-11
Taking Bulk Samples 3-12
Preparing Bulk Samples 3-14
Cleaning Equipment 3-14
Sample Preparation 3-15
Putting the Sample in the XRF Sample Cup 3-17
Preparing Liquids, Sludges or Dust 3-19
The Bulk Testing Platform 3-20

Chapter 4: Analyzing Thin Samples 4-1
Overview 4-1
The Dust Wipe and Filter Test Platform 4-2
Before You Test 4-3
37mm CE and Fiberglass Filter Mode 4-4
Positioning a Filter 4-5
Taking a Reading 4-6
Reading the Display 4-8
The Final Result Screen 4-9
TSP and PM Filter Mode 4-10
Testing TSP and PM Filters on the Sampler 4-10
Method 1 4-10
Method 2 4-12
Reading the Display 4-14
The Measurement Screen 4-14
The Final Result Screen 4-14
Other Air-Monitoring Filters 4-15
Dust Wipes 4-16
Taking a Dust Wipe Sample 4-17
Taking Measurements of your Dust Wipe Sample 4-19
Taking a Reading 4-20
Reading the Display 4-20
The Measurement Screen 4-20
The Final Result Screen 4-21

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Standard Thin Sample Mode 4-22
The Measurement Screen 4-23
User-Definable Thin Sample Testing 4-24

Chapter 5: Analyzing Lead Paint 5-1
Overview 5-1
Getting Started in Paint Mode 5-1
Before You Test 5-2
User Calibration on Standard Lead Paint Samples 5-2
Lead Paint Standards 5-4
Taking a Measurement 5-5
How to Take a measurement 5-6
Using the NITON on a Flat or Curved Surface 5-8
Test Duration 5-9
Reading the Display 5-10
The Depth Index 5-11
The Depth Index (K & L + Spectra Mode) 5-11
Averaging Readings 5-11
Toggling Between Paint Modes 5-12

Appendices
Appendix A: Summary of Warnings A-1
Appendix B: Summary of Cautions A-2
Appendix C: Tips For Better Testing A-4
Appendix D: Range, Precision and Limits A-6
Appendix E: Multi-Element Analysis (700*Series* only) A-8
Appendix F: Warranty A-9
Appendix G: X-Ray Emission Energies, by Element, by Atomic Number A-10
Appendix H: X-Ray Emission Energies, by Element, Alphabetically A-12
Appendix I: X-Ray Emission Energies, by Element, by Increasing Energy (keV) ... A-14
Appendix J: Chemical Composition of NIST Samples A-16

Preface

NITON XRF analyzers are the fruit of our long-term dedication to cutting-edge research and development in x-ray fluorescence (XRF) technology. Every NITON XRF offers outstanding performance, unsurpassed value, plus a company that stands behind each instrument with no-charge, life-time software upgrades; a 15-month limited warranty; and a highly-trained, dedicated staff of professionals. Our mission is to serve the needs of our users with state-of-the art instruments: the finest, safest, most economical hand-held XRF analyzers money can buy.

This User's Guide is a detailed instruction and reference manual for NITON **XL-309 (300*Series*)**, 701, 701A, 702, 702A, 703 and 703A (**700*Series***) XRF analyzers. The operation and safety instructions in this User's Guide are complete, including sections on radiation safety, and the proper operation, cleaning, storing and shipping your NITON XRF. This User's Guide is designed to compliment the instrument training that NITON provides to NITON users free of charge. Prior to turning on your NITON analyzer, please carefully review *Chapter 1: Getting Started; Chapter 2: Radiation Safety;* and all other sections of this User's Guide that pertain to the type(s) of testing that you will be doing.

NITON **300*Series*** and **700*Series*** XRF analyzers have been designed and manufactured with radiation safety foremost in mind. If you use your NITON properly, according to the instructions in this User's Guide, you will only be exposed to levels of radiation too low to be detected with an ordinary Geiger counter. For your safety, always follow radiation-safe work practices, and never attempt to open or disassemble your NITON XRF analyzer for any reason. All Service except changing battery packs and exterior cleaning must be performed by NITON Corporation. Do not attempt to make repairs yourself. Any attempt to open the aluminum outer casing of your NITON will void the instrument warranty.

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User's Guide Conventions

⚠ **Warnings:**	Provide information on how to safely operate the NITON.
⚠ **Cautions:**	Provide information on how to avoid damaging the NITON.
Notes:	Highlight other important information.

Warnings, cautions, and notes are printed in bold type.

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Chapter Summaries

Chapter 1: Getting Started

Supplies instructions for unpacking the shipping container. Includes basic operating instructions; an overview of NITON XRF test modes; and supplies instructions for instrument calibration, for taking a reading, for downloading data, and for charging and changing battery packs.

Chapter 2: Radiation safety

Includes an overview of radiation safety, instrument radiation profiles, and guidelines for safe operation of NITON XRF analyzers.

Chapter 3: Analyzing Bulk Samples

For users of **702, 702-A, 703** and **703-A** model analyzers (for multiple elements).
For users of ***300Series*** with optional Lead in Soil Analysis Package (for lead only).

Supplies instructions for rapid, on-site, multi-element detection and analysis of a variety of bulk samples, including soils, house dust, sludges, and liquids.

Chapter 4: Analyzing Thin Samples

For users of **701, 701-A, 703** and **703-A** model analyzers (for multiple elements).

For users of ***300Series*** with optional Dust Wipe Analysis Package (for lead only).

Supplies instructions for rapid, on-site, multi-element detection and analysis of a variety of thin samples, including filters, dust wipes and thin films.

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Chapter 5: Analyzing lead paint

For users of **701-A, 702-A, 703-A** and **300*Series*** model analyzers.

Supplies instructions for rapid, on-site detection and analysis of lead-based paint.

Chapter 8: Appendices

Appendix A: Summary of Warnings
Appendix B: Summary of Cautions
Appendix C: Tips for Better Testing
Appendix D: Range, Precision and Limits
Appendix E: Multi-level Analysis (**700*Series*** only)
Appendix F: Warranty Information
Appendix G: W-Ray Emission Energies, by Element, by Atomic Number
Appendix H: W-Ray Emission Energies, alphabetically
Appendix I: W-Ray Emission Energies, by Element, by increasing energy keV
Appendix J: Chemical Composition of NIST samples

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Unpacking Your NITON

1. **Inspect the shipping carton** for signs of damage such as crushed or water damaged packaging. Immediately notify the shipper and NITON Corporation if any damage is noted.

Note: **The radioactive cadmium-109 source is completely sealed and extremely secure.It meets ANSI standard 33232.**

2. **Open the packing carton.** If your NITON Spectrum Analyzer is not packed in its carrying case, please call NITON Corporation immediately at (401) 294-1234

3. **Verify the contents** of the shipping container against the packing list. Please record any discrepancies and notify NITON Corporation.

4. **Open the carrying case and visually inspect the instrument** for damage before removing it from the case. Call the shipper and NITON Corporation if you find any damage to the case or its contents.

5. **Save the shipping carton and all packing materials.** Store them in a safe, dry area. Use when the spectrum analyzer is next shipped.

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Operation

NITON **300*Series*** and **700*Series*** Spectrum Analyzers are hand-held, portable XRF detectors, designed to make fast, accurate measurements. The **300*Series*** measures concentrations of lead, while **700*Series*** instruments measure concentrations of many different elements simultaneously. NITON instruments measure the precision of each reading, store up to 3,000 readings with complete x-ray spectra, and download data quickly to a PC.

NITON has designed the radioactive source and shielding of our analyzers with one guiding principle in mind: properly used, these will not expose the NITON user to levels of radiation significantly above natural background levels.

Note: **The accuracy and precision of the data you collect with your NITON XRF will largely depend on your familiarity with the instrument and your knowledge of the media you are testing.**

Our free factory training is designed to give you the basic tools to use our instruments. This User Guide supplements our training. You can use it as both a quick reference and a detailed operating manual for any of our XRF analyzers.

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This is your NITON XRF Spectrum Analyzer

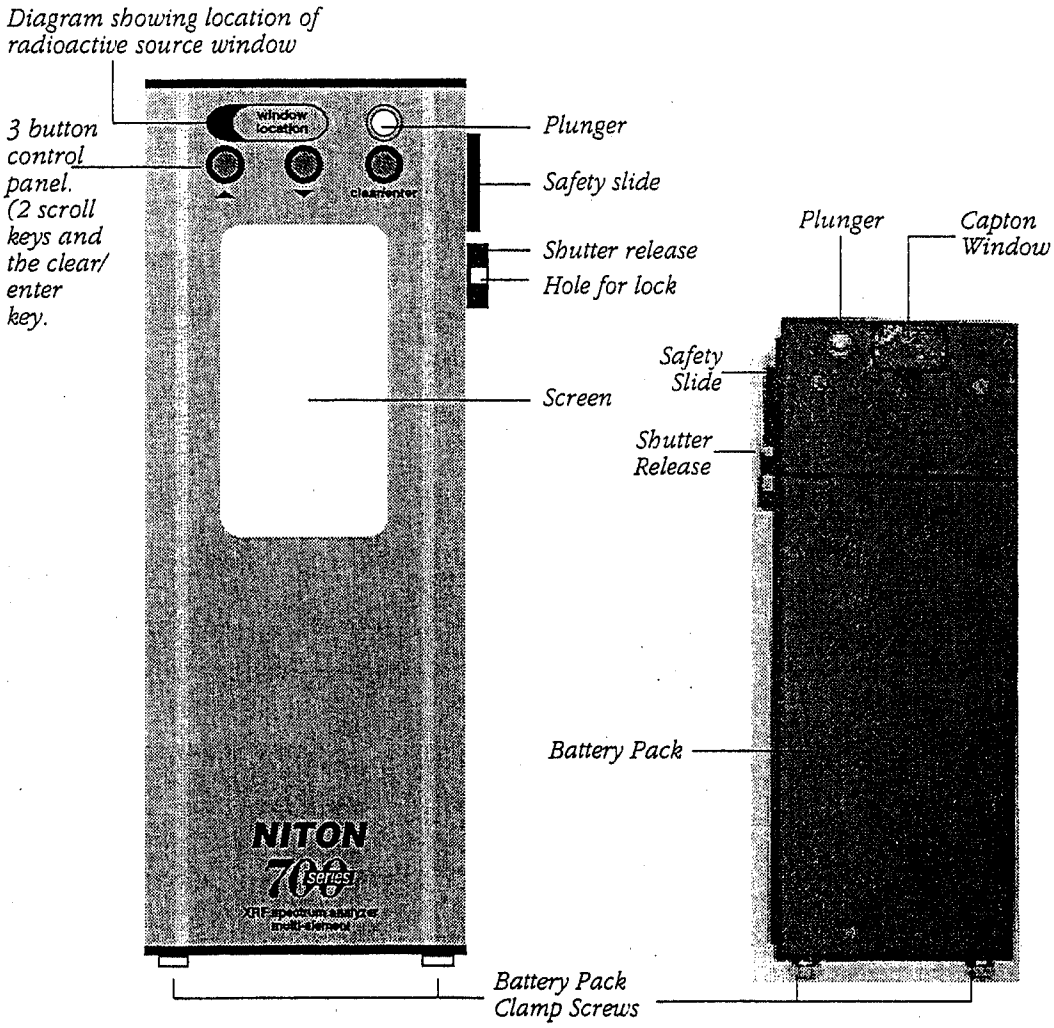

Figure 1.01
Front View of the NITON Spectrum Analyzer

Figure 1.01a
Bottom View of the NITON Spectrum Analyzer

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The Control Panel Buttons

The NITON control panel consists of three buttons (**Figure 1.06**). These buttons allow you to navigate all of your NITON's screens and menus. The amount of time you hold down the buttons also controls the function of the buttons. Pressing the Clear/Enter button briefly (less than 1 second) allows you to scroll down through the listed items showing on the screen. Holding down the Clear/Enter button for a longer period (more than 3 seconds) will put you into a different screen.

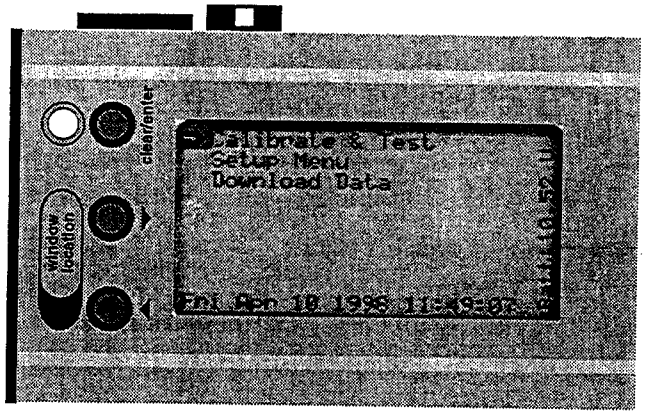

Figure 1.06
The NITON Control Panel

When you turn on your NITON, the Screen arrow will be pointing to **Calibrate & Test (See below)**. Press the **Clear/Enter** button to select the function indicated by the screen arrow.

Note: **You can begin to test immediately in whatever mode you last tested in by pressing the Clear/ Enter button.**

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Calibration and Testing

Please read the section "Tips for Better Testing" in the Appendix.

The **300*Series*** and **700*Series*** Instruments are highly sophisticated, electronic spectrum analyzers. The more familiar you are with your NITON's operation, the better your measurements and reports will be. Here, in brief, is an outline of how to do various kinds of testing using your NITON. More detailed information for each type of testing is offered in subsequent chapters.

1. Turn on the instrument. When testing in Bulk Sample or Thin Sample modes, leave your NITON on for fifteen minutes prior to testing. This is not necessary if you are going to test in any of the Paint Modes.

2. If your NITON is in the mode you want, press Clear/Enter to begin self-calibration. If you want a different mode, go to the Setup Menu (**Figure 1.07**) and set the mode in which you wish to test.

3. When the NITON beeps, calibration is complete. You are now ready to test.

Note: **Before beginning a test, be certain the battery pack has sufficient charge. It is always a good idea to carry a spare battery pack.**

For instructions on how to take a measurement, depending on the nature of the media you will be measuring, turn to one of the following chapters:

Chapter 3: *Analyzing Bulk Samples;*
Chapter 4: *Analyzing Thin Samples; or*
Chapter 5: *Analyzing Lead Paint.*

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Note: **Check your instrument's calibration with testing standards NITON has provided before and after testing and at least once per hour during testing. Although the standards do not contain every element our multi-element analyzers test for, when an instrument correctly measures the standards you have received with your NITON, it will correctly measure the other elements. See for more details.**

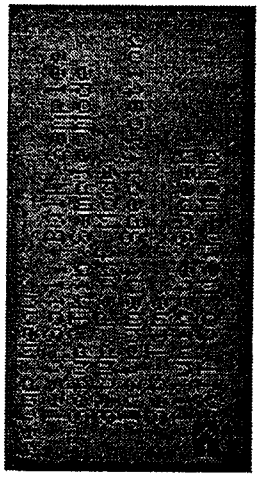

Figure 1.07
The Setup Menu

The Setup Menu (for purposes other than testing)

Use the **Setup Menu** (**Figure 1.07**) to check your instrument specification; to set the date and time; to illuminate the screen continuously; or to select a different testing mode. Once set up, the screen will remain the same each time you turn on your NITON until it is reset. Select the **Setup Menu** from the Main Menu with the Arrow buttons; enter the Setup Menu by pressing **Clear/Enter**.

Checking and Updating Current Information

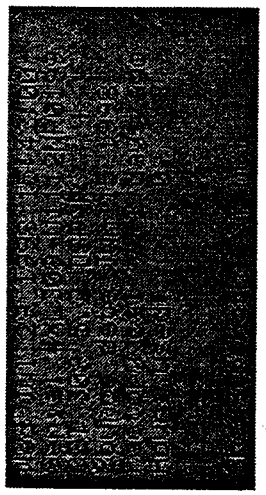

Figure 1.08
Instrument Specification Screen

To check the source strength of your instrument and other useful information (listed below), use the **Arrow buttons** to select the Instrument Specification screen (**Figure 1.08**) from the Setup Menu. Press **Clear/Enter**. The screen will display the following information:

- The **Day, Month, Date, Year** and **Time** (hours, minutes and seconds).
- The **Instrument Serial Number**
- The **Instrument Model** and the versions of **Firmware** and **DSP software** installed on the instrument.
- The **Source Date**, the assay date of the source.

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- The **number of days since the last factory calibration** of the instrument.
- The **Hours used**, the number of hours the instrument has been used since the last factory calibration.
- The **Source Strength**, the current strength of the instrument's radioactive sources, in millicuries (mCi).

To exit the Instrument Specification screen to the Main Menu, press the **Clear/Enter** button.

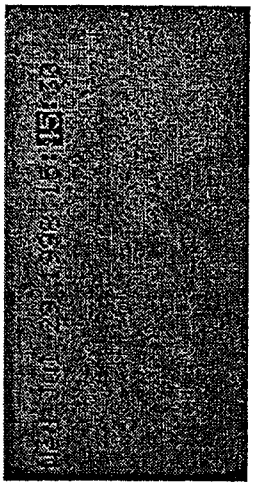

Figure 1.09a
The Setup Menu: Set Time

Setting the Date and Time

NITON sets the date and time (EST) on each instrument before it is shipped. Reset as needed when changing time zones, daylight savings time, or whenever the time or date is wrong.

Caution: Check the Date and Time displayed on the Ready to Test screen. If they are not correct, reset them before taking any measurements. Your readings will not be accurate unless the date and time are correct.

To reset the date and time from the Setup Menu, do the following steps:

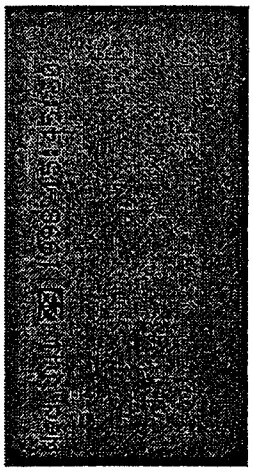

Figure 1.09b
The Setup Menu: Set Date

1. Use the Arrow buttons to scroll to **Set Time** (**Figure 1.09 a,b**).
2. Press Clear/Enter to select it. The **Date** and **Time** appear as follows:

   Month—Day—Year—Hour—Minute—Second

Note: **Set the year first. Press Clear/Enter twice to move to the year position and use the Arrow buttons to set the year. Press Clear/Enter five more times to set the remaining fields as described on the next page.**

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The cursor will start at **Month** and move to the right each time you press **Clear/Enter.** To change the time and date, move from left to right on the screen. For example, to change the hour and seconds:

1. Press **Clear/Enter** three times to move the cursor to **Hour**.
2. Use the **Arrow buttons** to change the hour shown to the desired hour. Press **Clear/Enter**.
3. The cursor will automatically move to the next field: **Minute**. Use the **Arrow buttons** to change the minutes shown to the desired minutes. Press **Clear/ Enter** again to move the cursor to Second.
4. Use the **Arrow buttons** to change the seconds shown to the desired seconds. Press **Clear/Enter**.
5. After selecting **Seconds**, the **Main Menu** screen is again displayed, set to **Calibrate & Test (Figure 109c).**

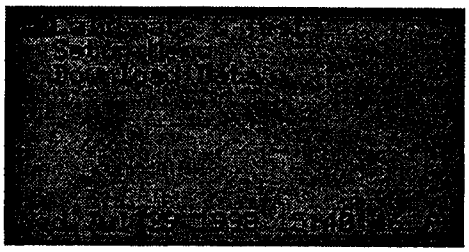

Figure 1.09c
Set Time Screen with corrected settings

Lighting the LCD Screen

Your instrument's LCD screen will remain back-lit for 15 seconds after any of the three buttons are pressed. After 15 seconds, you can light the screen by pressing any of the three buttons. When working in a dark place, you also have the option to light the screen continuously.

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To light the screen continuously, or to turn off continuous screen lighting if it is currently activated:

1. Use the **Arrow buttons** to select **Illuminate Screen** from the **Setup Menu** (**Figure 1.10**).

2. Press the **Clear/Enter** button to turn continuous screen lighting on or off. The instrument will then return automatically to the **Main Menu**.

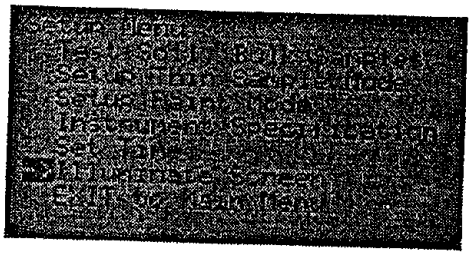

Figure 1.10
Illuminate Screen

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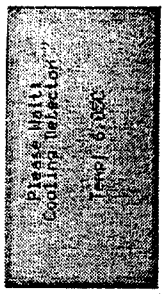

Figure 1.11a
Cooling detectors

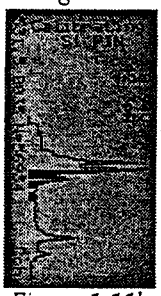

Figure 1.11b
Calibrating Pin Diode

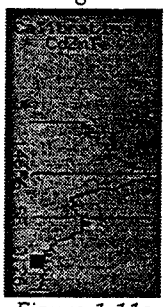

Figure 1.11c
Calibrating CZT

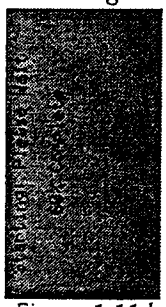

Figure 1.11d
% Complete

Calibrating Your NITON

Your NITON has been thoroughly calibrated at the factory. This calibration should be re-done every 24 months. To further assure the best Quality Assurance/Quality Control, your NITON performs a second self-calibration check every time you turn on or reset the instrument to a new mode.

In addition, NITON has provided you with several standard samples so you may check both calibrations. These tests against known standards insure that the instrument is functioning properly and can validate your results with a permanent record of regular calibrations.

Instrument Self-Calibration

When the screen arrow (->) is on Calibrate & test, press Clear/Enter to start the self-calibration process (**Figure1.11a-d**). Self-calibration takes one to two minutes. When it is completed, the instrument will beep and the Ready to Test screen will appear.

The Ready to Test Screen

The **Ready to Test** screen (**Figure 1.12**) displays the following fields:

- The current **Date** and **Time.**

Caution: Check the Date and Time. If they are not correct, reset them before taking any measurements (see page 10). Your readings will not be accurate unless the date and time are correct.

- The instrument **Serial Number**.
- The indication that the instrument is **Ready to Test**
- The **testing mode** the instrument is ready to test in.

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- The **Action level** the instrument will use to make either a "Positive" or "Negative" determination of lead in paint testing. The Action-level is only used in paint testing modes.

- The **Energy Resolution**. The lower the number (in eV), the better the instrument will perform.

Caution: If you try to calibrate the instrument and it does not calibrate successfully, push the Reset Button on the bottom of the instrument and recalibrate. If your NITON does not calibrate successfully in three attempts, please call the NITON Service Department at (401) 294-1234.

- The **Source Strength** (Src Strength). The Source Strength indicates the current activity of the radioactive sources in your instrument, in millicuries. Your NITON will compensate automatically for the decay of the source.

Re-Calibrating Your NITON During Testing

To insure the accuracy and precision of your NITON, it is recommended that you re-calibrate hourly during testing. In rapidly changing environmental conditions, your NITON may require you to stop and recalibrate before resuming testing. To recalibrate:

Press the reset button on the bottom of your NITON. or
Turn the NITON off, then on, and press the Clear/Enter button.

Note: **Occasionally, the screen will display the following message: YOU MUST RECALIBRATE. This typically happens when there is a sudden, very large change in the ambient temperature. If this occurs, recalibrate and continue testing.**

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User Calibration on Standard Samples

NITON provides sets of standard samples for each testing mode. These are used to check the calibration of the instrument:

- For **Bulk Sample Mode**, there is a set of three NIST soil standards: Lead high, Lead medium, and lead low.
- For **Thin Sample Mode** there is a set of three thin film standards: lead, copper, and iron. This mode should not be used for quantitative lead paint testing.
- For **Lead Paint Mode**, there is a set of government-traceable lead paint films.

Note: **Although the standards do not contain every element our multi-element analyzers test for, when an instrument correctly measures the standards you have received with your 700, your NITON will correctly measure the other elements.**

Test the standards regularly. NITON recommends testing immediately after the instrument finishes self-calibration. Test the standard samples appropriate to the type of tests you are conducting, and once every 1–2 hours thereafter.

Note: **For defensible Quality Control, keep a record of the time and precision of every calibration, using the bar code system wherever possible.**

Warning: Tampering with the 5,500 ppm lead-in-soil standard may cause exposure to lead dust. Keep all standards out of reach of children.

Caution: Never tamper with Test Standards. They should not be used unless they are completely intact.

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Soil and Thin Film Standards

To test soil or thin film standards, place the sample in the test platform receptacle and proceed to test as with any prepared sample. The NITON standard soil samples provided with your instrument contain known amounts of several elements.

Caution: Do not contaminate the thin film samples with your fingerprints. Handle them by the edges with clean hands.

Lead Paint Standards

1. Place the NITON standard with the colored side face up. Choose the RED strip labelled 1.0 ± 0.1. Take a reading of that standard. Place the instrument on the standard so that the instrument window is fully on the standard. Your NITON should display a value between 0.9 and 1.2 mg/cm^2 and should indicate surface lead.

2. Place the same standard with the colored side down so that the instrument window is fully on the standard. Take a reading of the standard (buried beneath the equivalent of 5–6 coats of non-lead paint). Your NITON should still display a value between 0.9 and 1.2 mg/cm^2 and should not display Surface lead.

Note: **If your instrument is testing high on Standard samples, check only the surface the Standards are resting on. That surface may contain lead.**

When you test the Standard samples, your instrument should give readings that approximate the certified values. Your instrument should give consistent readings for each sample.

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Overview of Test Modes

The **Setup Menu** allows you to choose the pre-programmed test mode best suited for the type of testing that you will be doing. For a more detailed explanation of each test mode, see the appropriate chapter in this guide.

Note: **The Setup Menu shows all NITON analyzer modes for all instruments. If you select a test mode which is not available on your NITON instrument, a reminder message will be displayed on the screen.**

Please contact NITON instrument sales at (800) 875-1578 or your local NITON sales representative to enquire about upgrading your NITON analyzer to add capabilities.

Use the Arrow buttons to select the mode you wish to test in. Press Clear/Enter to activate the mode.

Note: **All NITON analyzers correct automatically and continuously for cross-element interference in all modes throughout each test. Please see Appendix E, *Multi-Element Analysis* for more details.**

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The Bulk Sample Mode

Bulk Sample Mode can be used to measure concentrations of contaminants in any fairly homogeneous, fine-grained medium such as soil, ground-up paint chips, a liquid or many other kinds of bulk materials.

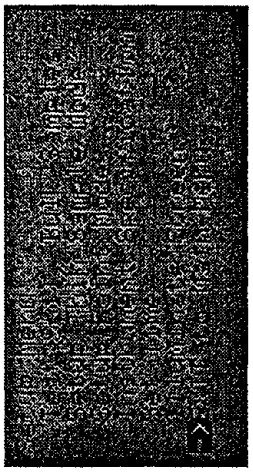

Figure 1.12
Setup Menu

To test in Bulk Sample Mode:

1. Use the Arrow buttons to select Test Soil, Bulk Samples from the Setup Menu (**Figure 1.12**). Press the **Clear/Enter** button.

2. The instrument will return to the Main Menu ready to Calibrate & Test in Bulk Sample Mode. Press the Clear/Enter button.

3. The instrument will initiate self-calibration. This will take one to two minutes. When self-calibration is complete, the instrument will beep and display the Ready to Test screen for Bulk Sample Mode (**Figure 1.13**).

4. See Chapter 3: Testing Bulk Samples for details on how to test particular kinds of bulk samples.

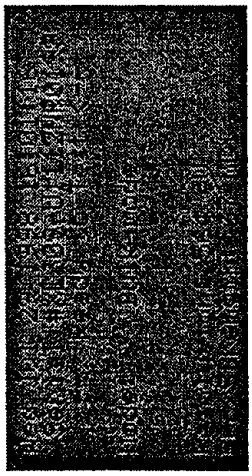

Figure 1.13
Ready to Test Screen
Bulk Sample Mode

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The Thin Sample Modes

Thin Sample Modes can be used to measure concentrations of contaminants in a variety of thin layers, including deposits on dust wipes, filters and many other substrates, including, for example, thin layers of uranium on concrete.

Caution: The Standard Thin Sample Mode should not be used for quantitative lead-paint testing. Use only the three Paint Testing modes to test lead-based paint.

There are five Thin Sample Testing Modes, each designed for a different type of test media:

1. **37 mm CE Filter Mode:** for 37 mm diameter filters (fiberglass or cellulose-ester) which monitor personal exposure. This mode can also be used for 37 mm filters used to analyze dust in Dust Vacuum Methods. In this Thin Sample Mode, three measurements are taken, weighted, and summed for each filter.

2. **TSP/PM Filter Mode:** for larger filters which monitor the concentration of metals in air. In this mode, the instrument averages measurements taken on the filters.

3. **Dust Wipe Mode:** for dust wipe samples taken by wiping surfaces following HUD guidelines to determine risk assessment and clearance testing for lead in dust.

4. **Standard Thin Sample Mode:** for taking single measurements of samples or coatings. In this mode, results are displayed, in $\mu g/cm^2$.

5. **User-Definable Thin Sample Mode:** for specifying custom thin sample measurement protocols. This mode give you the flexibility to design your own tests.

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To Test in the Thin Sample Modes:

1. From the **Setup Menu**, use the **Arrow buttons** to select Setup Thin Sample Mode. Press **Clear/Enter**.
2. The **Choose Operation Mode for Thin Samples** screen will appear (**Figure 1.14**)
3. Use the **Arrow buttons** to select the mode appropriate for the kind of thin samples you are going to test. Press **Clear/Enter**.
4. The **Choose Operation Mode for Thin Samples** screen will highlight the thin sample mode you have selected and the cursor will move to Exit to **Main Menu** (**Figure 1.15**). Press the **Clear/Enter** button to return to the Main Menu. Press the **Clear/Enter** button again to initiate **Calibration & Testing** in the thin sample mode you have selected.
5. The instrument will initiate self-calibration. This will take one to two minutes. When calibration is complete, the instrument will beep and display the **Ready to Test** screen for the thin sample mode you have selected (**Figure 1.16**).
6. See ***Chapter 4: Analyzing Thin Samples***, for a more complete description on how to test thin samples.

Figure 1.14
Choose Operation Mode for Thin Samples

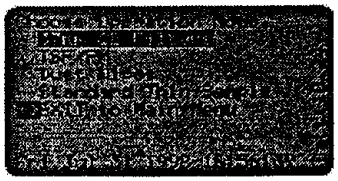

Figure 1.15
Exit to Main Menu

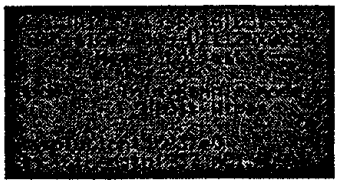

Figure 1.16
Ready to Test Screen
Thin Sample Mode

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The Paint Modes

All three Paint Modes can be used interchangeably to measure lead concentrations in paint in mg/cm^2. You many toggle among these modes. In each paint mode, NITON analyzers simultaneously measure and analyze both K-shell and L-shell lead x-rays to determine

- the numerical value of the lead in mg/cm^2 present in the sample; and
- whether the sample has a lead concentration that is greater-than-or-equal-to ("Positive") or less-than ("Negative") the lead Action-level (in mg/cm^2) that has been entered, with 95% or better confidence.

During each test, the NITON looks at the full range of x-ray spectrum and continuously corrects for cross-element interference and, continuously corrects for substrates, comparing K- and L-shell x-rays to determine when a 95% "confident" positive or negative reading vs. the user-set action level is allowed.

Standard Paint Mode

In Standard Paint Mode, the instrument will take readings until a 95% confident reading of "Positive" or "Negative" versus the Action-level is achieved. The instrument will then display

- either "**Positive**" or "**Negative**"
- the **Result** in mg/cm^2, and
- display "**Surface lead**" for all "Positive" readings where the lead is not shielded by overlying layers of non-leaded paint.

In **Standard Paint Mode**, testing times will vary somewhat from sample to sample. The instrument will measure only until a 95% confident reading of "Positive" or "Negative" (according to the Action-level you have set) has been attained.

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Standard Mode + Spectra

Standard Mode + Spectra is identical to **Standard Paint Mode** except that the x-ray spectrum is displayed with each reading. A spectrum confirms the presence of lead (required by many agencies).

K & L + Spectra Mode

In **K & L + Spectra Mode**, the instrument will display the complete test information continuously, from the beginning of each reading, including

- the K-shell reading with 2-sigma confidence interval
- the L-shell reading with 2-sigma confidence interval
- the combined reading (Pb) with at least 2-sigma confidence interval, and
- the x-ray spectrum from 8-22 keV and 72-90 keV.

With each reading, a "Null" result is displayed until a "Positive" or "Negative" result is determined.

In **K & L + Spectra Mode,** you may continue readings indefinitely after a "Positive" or "Negative" result is obtained, until you have attained a desired measurement time or degree of precision.

Note: **In all paint testing modes, if a test is stopped before a "Positive" or "Negative" determination has been made, you will get a "Null" test result.**

Note: **You may toggle among these three modes by pressing briefly on the Clear/Enter Button.**

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To Test in the Paint Modes:

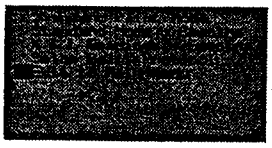

Figure 1.17
Setup Paint Mode

Figure 1.18
Paint Protocol Screen

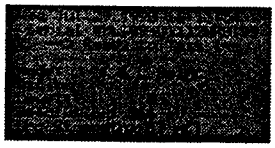

Figure 1.19
Ready to Test: Paint Mode

1. From the **Setup Menu**, use the Arrow buttons to select **Setup Paint Mode**. Press **Clear/Enter**. The **Setup Paint Mode** menu screen will appear (**Figure 1.17**)

2. Use the **Arrow buttons** to select **Set up Paint Protocol**. Press **Clear/Enter.** The Paint Protocol screen will appear (**Figure 1.18**)

3. Use the **Arrow buttons** to adjust the times for the 1st beep, the 2nd beep and the 3rd beep signals (for **K & L + Spectra Mode**) and to set the Action level between 0.5 and 2.2 mg/cm^2. Use the Clear/Enter button to enter each selection.

4. When the Action-level has been entered, the Setup Paint Mode screen will re-appear (**Figure 1.17**). Now use the Arrow buttons to select a **Paint Testing Mode**. Press **Clear/Enter**.

5. The **Main Menu** will appear, with the instrument ready to **Calibrate & Test** in the paint mode you have selected. Press **Clear/Enter**.

6. The instrument will self-calibrate in one to two minutes. When self-calibration is complete, the instrument will beep and display the **Ready to Test** screen for the paint mode you have selected (**Figure 1.19**).

7. See Chapter 5: Testing Paint Samples, for detailed descriptions of all three paint testing modes.

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SpectraView

SpectraView enables you to qualitatively analyze the fluorescent x-rays of every element in the periodic table from titanium (element 22) through plutonium (element 94) in a given sample. For lists of elements and their fluorescent x-ray energies, see Appendices G, H, and I. In SpectraView Mode, the spectrum is autoscaled logarithmically so that the highest peak on the screen reaches the top of the scale.

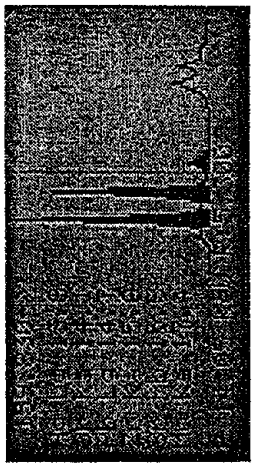

Figure 1.20
SpectraView Screen

SpectraView is standard on all **700*Series*** models and on **300*Series*** equipped with either the optional Lead-in-Soil Analysis package or the Dust Wipe Analysis package. It is also available on **300*Series*** as a separate option.

Using SpectraView:

For NITON instruments equipped with SpectraView, you can toggle to the SpectraView screen (**Figure 1.20**) after taking a measurement in any mode by holding down the Clear/Enter button until the SpectraView screen appears. Once you are in SpectraView, you can use the Arrow buttons to scroll through the spectrum. The vertical cursor-line indicates the current position along the spectrum.

Viewing the Information in SpectraView Mode

To the left of the spectrum is a list of the elements with XRF energies close to where you are currently looking on the spectrum. (**Figure 1.21**). To determine if a given element is present, look at the bottom of the screen. Next to the number indicating the position of the SpectraView cursor on the energy-level scale (from 4 to 100 keV) is a number representing the x-ray count rate (in counts per second) at that energy-level.

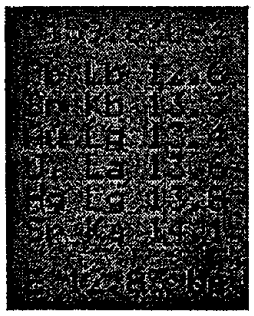

Figure 1.21
Spectrum

Note: **SpectraView cannot be used to determine quantitative element concentrations in a sample.**

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SpectraView zoom

Use the SpectraView zoom feature to look at a part of the spectrum in greater detail, .

1. Use the **Arrow buttons** to move the cursor to the center of the spectral peak you wish to see more clearly.

2. Push **Clear/Enter** to increase the scale of the displayed spectrum. The spectrum may be viewed in four different scales.

3. The part of the spectrum you were looking at will appear in expanded form so you can look at it in detail (**Figure 1.22**).

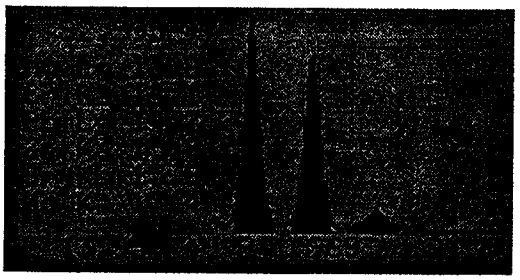

Figure 1.22
SpectraView Zoom

To Exit SpectraView

To exit SpectraView and continue testing, simply start another measurement. The measurement will be taken in the last paint testing mode you used.

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Downloading data

Your NITON can store data on up to 3,000 measurements in all Paint modes, or 1,000 readings in Bulk Sample or Thin Sample modes. You can download this data to a computer to print reports or to insert data into a database. NITON recommends downloading data frequently (not less than once at the end of each day of usage) to avoid loss of data.

Note: **Downloading data does not erase readings. To make room for the next set of data, erase readings after verifying that the data was downloaded successfully (see next section).**

The RS-232 port on the back of your NITON accommodates a 4-pin LIMO connector. A LIMO to 9-pin RS-232 connector cable is provided with your NITON. Your NITON can communicate with either a "dumb" or an "intelligent" terminal, such as a VT100 connected to a mainframe computer or a PC-compatible computer.

Fast data dump;

You can download up to 3,000 measurements, their descriptions, and complete x-ray spectra (4–90 keV) in a few minutes, using NITON XTRAS Software™ provided with your instrument.
To do this:

1. Open the **XTRAS program** on your computer and open a file.
2. **Connect** your NITON to your computer with the standard RS-232 port cable that is provided.
3. From the **Main Menu**, use the **Arrow buttons**, select **Download Data** and press **Clear/Enter** (**Figure 1.23**).

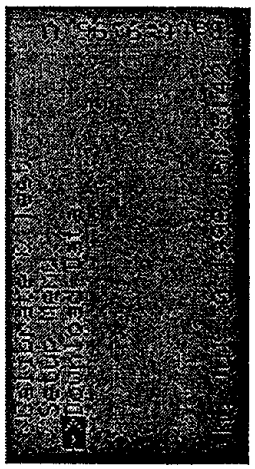

Figure 1.23
Main Menu, arrow on downloading data

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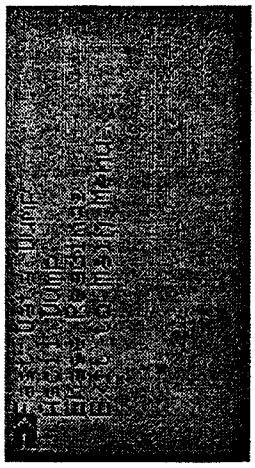

Figure 1.24
Fast Data Dump

4 From the **Download Data** menu (**Figure 1.24**) select **Fast Data Dump** and press **Clear/Enter**. Select the first to the last readings you wish to download. If you do not specify first and last readings, the default setting will download all readings currently stored in memory.

5 When the instrument finishes downloading, it will return to the **Main Menu**.

ASCII data dump

For users who wish to download data in ASCII format, the NITON can dump its data as an ASCII file to any terminal emulator program. To do this:

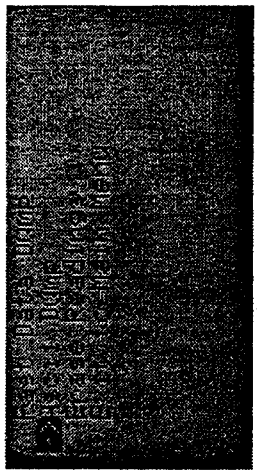

Figure 1.25
ASCII Data Dump

1 Connect the NITON to your computer with an RS-232 cable.

2 In the **Download Data** screen, press the **Arrow buttons** to scroll to **ASCII dump** (**Figure 1.25**). Press **Clear/Enter**.

3 When the instrument finishes downloading, it will return to the **Main Menu**.

Erasing readings

If you do not erase your data, the NITON will continue to record data until the memory is full. The NITON will then start to overwrite older data. Any data that is overwritten in this way will be lost.

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Note: **To avoid loss of data, download your data before the memory is completely full. Clear the memory after downloading.**

The erase readings function is designed to protect you from *accidentally* erasing readings.

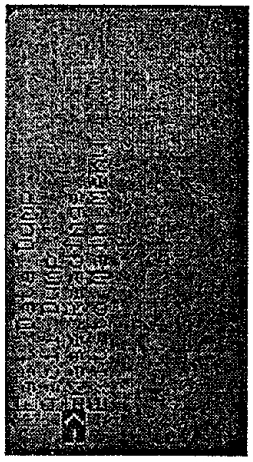

Figure 1.26
Erase Readings

To erase readings:

1. From the **Download Data** menu, use the **Arrow buttons** to scroll to **Erase Readings** (**Figure 1.26**). Press **Clear/Enter**.

2. The Erase Readings screen (**Figure 1.27**) will appear with the following choices:
   ERASE all readings
   => CANCEL do not erase
   EXIT to Main Menu

3. The screen arrow defaults on **Cancel do not erase**, so that if you select it by mistake, you will not erase any readings.

4. To **Erase Readings**, use the **Up-Arrow button** to go to **ERASE all readings**. Press Clear/Enter.

   Press **YES** when the prompt asks "Are you sure?"

5. Press **Enter**. When you enter either **ERASE all readings** or **CANCEL do not erase** your instrument will return to the **Main Menu**, ready to take and store more readings.

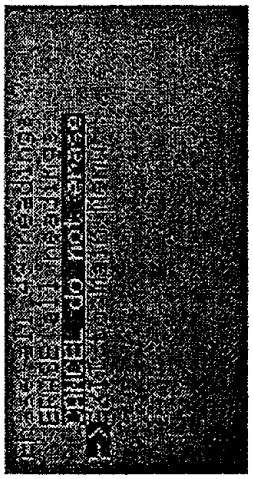

Figure 1.27
Erase Readings Screen

For further information, please refer to the XTRAS manual which is included with your NITON.

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Barcode Data-Entry

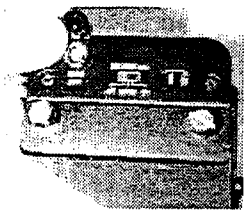

Figure 1.28
Serial Port

Model 300*Series*, 701A, 702A, 703A Analyzers:
Standard paint-testing barcodes plus no-cost option user-defined custom barcodes

Model 700, 701, 702, 703 Analyzers:
No-cost option with user-defined custom barcodes

NITON allows the instrument user to enter test location information and other data electronically, while taking readings, through the use of a portable barcode reader (light pen) that plugs into the instrument serial port (**Figure 1.28**). NITON barcode readers may be used with either standard NITON paint-testing barcode templates or user-defined barcode templates. A portable set of paint-testing barcode templates is provided with every **300*Series***, **701A, 702A** and **703A** Analyzer (**Figure 1.29**). User-defined barcode templates are discussed in the next section of this User's Guide.

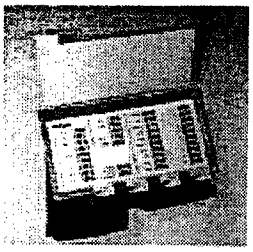

Figure 1.29
Paint Testing
Barcode Templates

All barcode-entered data appears in the Barcode Data-Entry screen (**Figure 1.30**), and is automatically downloaded with the appropriate readings. You may access the Barcode Data-Entry screen in either of two ways from any test mode:

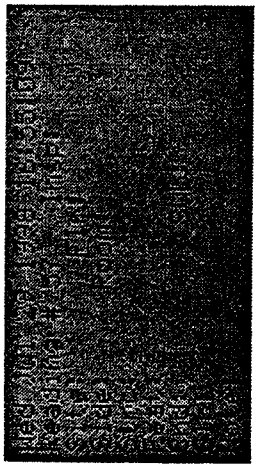

Figure 1.30
Barcode
Data Entry Screen

1 From the Ready to Test screen, hold down the Clear/Enter button for approximately six seconds, until the Barcode Data-Entry screen appears; or

2 Scan the light pen over either

- one of the standard paint-testing barcode templates or,
- any permissible user-defined barcode template (see next section).

Whenever the barcode reader is used, the Barcode Data-Entry screen appears automatically.

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Scanning appropriate standard and/or user-defined barcodes, you may enter data in up to 11 data-entry fields for each reading. The 11 data-entry fields are:

01	Inspector number (Insp)
02	Site Number (Site)
03	Floor (Flr)
04	Side
05	Room
06	Structure (Strc)
07	Feature (Feat)
08	Condition (Cnd)
09	Substrate (Sub)
10	Color (Clr)
11	Notes (Note).

User-defined barcodes may be used in any or all of these 11 data-entry fields.

Data may be entered by barcode reader for any reading, in any test mode. To scan in a barcode, plug the barcode reader into your NITON's serial port. Hold the barcode reader like a pen or pencil, perpendicular to the barcode surface, and move the reader across the bars of the barcode you are entering. Barcodes may be scanned in using either a right-to-left or a left-to-right motion. If you accidently enter an incorrect barcode, you may delete it by scanning in the appropriate Delete barcode from the paint-testing barcode templates (**Figure 1.31**).

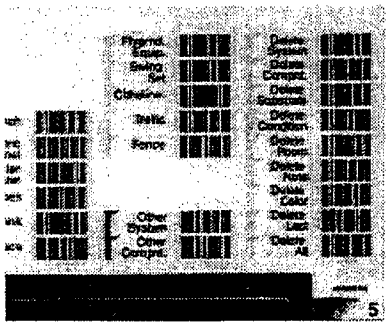

Figure 1.31
Delete Barcode from Paint Testing barcode templates

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Creating Custom Barcodes with Your NITON XRF Analyzer

NITON **300*Series*** and **700*Series*** instruments can read barcode strings written in Code 39 format. This allows NITON users to make up their own barcodes to fit a variety of applications. User-defined barcodes are fully compatible with NITON XTRAS reporting software.

All user-defined barcodes created for use with NITON XRF Analyzers must be written in Code 39 (3 of 9) barcoding format.

The NITON XRF will not accept barcodes of any other symbology. You can create barcodes using any commercially available software program that utilizes Code 39 barcode fonts. You have the flexibility to design and create your own barcoding sheets as long as you adhere to the protocols outlined below.

Barcoding Protocol

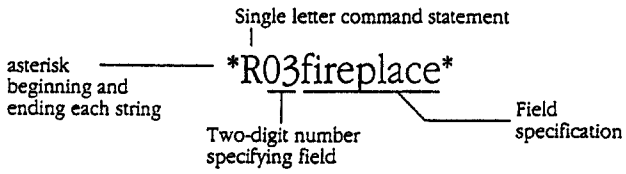

Figure 1.32: Example of a barcoding Protocol

1. An **asterisk** must begin and end each barcode string (**Figure1.32**).

2. The **initial single letter** is the comand statement for the barcode string.

   a. C is used for the CLEAR command. When this comand is read in, it will clear the specifies field of information.

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b. R is used for the REPLACE command. When a barcode with this command is read in, it will automatically replace the information in a specified field with the information contained in the barcode.

c. A is used for the APPEND command. This comand is commonly used for further qualifying already existing information to information in a field. It adds, or appends, information to that which already exists in a specified field.

3. Each **field** is specified by a two-digit number. (For numbers less than 10, a 0 is placed before the integer, as shown in the example above.) Some fields are 26 characters in length, others are 13 characters, as shown in the table below.

Field Number	Current Name	Character Spaces Alloted
01	Site	26
02	Inspector	26
03	Floor	13
03	Side	13
05 Cor1	Room	26
06 Cor2	Structure	26
07 Type	Feature	26
08	Substrate	13
09	Condition	13
10	Color	13
11	Note	13

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4. The information for input into a specified field may include letters, numbers, and spaces, but NOT punctuation. Once read in, the information is displayed and saved in capital letters. Capital versus lower case designations will be ignored.

The input information will be limited in length to fit the number of character spaces in a given field. If you attempt to enter a barcode with more characters than are available for a given field, the data will be truncated to fit the maximum allowable character spaces.

For example, if the phrase "underbody plow casing" was read into field 04 (maximum 13 characters), the entry would be displayed and saved as "UNDERBODY PLO" under Field 04.

Note: **If you are using a Code 39 Font in a word processing application, simply type out your barcode string in an easily readable font, highlight the string and change it into the Code 39 barcode font (Figure 1.33).**

NITON CORPORATION: ACME TRUCKING COMPANY
BARCODE SET

TRUCK systems

CAB

BED

UNDERCARRIAGE

CHASSIS

TRUCK components

AXLE

FENDER

WHEELWELL

TAILGATE

PLOW

HOOD

DELETE TRUCK SYSTEM

DELETE TRUCK COMPONENT

Figure 1.33
Example of custom barcode sheet in Code 39 format

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Battery Packs and Battery Charger

General Information

Fully charged, each Nickel Metal Hydride battery pack gives eight or more hours of continuous use. It takes about 2-1/2 hours to fully recharge a spent battery pack if the batteries have been recently used. If the NITON has not been used for several weeks, or if the batteries are completely discharged, they must be pre-charged before they can be recharged. This will happen automatically. See Pre-Charge Mode, below.

NITON Battery packs can be recharged at least 500 times. They are warranted to be free of defect when shipped. They are not further covered by manufacturers' warranty. When they need to be replaced, new battery packs may be purchased from NITON.

Note: **Before beginning a test, be certain the battery pack has sufficient charge. It is always a good idea to carry a spare battery pack.**

Caution: NITON's Nickel Metal Hydride battery packs discharge at a rate of about 2% per day when not in use.

Pre-charge Mode

If your NITON battery packs run down completely, they must be pre-charged before recharging. If the Green charge light is blinking slowly and the Discharge and Temperature lights are off, you are in Pre-Charge Mode. The process can take up to 5 hours.

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Battery Pack Routine Maintenance

Some guidelines:

- Don't leave battery packs on the charger all the time. Overnight recharging is recommended.
- To preserve the life of your battery packs, use them until they are fully discharged before recharging them.
- Don't recharge a fully charged battery pack. If you want to charge a partially charged battery, run the Discharge cycle before recharging.
- Store the charger and battery packs in a cool place (10°C - 26°C), away from direct sunlight.
- When a battery pack is not used for a long period of time, it will lose its charge completely. Fully recharge it before use.

Note: **A lithium backup battery inside your NITON will prevent any loss of data should you need to change the battery pack before downloading readings.**

Changing Battery Packs

Removing a battery pack

1. Avoid changing the battery pack outdoors. Moisture and dirt can damage a battery.
2. Rest the NITON on a clean surface.

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3 Loosen the (2) clamp screws. They do not come off (**Figure1.34**).

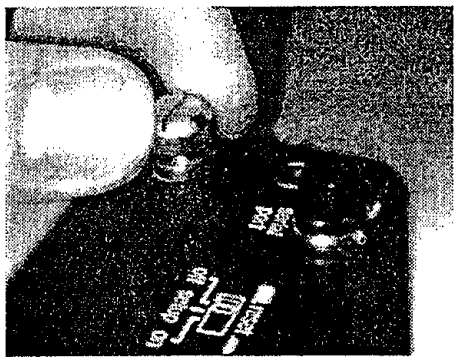

Figure 1.34
Loosen clamp screws to remove the battery pack. They do not come off.

4 Pull the battery pack away from the instrument by grasping the knurled screws and gently rocking the battery pack from side to side while removing it.

Installing a battery pack

1 Rest the NITON on a clean surface, as before.

2 Slip the notch at the bottom of the battery pack into the wide slot.

3 Gently push the battery pack in, taking care that the battery pack connector is seated properly to the instrument's connector.

4 Tighten the (2) knurled screw clamps that fit into holes on the NITON. If the screw clamps do not tighten, the connectors are not lined up properly. These screw clamps must be tight for a secure connection.

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Recharging battery packs

Recharging with the AC adapter

1 Lay the battery pack on top of Battery Charger. Fit connectors together snugly (**Figure 1.35**).

Figure 1.35
Front view of the battery charger

2 Plug one end of the AC adapter into the power port on the bottom of the charger. Push the plug in, making sure it seats fully.

3 Power up the charger: Plug the other end of the AC adapter into a 110V outlet. The yellow Power light will come on and stay on throughout. The green Charge light will also come on. It will blink slowly at first, indicating that the battery is on Pre-charge, and then stay on with a steady light, indicating that the battery is on Full Charge.

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4. In Full Charge Mode, the green Charge light will stay on with a steady light while the battery is being charged. It is normal for the charger to make some noise in Full Charge mode.

5. In Trickle Charge Mode: When the battery is fully charged, the charger will automatically switch to Trickle Charge mode and the green Charge light blinks rapidly.

Caution: Do not leave battery packs on the Battery Charger longer than necessary.

Discharge cycle

Put battery packs on the Discharge Cycle only if they are not holding a charge; or, if they are partially charged, run the Discharge Cycle before recharging. It takes about eight hours to fully discharge a battery pack. To discharge a battery pack, place it on the charger and:

1. Press the red Discharge button. The red Discharge light will come on, and the green Charge light will blink slowly, showing charger is in Discharge mode.

2. After a full Discharge cycle, the charger will automatically recharge the battery.

3. The red Discharge light goes out and the green Charge light will blink rapidly, showing it is in the Trickle Mode.

Caution: If the red Temp light comes on repeatedly when a battery pack is on the battery charger in the Full Charge cycle, call NITON Customer Service at (401) 294-1234.

Caution: Do not store the battery packs or battery charger in direct sunlight.

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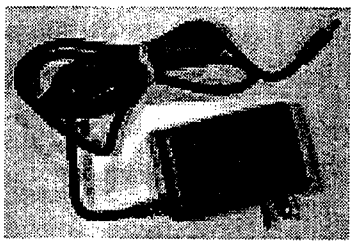
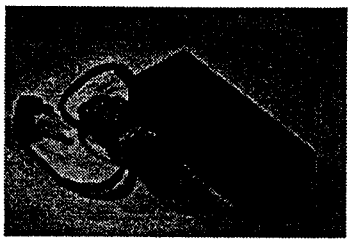
Using your vehicle's 12V DC outlet

A 12V DC Adapter is provided with your NITON (**Figure 1.36**). Instructions are the same as for using the 110V AC Adapter. When you have seated all connections well, the yellow **Power** light will come on.



Domestic Power Adapter



International Power Adapter

Figure 1.36
DC Power Adapters: Domestic and International

Caution: Do not use the Discharge Cycle while on the DC outlet.

- Secure the charger so the power cord does not get pulled out while the vehicle is in motion.
- The plug of the DC Adapter has a 5A internal fuse. To check the fuse, unscrew the cap that retains the contact from the end of the plug. Replace this fuse only with a 5A fuse of the same size. If the fuse in the 12V Adapter burns out frequently, call NITON's Service Department at (401) 294-1234.

Note: **Please do not throw away spent battery packs. Return spent battery packs to NITON so they can be properly disposed of.**

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Maintenance, Cleaning and Repairs

NITON Corporation welcomes any questions or comments you may have about your NITON analyzer. Please do not hesitate to call us at either our Main Office number: (781) 275-9275 or at our Rhode Island Service Facility number: (401) 294-1234.

Caution: All Service except exterior cleaning must be performed by NITON Corporation. Do not attempt to make repairs yourself. Opening the case of your NITON will void the instrument Warranty.

Keep your NITON clean, particularly the capton plastic window on the bottom of the instrument. If the window is dirty, the performance of your NITON will be affected. Clean the window gently with cotton swabs. Clean the instrument's metal case with a soft cloth. Never use water, detergents, or solvents. These may damage the instrument.

Note: **Never ship your NITON analyzer back to the factory for any reason without calling and obtaining a Return Authorization (RA) Number from NITON Corporation.**

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Storage, Transport, and Shipping

Storing and Transporting Your NITON

All NITON instruments come in waterproof, drop-proof carrying cases with padlocks. NITON instruments can be transported by car or plane or shipped as an ordinary package. There are no restrictions for tunnels or bridges. No notification is required for transportation except the following: There may be disclosure and/or licensing requirements if you take your NITON instrument across state or national boundaries. Please check with the appropriate agencies for details. To keep up with the latest agency changes visit the NITON web site at http://www.niton.com .

Your NITON is an "excepted" instrument which requires no special labelling on the outside of case or packaging. A compliance statement must be kept with the instrument case. Always transport the unit in its carrying case, and keep the NITON in its case whenever it is not being used. Store the instrument, in its case, in a secure area.

Shipping your NITON

All NITON instruments must be packed in their original padded carrying cases for shipment. Pack the NITON in its carrying case and ship in either the original carton and packing material or their equivalent.

Caution: Do not ship your instrument back to NITON for any reason without first notifying NITON Corporation and receiving a Return Authorization Number.

Caution: If you return your NITON without the carrying case you will void the instrument warranty. You will also be billed for a replacement case plus any repairs resulting from improper shipping.

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Always enclose a copy of a current leak test certificate when you ship your instrument back to NITON.

Caution: NITON's license prohibits us from repairing or upgrading any of our XRF instruments without a current leak test certificate. If you return an instrument without a current leak test certificate, NITON will perform a leak test and bill you.

Note: **Keep a copy of the following statement in the NITON case whenever the instrument is shipped:**

DEPARTMENT OF TRANSPORTATION

THE NITON SPECTRUM ANALYZER CONFORMS TO THE CONDITIONS AND LIMITATIONS SPECIFIED IN 49 CFR 173.422 FOR EXCEPTED PACKAGE, INSTRUMENTS AND ARTICLES, N.O.S. UN—2910. THIS PACKAGE CONTAINS NO MORE THAN 50 mCi CADMIUM-109 IN A PLATED, SOLID, SEALED SOURCE INSTALLED IN AN X-RAY FLUORESCENCE ANALYZER.

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Radiation Safety

NITON has designed its XRF analyzers so that there is virtually no measurable radiation external to any part of the instrument when the shutter is closed. When our instruments are used according to instructions, there is minimal radiation exposure even with the shutter open. NITON XRFs contain sealed cadmium-109 radioactive sources. The source is designed to remain secure even under extreme conditions, so that even if the instrument is broken, crushed or burned, there will be no leakage of radioactive material.

During manufacturing, each sealed source is placed in a solid metal source holder. A plug is screwed into the access hole and secured with a set screw and Locktite. The source is completely secure in its housing beacause the aperture at the other end of the housing is smaller than the source. The small aperture is sealed with a beryllium metal window that is transparent to the cadmium x-rays and gamma-rays. The source assembly is secured in the NITON's aluminum case. The case has tamper proof screws.

The following table lists typical radiation doses encountered in everyday living and lists the annual occupational radiation dosage limits for adults set forth in NITON's Materials license from the Rhode Island Radiation Control Agency, Section A.2.3.

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Typical Radiation Doses in mR (NCRP, 1987)

Average total dose in US. (annual)	360 mR
Average worker exposure (annual)	210 mR
Average exposure for underground miner (annual)	400 mR
Exposure for airline crew (1,000 hours at 35,000 ft)	500 mR
Additional from living in Denver at 5300' (annual)	25 mR
Additional from 4 pCi/l radon in home (annual)	1,000 mR
Typical chest x-ray	6 mR
Typical head or neck x-ray	20 mR
Typical pelvis/hip x-ray	65 mR
Typical lumbar spine x-ray	130 mR
Typical upper G.I. x-ray	245 mR
Typical barium enema x-ray	405 mR
Typical CAT scan	110 mR
Minimum detectable dose on a standard film badge	5 mR

Annual occupational dosage limits:

Maximum allowable for the general public (annual)	100 mR
Annual Occupational Dose Limits for Adults:	
The lesser of (1) total effective radiation dose	5 ,000 mR
or the (2) sum of the deep dose equivalent plus the committed dose equivalent to any individual organ or tissue *other* than the lens of the eye	50,000 mR
For a pregnant worker (during gestation period)	500 mR
For a minor	500 mR
Eye dose equivalent	15,000 mR
Shallow dose equivalent to the skin or any extremity	50,000 mR

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How to use your NITON safely

Each NITON is designed to be safe as possible. However, we strongly recommend that you follow these precautions to insure your safety and the safety of those around you:

- Always be aware of the location of your instrument's radioactive source and the direction of its beam of x-rays. The location of the source and the direction of its beam are both clearly marked on the front (**Figure 2.01**) and top side (**Figure 2.02**) of your NITON.
- Open the shutter *only* to do a test.
- During testing, a strong beam of radiation (gamma-rays and x-rays) is continuously emitted through the beryllium window at the bottom of the NITON. There will be some radiation at the front and top-front of the instrument. There is negligible radiation where your hand should be holding the instrument.

Warning: Always treat radiation with respect. Do not put your hand on the top end of the NITON while measuring. Never point the instrument at yourself or anyone else when the shutter is open.

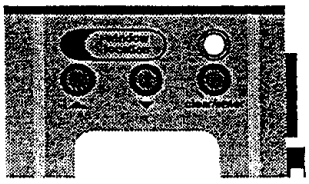

Figure 2.01
Top view of NITON with source location marked

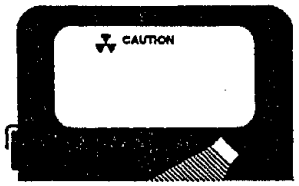

Figure 2.02
Top view of NITON with direction of beam marked

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Shutter safety

Your NITON is designed so you cannot accidently open the shutter or leave it open accidentally when you lift the instrument from a surface. To open the NITON's shutter and to keep it open, the instrument must be held against a surface. The shutter will close as soon as you cease to hold your NITON against a surface.

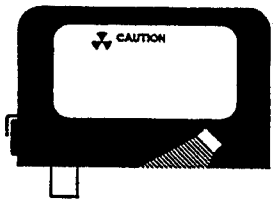

Figure 2.03
End plate with shutter in closed position

- The shutter should be open only during a test.
- Under no circumstances should the shutter be open when the instrument is not in use.
- Your NITON clearly indicates any time the shutter is open (**Figure 2.03**). The plunger will stick up through the instrument case whenever the shutter is open (**Figure 2.04**).

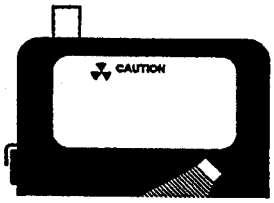

Figure 2.04
End plate with shutter in open position

Warning: In the unlikely event that the plunger gets stuck in the open position, simply push it closed. Then call the NITON Service Department at (401) 294-1234.

Monitoring your radiation exposure

There is virtually no measurable radiation from a NITON when its shutter is closed. The maximum dosage to which you are exposed when properly operating your NITON is 0.1 mR/hr on the fingers of the hand holding the instrument with the shutter open.

As an additional precaution to insure that your radiation exposure is always minimal, NITON strongly recommends that you wear a dosimeter at all times when using the instrument.

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Note: **Your state may have regulations concerning radiation monitoring.**

A dosimeter badge is usually worn close to the parts of your body that are most sensitive to radiation, including your reproductive organs and your eyes. These badges are available from many companies. One company selling dosimeters is:

Landauer, Inc.
2 Science Road
Glenwood, IL 60425-9979.

Each month, your radiation badge company will send you a new badge.

Warning: Wearing a dosimeter badge does not protect you against current exposure. A dosimeter badge measures your exposure after the fact. If, at any time, you find measurable exposure, call NITON immediately at (401) 294-1234.

Warning: Pregnant female workers may want to take special precautions to reduce their exposure to radiation. Qualified scientists have recommended that the radiation dose to pregant women should not exceed 500 mR/gestation period.

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The Principles of Radiation Safety

Your exposure to radiation is related to three factors: time, distance, and shielding. Human exposure to radiation is typically measured in rems, or in one-thousandths of a rem, called millirems (mR).

As noted previously in this chapter, the allowable limit in the US. for occupational exposure is 5,000 mR/year for a whole-body and 50,000 mR for shallow penetration of extremities. Exposure from a properly-used NITON will be less than 50 mR per year, even if the instrument is used 2,000 hours per year.

For a given source of radiation three factors will determine the radiation dosage you receive from the source:

Duration of Exposure

The longer you are exposed to a source of radiation the more radiation strikes your body and the greater the dose you receive. Dosage increases in direct proportion to the length of exposure.

Distance from the source

The closer you are to a source of radiation, the more radiation strikes you. The dosage increases in inverse-squared relation to the distance from the source. For example, the radiation dose one inch from a source is *nine* times greater than the dose three inches from the source, and *144* times greater than the dose one foot from the source. Keep your hand away from the source-end of your NITON when the shutter is open to minimize your exposure.

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Shielding

Every NITON XRF emits virtually no radiation with the shutter closed because the cadmium-109 source is thoroughly shielded in every direction. This shielding absorbs nearly all of the radiation produced by the source—except when the shutter is open during testing. With the shutter open, the instrument emits a directed radiation beam of about one mR/hr intensity; the direction is clearly indicated by the diagram on the front of the NITON. Always hold your NITON so as to avoid the radiation beam.

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Safe Operation of the Multi-Source Analyzer

The multi-source instruments can have any combination of Cd-109, Am-241, and/or Fe-55. These sources are changed by the operation of a thumb-wheel. This thumb-wheel is located on the front (shutter) end of the instrument. There is a position for each source installed, in addition to a position with no source in place. The two source holder has three positions, and the three source holder has four positions. Position is confirmed by the thumb-wheel "clicking" into place. The Cd-109 is indicated by a blue indicator dot on the thumb-wheel. The Am-241 is indicated by a yellow indicator dot on the thumb-wheel. The Fe-55 is indicated by a red indicator dot on the thumb-wheel. The source that is in position will be displayed on the screen of the instrument.

The operation of the thumb-wheel in no way affects the operation of the instrument shutter. The thumb-wheel must only be operated either with the shutter closed or while the instrument is positioned on a sample. Follow all instructions concerning the operation of the shutter as the single source instrument.

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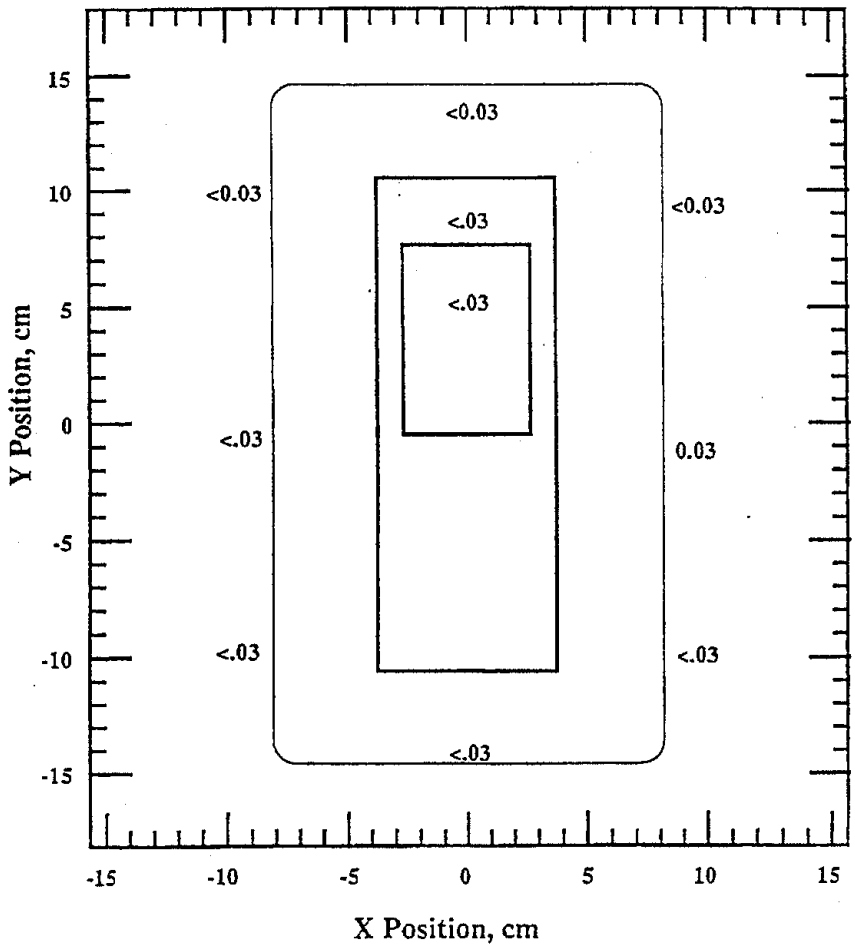
Instrument radiation profiles

Radiation Profile of NITON Analyzer on Sheetrock Substrate in mR/hr for 50 mCi ^{109}Cd Source with Shutter Closed (Nov 7 93)



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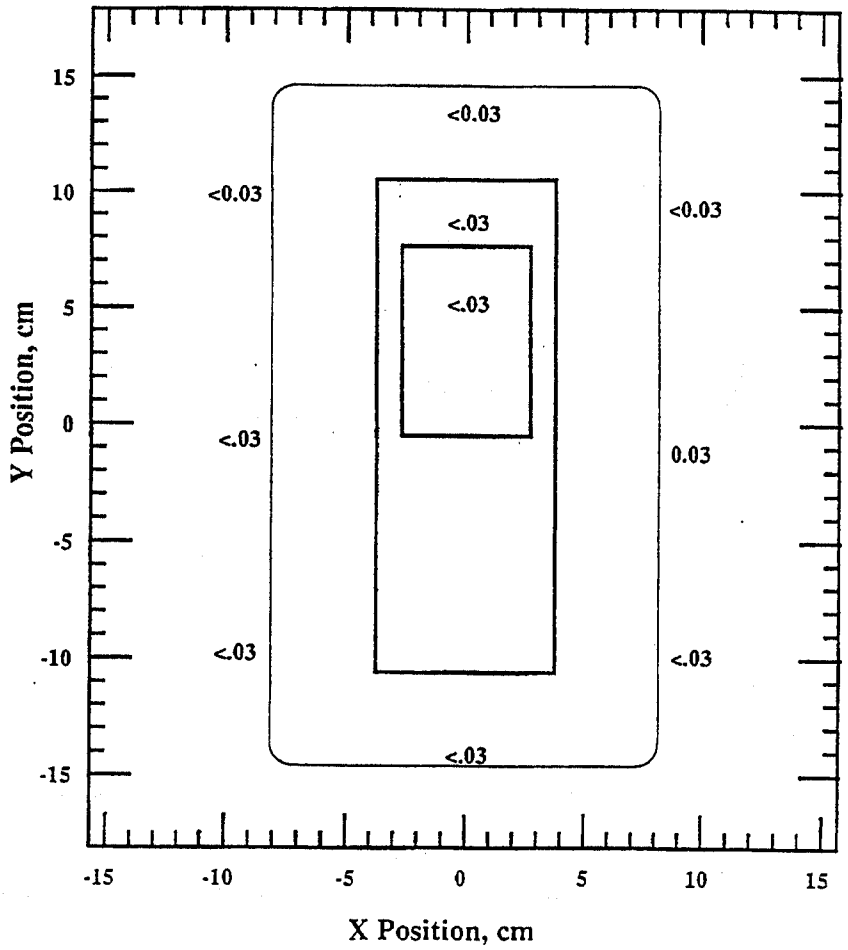
Instrument radiation profiles

Radiation Profile of NITON Analyzer on Sheetrock substrate in mR/hr for 10 mCi ^{109}Cd Source with Shutter Open (Nov 7 93)



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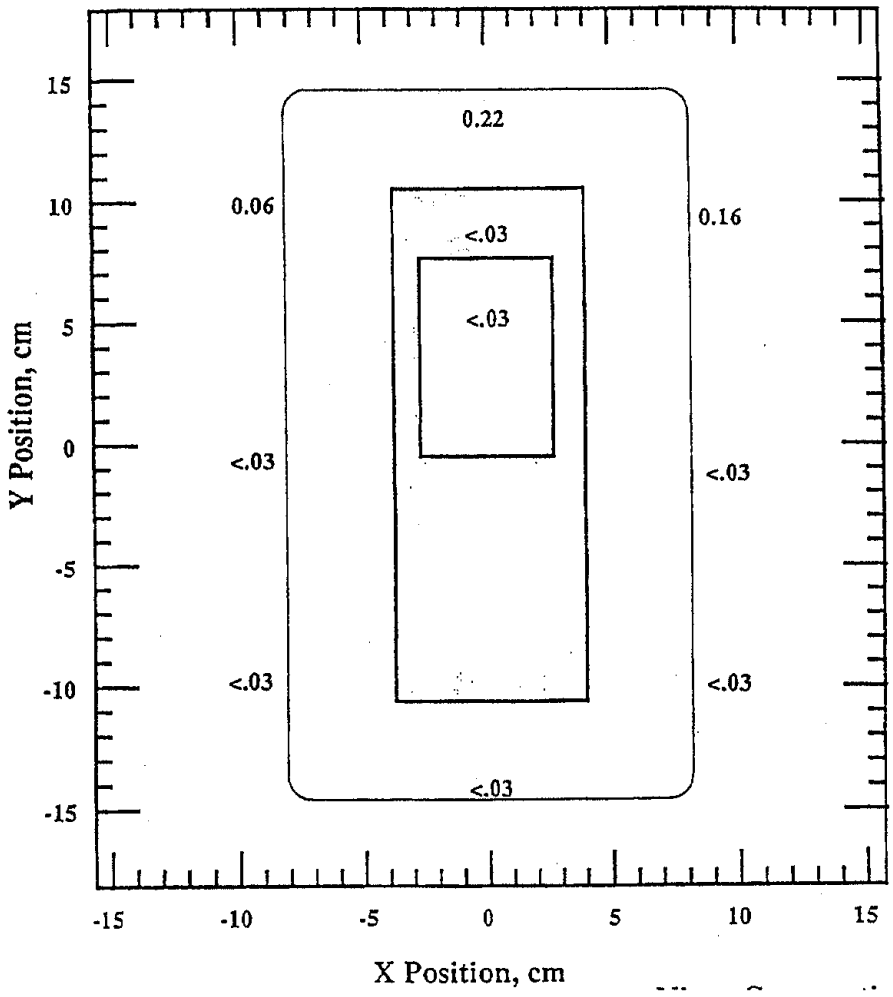
Instrument radiation profiles

Radiation Profile of NITON Analyzer on Wood Substrate in mR/hr for 50 mCi ^{109}Cd Source with Shutter Closed (Sept 14 94)



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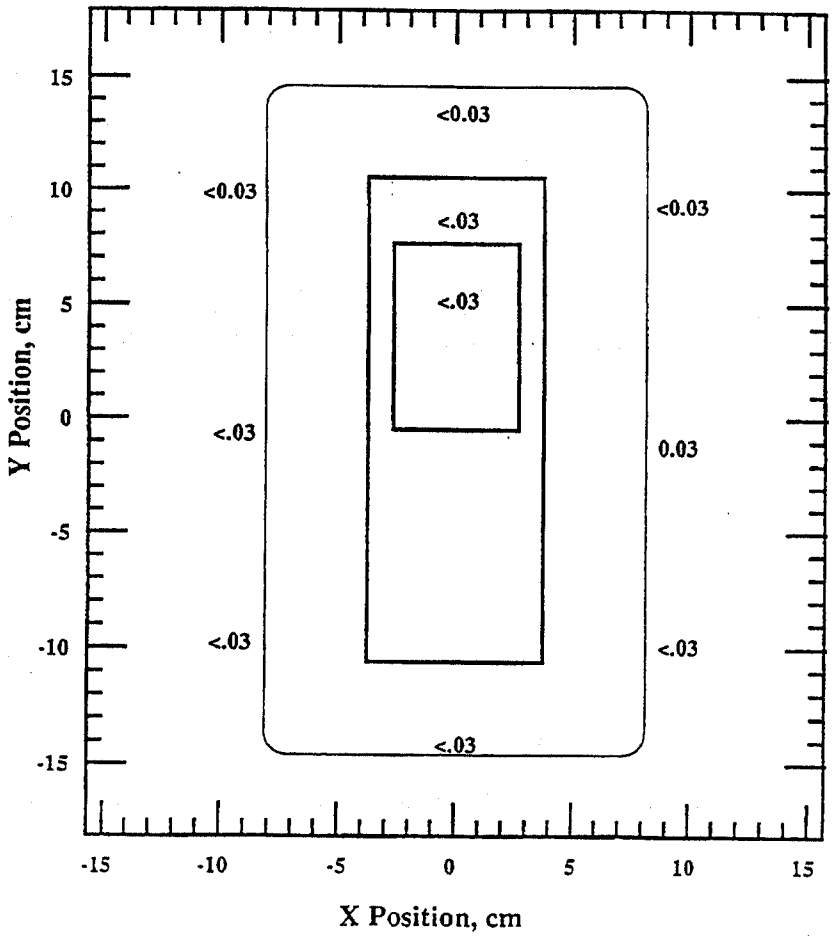
Instrument radiation profiles

Radiation Profile of NITON Analyzer with 10 mCi sources of ^{109}Cd, ^{241}AM, and ^{55}Fe, on 3/4" wood, with both shutters closed. Radiation strengths in mR/hour.



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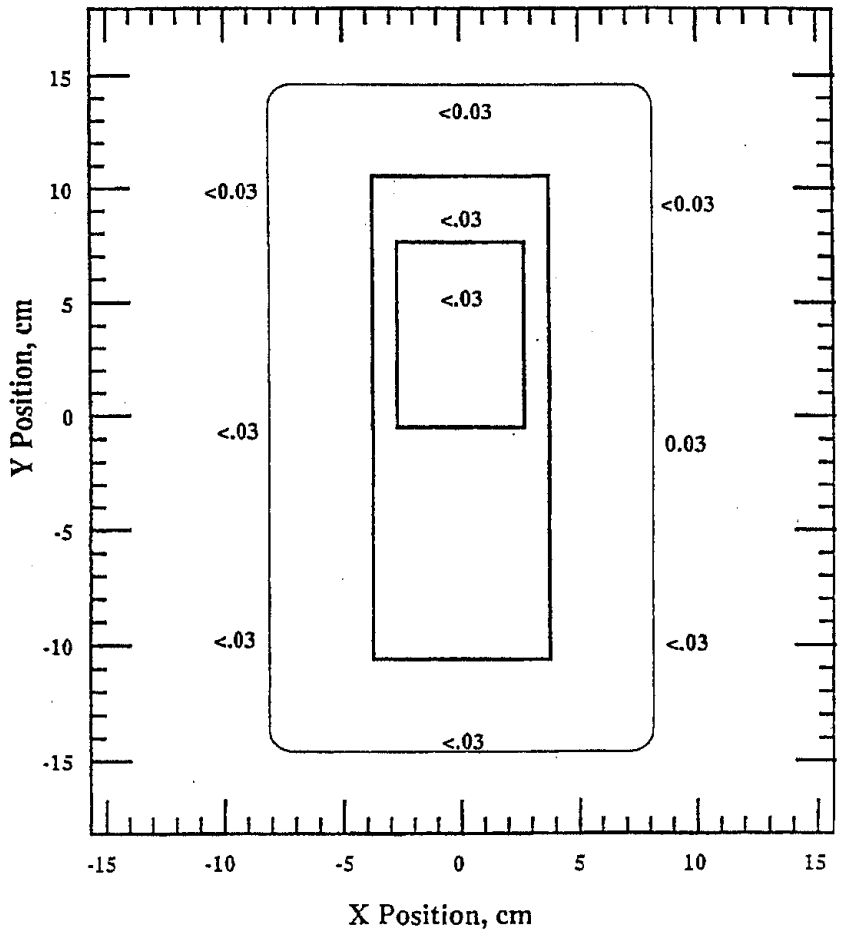
Instrument radiation profiles

Radiation Profile of 3-source NITON Analyzer with 10 mCi sources of ^{109}Cd, ^{241}AM, and ^{55}Fe, on 3/4" wood, with either the inner or the outer shutters closed. Radiation strengths in mR/hour.



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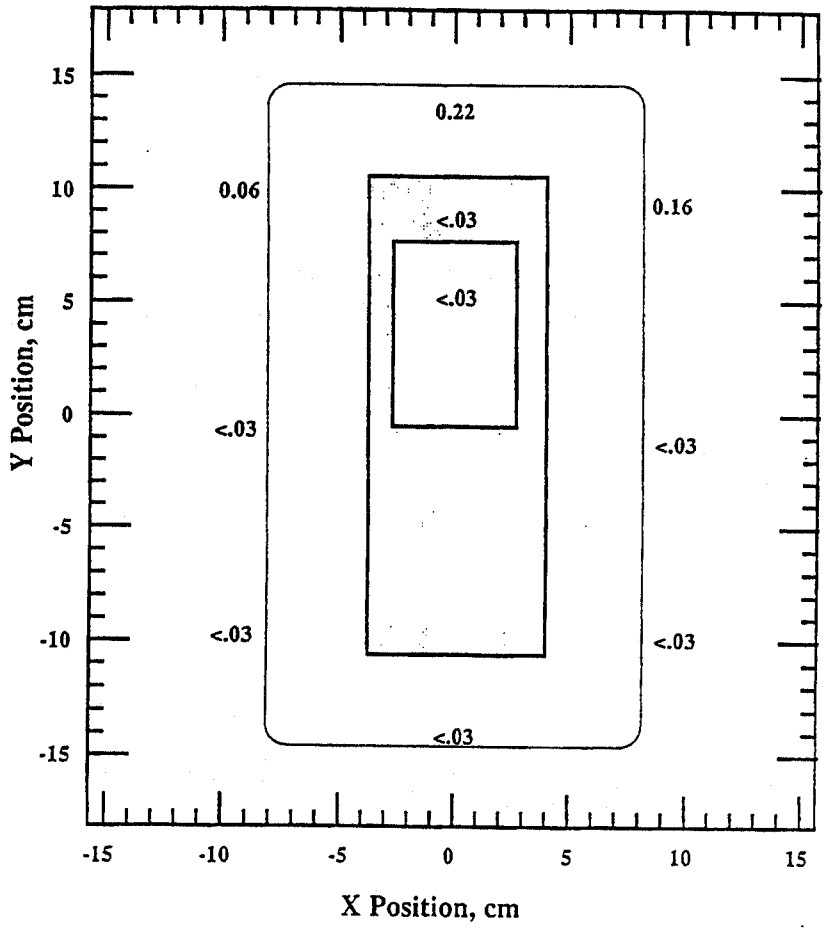
Instrument radiation profiles

Radiation Profile of NITON Analyzer with 10 mCi sources of ^{109}Cd, ^{241}AM, and ^{55}Fe, on 3/4" wood, with both shutters open. Radiation strengths in mR/hour.



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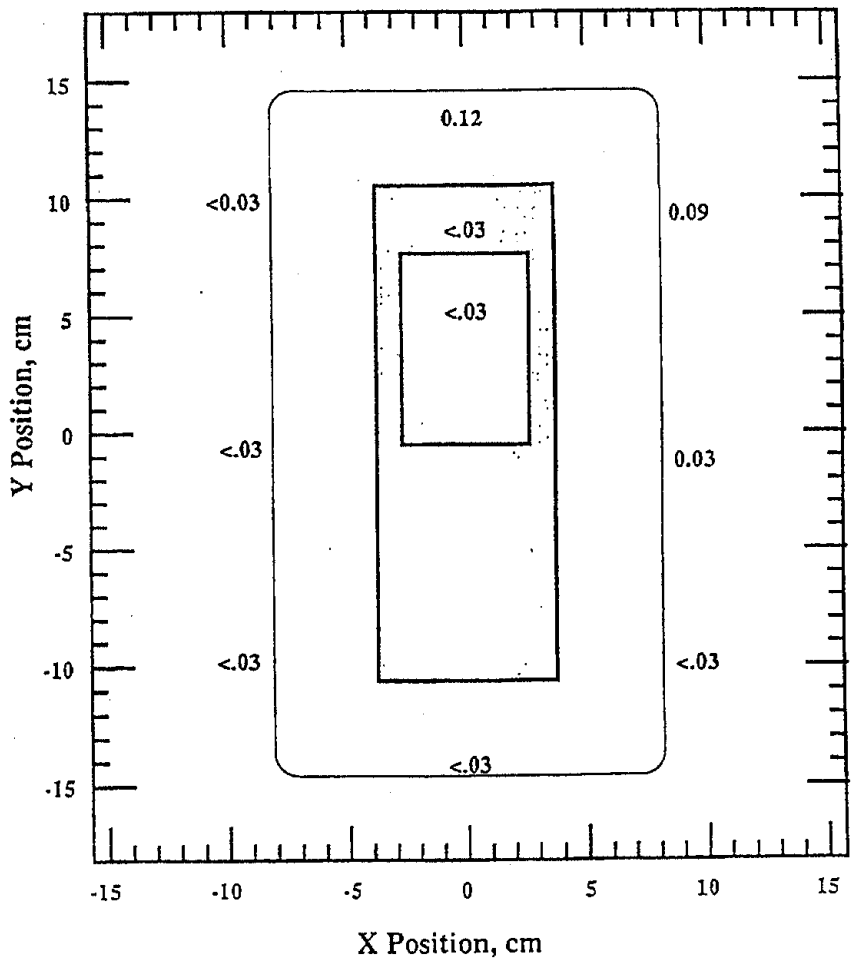
Instrument radiation profiles

Radiation Profile of NITON Analyzer with 10 mCi sources of ^{109}Cd, ^{241}AM, and ^{55}Fe, on 3/4" wood, with both shutters open, ^{109}Cd operating. Radiation strengths in mR/hour.



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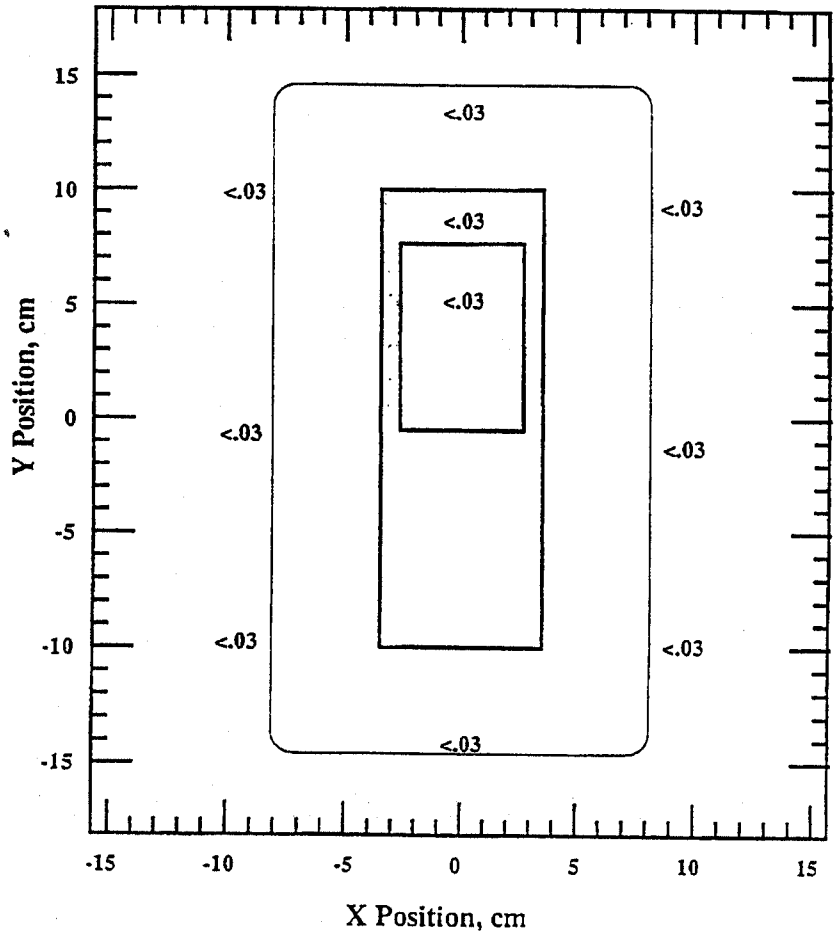
Instrument radiation profiles

Radiation Profile of 3-Source NITON Analyzer with 10 mCi sources of ^{109}Cd, ^{241}AM, and ^{55}Fe, on 3/4" wood, with both shutters open, ^{55}Fe operating. Radiation strengths in mR/hour.



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Wipe testing

The shielding on your NITON is designed to hold up even under extreme conditions, including the instrument's being crushed or burned. The continued effectiveness of the instrument's radiation shielding should be tested every six months with a thorough leak test of the instrument (**Figure 2.05**).

NITON's license requires that leak tests be done every 6 months. Leak test kits, with full instructions, are available from several vendors. These vendors will remind you when it's time to do another semi-annual leak test on your NITON. Please follow the accompanying instructions and promptly mail the test sample to the laboratory. The following are just a few of the labs that offer leak tests:

Applied Health Physics
2986 Industrial Blvd.
Bethel Park, PA 15102
Tel: (412) 835-9555

Stan A. Huber Consultants
200 N. Cedar Road
New Lennox, IL 60451
Tel: (800) 383-0468

Valley Safety Services
330 Old Enfield Road
Belchertown, MA 01007
Tel: (413) 323-9571

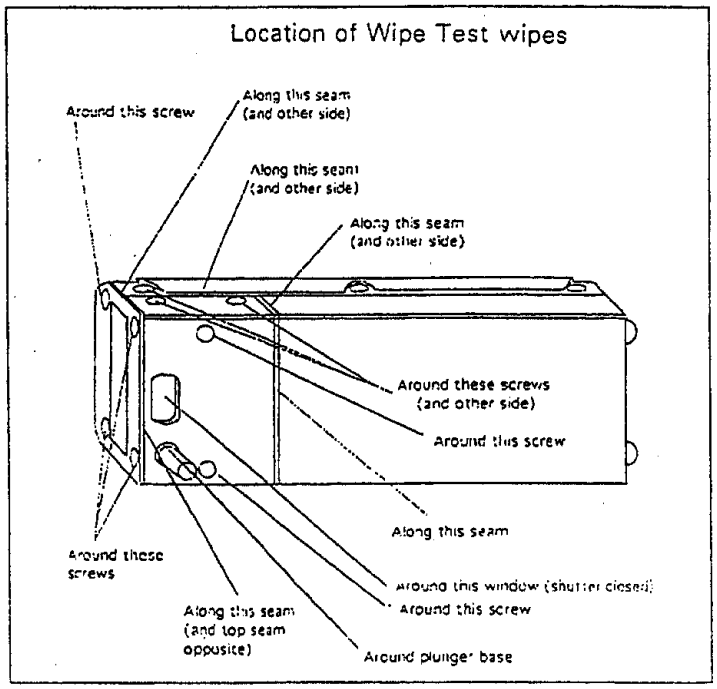

Figure 2.05
Leak Test: Location of Test Wipes.
NOTE: MUST BE DONE WITH SHUTTER CLOSED

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If your NITON is damaged, destroyed, lost or stolen:

Immediately

1 **Notify the Office of Radiological Safety in your state Dept. of Health.**

- Telephone: _____

2 **Notify NITON Corp's Radiation Safety Officer, Ken Martin, C.I.H.**

- During regular business hours: (800) 875-1578
- Evenings and weekends: (617) 923-6312

3 **If your NITON is lost or stolen, or damaged in a car accident:**

- **Also *immediately* notify your State Police.**

  Telephone: _____

4 **If your NITON is damaged in a fire or an explosion:**

- **Also immediately notify your local fire department.**

  Telephone: _____

Please fill in the phone numbers on this page today.
Keep copies where you can find them in case of an emergency.

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Analyzing bulk samples

Overview

The NITON *300Series* may be used to test lead in soil and ground-up paint chips if equipped with optional Lead In Soil Analysis software and hardware. 702, 702-A, 703 and 703-A Model Spectrum Analyzers are multi-element analyzers for bulk media, thick samples of materials such as soil, sludge, and various liquids. Applications include:

- in-situ soil testing
- in-situ materials testing (e.g., contaminated concrete)
- bagged soil sample testing
- testing sludge, sediments, liquids, and dust in cups,
- testing prepared soil samples.

Before You Test

Turn your NITON on at least 15 minutes prior to testing in Bulk Sample Mode. This will give you more precise measurements.

NITON provides three NIST soil standards: Lead high, Lead medium, and lead low to check the calibration of the instrument when testing in bulk sample mode.

Note: **Although the standards do not contain every element our multi-element analyzers test for, when an instrument correctly measures the standards you have have received with your 700, your NITON will correctly measure the other elements.**

Test the standards regularly. NITON recommends testing immediately after the instrument finishes self-calibration. Test the standard samples appropriate to the type of tests you are conducting, and once every 1–2 hours thereafter.

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Note: **For defensible Quality Control, keep a record of the time and precision of every calibration, using the bar code system wherever possible.**

Warning: Tampering with the 5,500 ppm lead-in-soil standard may cause exposure to lead dust. Keep all standards out of reach of children.

Caution: Never tamper with Test Standards. They should not be used unless they are completely intact.

During each test, the NITON looks at the full range of the x-ray spectrum and continuously corrects for cross-element interferences.

Testing in Bulk Sample Mode

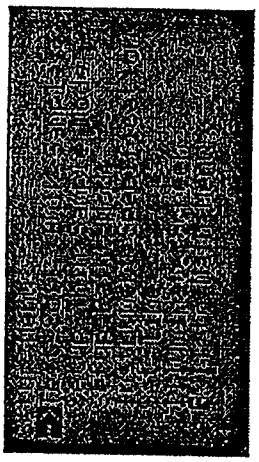

Figure 3.01
Setup Menu
Test Soil, Bulk Samples

Choose the **Bulk Sample Mode** from the Setup screen (**Figure 3.01**).

Testing methods for bulk media are generally of two types:

- Field screening and
- testing prepared samples.

Understanding the difference between these two types of analysis is crucial to getting good data. Field screening should be used to

- profile an area,
- locate sources of contamination,
- determine the boundaries of contamination, or
- gather data that will subsequently be used to design a sampling plan.

Field screening is usually only approximate; it will correlate very well with lab analysis for a highly-homogeneous sample, but may correlate extremely poorly for a non-homogeneous sample.

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Note: **Never use in-situ testing to compare field XRF results to laboratory results. For XRF evaluation purposes, use only well-prepared samples (see page 3-10).**

When comparing field screening to laboratory analysis, try to compare the same samples. For best results, collect a large sample in a zipper locking storage bag. Shake the bag to mix the sample. Test the bagged sample several times using the NITON and average the readings. Then compare this average reading with lab results.

If you must test in-situ for performance evaluation, take several XRF readings bracketing a spot. Then take a sample for laboratory testing from that spot. For further discussion of field screening, see EPA Method 6200, "Field Screening Using a Field-Portable XRF." Contact NITON for a copy. The EPA accepts field screening using the NITON if the screening is performed using Method 6200. Most states accept EPA Method 6200.

The measurement screen

On NITON **300*Series*** with optional Lead in Soil Analysis, only lead is displayed in bulk sample testing. On **700*Series*** models, only the two highest-concentration elements are displayed (in ppm, with the two-sigma confidence intervals) on the first Measurement screen (**Figure 3.02a**), with the x-ray spectrum. The black bars on the spectrum display highlight the presence or absence of lead or iron in the sample. The test time is also displayed in nominal (source) seconds.

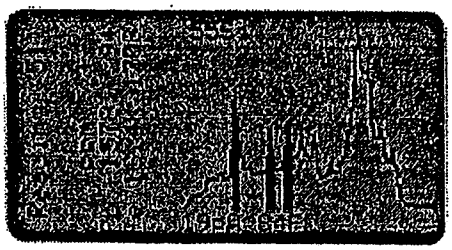

Figure 3.02a
Measurement Screen
Bulk Sample Mode

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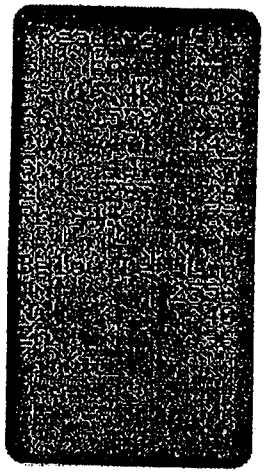

Figure 3.02b
The Summary Screen
Bulk Sample Mode

The summary screen

When you end a reading, the **Measurement Screen** will be replaced by the Summary Screen (**Figure 3.02b**). On 700 models, results are displayed for 14 elements. These elements are divided into two groups:

- elements that were detected in the sample, and
- elements that were not detected.

Press the **Arrow buttons** to scroll through the elements.

Detection Limit: For an element to be detected by the NITON in a given sample, the measured concentration of the sample must be at least three times the standard deviation of the measurement. This detection limit will depend on the composition of the sample.

Precision: The measurement precision for each element displayed appears to the right of the measured concentration, under the heading "+-". The **precision** of each measurment is two times the standard deviation (sigma).

An element is classified **detected** if the measured concentration (in ppm) is at least 1.5 times the precision. Detected elements are displayed as in the Measurement Screen. Non-detected elements are shown as < "xx", where "xx" is the detection limit for that sample. The detection limit for each element is calculated from each sample.

In-situ surveys

Before you take your first measurement, you must decide whether to test the bulk material

- in-situ (in-place)
- as bagged samples (or, for liquids and sludge, in cups) with a minimum of preparation, or
- in an XRF cup after careful preparation.

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Note: More sample preparation (drying, milling and sieving) will yield greater accuracy. The drier, finer, and more homogeneous the particles, the better the measurements.

Screening Techniques

Use direct measurement when you need to determine whether an element is present (rather than in accurately measuring how much is present). Use preliminary direct measurements to survey a site quickly even if you intend to take samples. Analyzing bagged samples can also be used for screening.

The NITON test guard

The NITON Test Guard (**Figure 3.03a,b**) is a formed metal plate designed to be placed directly between the ground or other bulk media and the NITON. The Test Guard shields the unit from contamination and damage. Use the Test Guard for surveys of bulk media in-situ or for testing bulk samples in bags.

Mylar film over window on Test Guard allows passage of x-rays but protects the instrument.

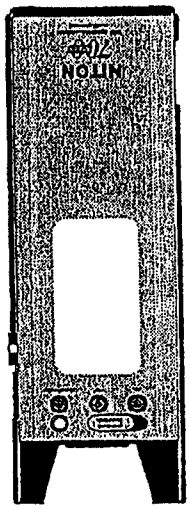

Figure 3.03a
NITON Test Guard

Figure 3.03b
NITON Test Guard with instrument in place

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Testing in-situ

Warning: When taking samples from a site where toxic chemicals may be present, always use gloves and respiration equipment for your own protection.

1 **Select a measurement site**
Valid results will depend on a sufficient and appropriate selection of sites to sample. Lead-in-soil from paint, for instance, will be concentrated within a few feet of the painted structure.

2 **Clear any surface debris or vegetation.**
Use a flat area so that the NITON will contact the test medium. The finer and more homogeneous the material, the more accurate the measurement. (You can increase your accuracy when testing soil by loosening the soil and letting it dry in the sun before testing.)

3 **Place the test guard on ground.**
Keep the top of the test guard clean.

4 **Hold the NITON in one hand.**

Warning: Always treat radiation with respect. Do not put your hand on the end plate of the NITON while measuring. Never point the NITON at yourself or anyone else when the shutter is open.

5 **Push the safety slide** (that locks the shutter release) **out from under the shutter release.** If the slide is still tucked in, you will not be able to press in the release and the instrument will not fit on the test guard correctly.

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6 **Place the NITON on the test guard so that the rectangular opening on the test guard is under the window of the NITON.** The back of the unit must be flush with the test guard. Squeeze the shutter release, and firmly press the instrument flat against the surface of the test guard (**Figure 3.04 a,b**). If you don't squeeze the shutter release, the plunger will not depress. If the plunger is not fully depressed, the window is not fully open and the NITON cannot measure accurately.

Note: **You do not need to squeeze the shutter release continuously while taking a measurement. Hold the NITON firmly against the test guard surface and it will continue to read. Once you lift the instrument, the plunger will back out of the bottom, the shutter will close, and the test will be finished.**

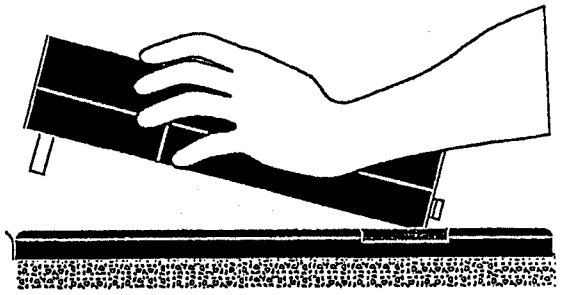

Figure 3.04a
Placing the NITON on the test guard

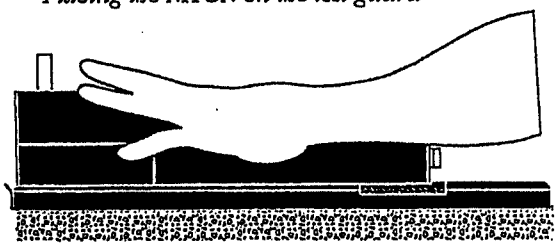

Figure 3.04b
Firmly pressing the NITON flat against the surface

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7 Follow the precision indicator ("±") on the NITON screen to see when the test has reached your desired levelof detection and precision.

Warning: In the unlikely event that the plunger gets stuck in the open position, simply push it closed. Then call the NITON Service Department at (401) 294-1234.

In-situ depth profiling

An XRF soil test examines only the top millimeter or so of soil. To do depth profiling, simply remove a vertical slice of soil and test several samples from different depths. Doing so rapidly yields information about the depth of contamination.

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Analysis of bagged bulk samples

Sometimes it is convenient to collect samples in plastic bags. Without further preparation of the sample, you can screen the site by testing each bag. Because you are testing through a bag, test results will tend to be 5–10% lower than test results obtained from direct analysis.

Taking bagged samples

1. **Size up the site for differences in soil characteristics before sampling.** Valid results depend on a sufficient and appropriate selection of sites to sample. Consider the site's topography, texture, drainage, color of topsoil, and past use.

2. **Take a composite sample from each predetermined area.** Do not combine samples from areas with different compositions or history. **A composite sample made up of samplings from two distinctly different areas is not representative of either area.**

3. **Mix the sample.** If it is too large, reduce the sample. Some techniques for reduction and homogenization are described in the section on analysis of prepared samples.

4. **Fill a clean plastic bag with 50–100 grams of soil and close it securely** (with a twist tie). The accuracy of your measurements will be limited by the thickness of the plastic in the bag you use. 1 mil-thick Polyethylene bags offer a reasonable compromise between accurate readings and bag durability. Be sure to label each bag with your name and the location of the sample site.

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Testing samples in bags

Shape the bag of soil to form a continuous uniform layer of at least 1 cm. (0.4 inch) thickness. Place the NITON test guard on the bag (**Figure 3.05**). Then follow in-situ testing instructions from page 5.

Warning: Do not hold bagged bulk samples in your hand during testing.

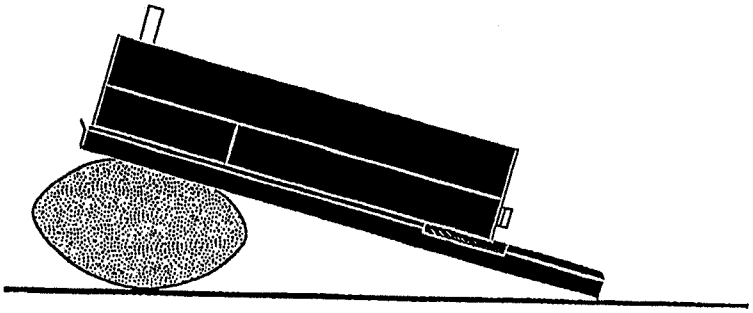

Figure 3.05
NITON Test Guard placed on bag of soil.

Analysis of prepared bulk samples

Prepared sample analysis is the most accurate method for determining the concentration of elements in a bulk medium using your NITON. Sample preparation will minimize the effects of moisture, large particle size and variations in particle size.

Warning: Always use gloves and respiration equipment for your protection when taking samples from a site where toxic chemicals may be present,

NITON recommends a specific sample protocol. See **Figure 3.06** for a flow chart of the protocol. Following this protocol for preparing and testing samples is vital for achieving a level of accuracy comparable with laboratory results.

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Flow Chart of Sample Preparation Method recommended by NITON.
Use of the #60 Mesh sieve is optional.

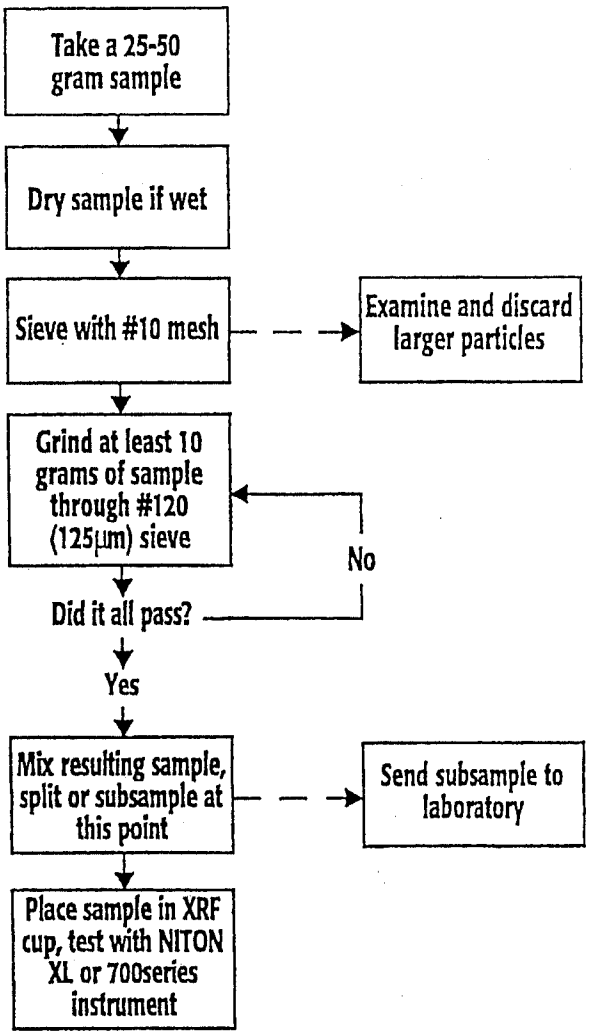

Figure 3.06
Soil Sample Preparation Protocol.
This sample preparation protocol should be followed whenever you are comparing XRF results to laboratory results. Following this protocol is the only way to guarantee that the samples being compared have approximately the same level of contamination present. Without such a preparation protocol there is no basis to compare XRF and laboratory results.

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Taking bulk samples

Note: **When testing for lead-in-soil in a residential setting, it is standard practice to sample the top 4 to 6 inches of soil.**

The soil probe or sampling tube is a very convenient sampling tool. because it

- allows speed
- makes more accurate composite samples than any other tool
- may always be inserted to a marked depth and
- removes the same amount of soil at each insertion.

There are core sampling devices that can remove an intact cylinder of undisturbed material.

A shovel, spade, dibble, narrow (1-1/2 inch) garden trowel, or other sampling tool can do the job. Take a half-inch soil slice. A satisfactory soil auger may be made by welding a 1-1/4 or 1-1/2 inch wood bit into a 1/2 inch pipe equipped with a T-handle.

Take 50–100 gram sample to insure that you have a sample large enough to be representative and unbiased after it is mixed, ground, and strained.

1 **Evaluate the area for differences in characteristics before sampling.** The validity of your results will depend on how well your samples represent the test site. Test results may be highly misleading or even worthless unless the samples tested actually represent the area.

Be sure to consider topography, texture, drainage, color of topsoil, and past use when selecting an area. Lead, for instance, is usually concentrated near a building with lead paint (within 4–6 feet).

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2 **Reduce the samples by taking a vertical slice** (so it is representative of the entire spadeful) about one inch wide if the individual samplings are taken with spade or trowel (**Figure 3.07**).

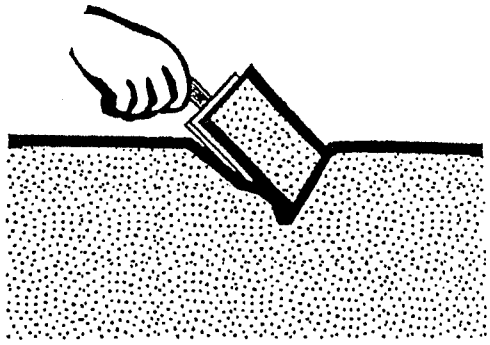

Figure 3.07
Taking a sample with a trowel

3 **Place the reduced samples in a clean pail.** Then mix the sample thoroughly by stirring and by rotating the pail at an angle of 45 degrees. Don't shake—you do not want to stratify the sample by weight).

4 **Take a composite sample from each predetermined area.** Do not combine samples from areas with different compositions or history. A composite sample made up of samplings from two distinctly different areas is not representative of either area.

5 **Prepare a composite sample by** taking several samplings from each predetermined area. These samples should consist of vertical columns of material approximately 1 inch in diameter. The length of each column should be about 6 inches. Lead from paint is usually concentrated within the top 1–4 inches. The elements you wish to measure and the local history will determine the depth at which you need to sample.

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Package samples from the following areas in separate categories:

- samples close to painted structures
- samples close to roads
- samples close to where various types of waste have been stored, or
- samples near pressure-treated lumber.

6 **Fill a clean plastic bag and close it securely with a twist tie.** Be sure to label it with the date, the site and the location from which it was taken.

Preparing bulk samples

The equipment you need to prepare samples is included in your kit. Among these are a mortar and pestle (for the 300*Series* with lead-in-soil-analysis), an electrically powered grinding mill (included with 700*Series*), and several sized-sieves.

Caution: All test equipment must be kept clean to prevent contaminated samples.

Cleaning Equipment:

The mortar, pestle, and grinding mill may be cleaned with dry paper towels. You can also clean the mortar, pestle, and the mill's container with water, but be sure each is absolutely dry before using them on another sample. The mortar and pestle may be cleansed by grinding clean dry sand in the mortar. Use the short bristle brushes (included in your Bulk Testing Kit) to clean the sieves. When Soil Grinder blades wear out, unbolt the worn blades and replace. Call the NITON Sales Department at 1-800-875-1578 for replacement blades.

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Sample Preparation

To best prepare a sample for presentation to the XRF, the material should be dry and well homogenized. Ideally, the entire sample should be dried to constant weight, sieved to remove gravel and debris, and ground or milled to a fine powder.

1. **Dry the sample if it is moist and cohesive.** The sample can be dried in any of several ways. Choose one of the following:

   - **Oven dry** the sample for approximately 2 hours at 150° C, until the sample reaches a constant weight.

     Note: **Oven drying is inappropriate when volatile compounds may be present in the sample.** For example, lead present as tetraethyl lead would be driven off by the heat of drying. Some forms of mercury and arsenic are volatile. Air drying will preserve more of these volatile substances.

   - **Air dry** the sample overnight at room temperature in a shallow pan.

   - **stir gently and warm the sample in a pan** over a hot plate or burner.

2. **Cone and quartering**

   You may need to divide your sample at various times during preparation. Cone and quartering is a method for splitting the sample into homogenous quarters.

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- Pour the dry material slowly and carefully onto a flat sheet or pan forming a symmetrical cone.
- Divide the cone into equal piles using a flat thin-bladed tool, such as a knife or ruler.
- Divide these in half again.

Now you have four samples, each one-quarter the size of the original and each more homogenous than the original.

3 **Grind the sample** to break up dirt clods and/or paint chips.

Warning: Grinding-and-sieving dried samples produces dust. Even clean soil contains silica, which may be hazardous when airborne. Prepare all samples in a ventilated area; wear a mask, gloves, and an apron; and spread a drop cloth.

4 **Sieve with the #10** (2mm) **mesh and separate out the larger pieces** (stones, organic matter, metallic objects, etc. Examine the larger particles by eye (look for paint chips), but do not include in the sample.

5 **Grind the sample again** so its particles will be finer and more homogenous. Use mortar and pestle, or an electrically powered grinding mill.

6 **Sieve at least 10 grams of the sample through #60** (250 µm) **and #120** (125 µm) **mesh.** Re-grind the unpassed material until the required fraction is able to pass.

7 **Mix** the resulting sample.

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Putting the sample in an XRF sample cup

The container used to hold the sample will affect the accuracy of the measurement. Use a container with as thin-walled a window as is convenient and use the same kind of container and window for each sample. Consistency and careful attention to detail are keys to accurate measurement.

Note: **The sample container should be a sample cup of a type that can be filled from the rear; that is, the side opposite the window (e.g. Chemplex #1330). NITON recommends using a 1/4 mil mylar film (Figure 3.08). A supply of cups and films are included.**

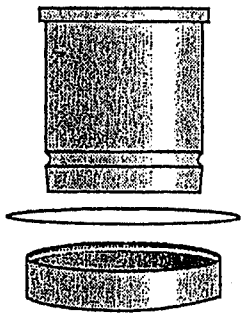

Figure 3.08
Sample cup with 1/4 mil mylar film

1. **Place a circle of mylar film on top of an XRF sample cup.** This film goes on the end of the cup with the indented ring. NITON recommends preparing the cup ahead of time, if possible.

2. **Secure the film with the collar.** The flange inside the collar faces down and snaps into the indented ring of the cup. Inspect the installed film window for continuity and smooth, taut appearance.

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3 **Set the cup on a flat surface film-window-side down.** Fill it with at least three grams of the prepared sample (no more than half-full). Take care that there are no voids or layering.

4 **Tamp the sample into the cup.** The end of the pestle makes a convenient tamper. If you intend to re-use the sample, you can, alternatively, place a filter-paper disk on the sample before tamping it.

5 **Fill the rest of the cup with polyester fiber stuffing to prevent sample movement.** Use aquarium filter or pillow filling as stuffing. A small supply of stuffing comes with your bulk sample kit.

6 **Fasten the cap on the cup (Figure 3.09).** Using an indelible pen, write an identifying number on the cup. Keep a record of the sample number, the site and location, the date of the sample, and any other relevant comments.

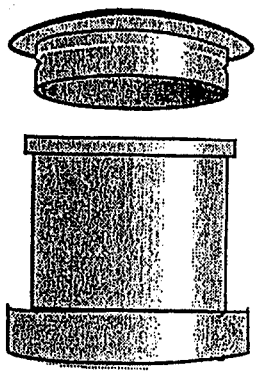

Figure 3.09
Sample cup with cap

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Preparing liquids, sludges or dust

Liquids:

Fill an XRF sample cup with the liquid to be tested (Use no cotton). The cup must be full so it is best if some overflows when the cap is put on.

Sludge:

Sludge can be placed directly into an XRF cup for screening. This is considered in-situ testing because no attempt has been made to prepare the sample. For more accuracy, the sludge can be dried, sieved, and ground.

Screening dust:

Vacuum dust with a household vacuum cleaner and use large dust samples taken from the vacuum cleaner bag. Remove fibers, hairs, and debris. At least three grams of dust are needed to assure accurate analysis. Samples as small as one or two grams may be measured with less accuracy. Even smaller samples (0.3 to 1.0 grams) can be analyzed by applying a weight correction factor and by using a funnel to place the sample in the center of the sample cup.

Prepare in an XRF sample cup and test the same way you would with a soil sample. For risk analysis, it is advisable to use a 60-mesh sieve to isolate and test only fine particles.

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The bulk testing platform

The test platform (**Figures 3.10a,b**) is an accessory fixture for holding bulk samples (such as soil or ground paint chips) in standard film-window XRF cups. This fixture snaps quickly and securely to your NITON instrument.

The platform latch screws underneath for storage. Before using the test platform, unscrew the latch and rescrew it on the end of the platform nearest the receptacle for the sample cup.

The test stand securely holds the XRF sample cup in place.

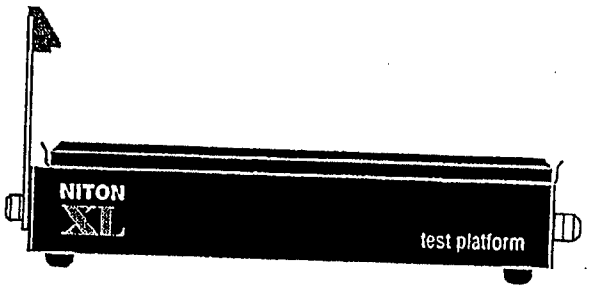

Figure 3.10a
The NITON Test Platform

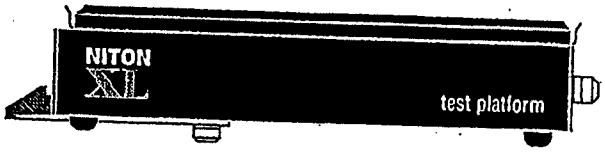

Figure 3.10a
The NITON Test Platform with its latch in the stored position

Testing the sample

Set the NITON test platform on a flat, solid surface. Place the sample cup in the receptacle of the sampler. Included in your kit are some foam disks that you can put in the receptacle under the cup for firmer contact between the NITON and the sample cup window. Attach the NITON to the test stand and follow in-situ bulk sample instructions (**Figures 3.11 a,b**).

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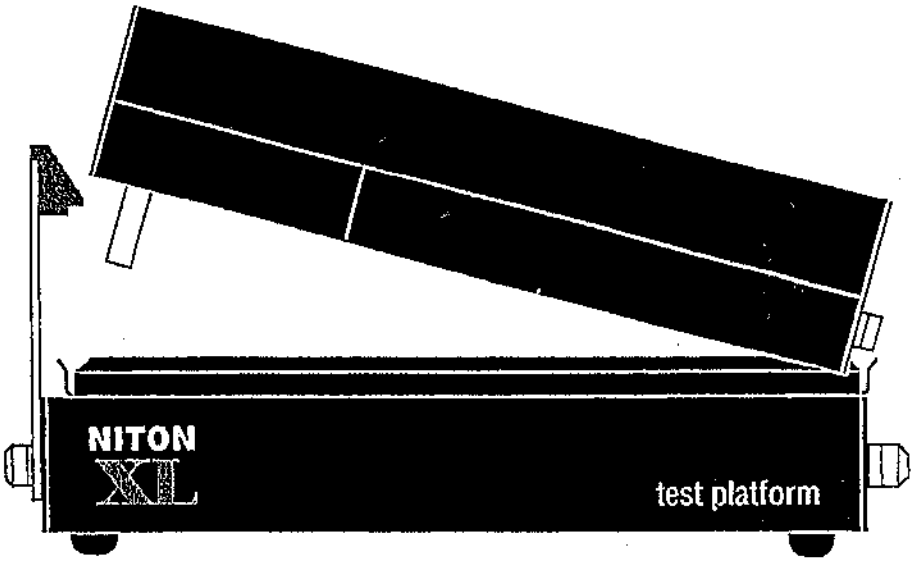

Figure 3.11a
Placing the NITON on the NITON Test Platform

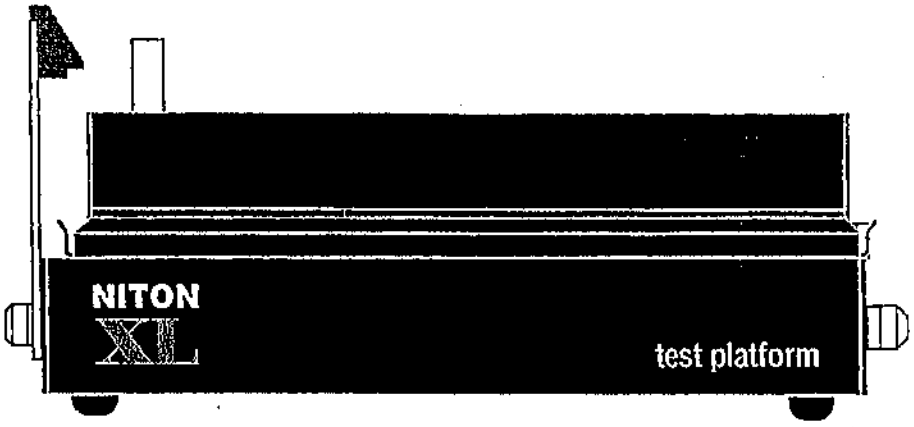

Figure 3.11b
Firmly latching the NITON flat against the NITON Test Platform

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Analyzing thin samples

Note: **Remember, turn your NITON on at least 15 minutes prior to testing in Thin Sample Mode. This will give you more precise measurements.**

Overview

The NITON **300*Series*** can test dust wipes and other thin samples for lead if it is equipped with optional Dust Wipe Analysis Software and Hardware. The **701, 701A, 703** and **703A** Model Analyzers are multi-element analyzers for a wide range of thin samples. Examples of thin samples include:

- 37 mm filters used for exposure monitoring filters, and filters used for Dust Vacuum methods
- Total Suspended Particulate (TSP) and Particulate Monitoring (PM) filters,
- dust wipes,
- filters used for measuring suspended and dissolved metal concentrations in liquids, and
- thin coatings deposited on substrates.

Contamination captured on filters or wipes is not usually deposited uniformly, because the filters and wipes are several times larger that the 1 cm x 2 cm scanning window of the NITON. Therefore, to produce meaningful results, several readings must be taken for each thin sample measurement. Readings are then summed or averaged.

The NITON follows a unique procedure for each application. For example, the procedure for testing dust wipes is different from the procedure for testing 37 mm personal exposure filters. Thus the number of readings, the weight given each reading, and whether the readings are summed or averaged may change for each application. These

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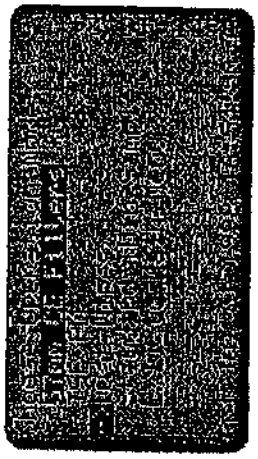

Figure 4.01
Setup Menu.
Thin Sample Mode

choices will be set automatically when you choose the appropriate Thin Sample Mode from the Thin Sample Setup Menu. (See **Figure 4.01**). *See the section titled "Setup Thin Sample Mode".* This mode should not be used for quantitative lead paint testing.

The dust wipe and filter test platform

The Dust Wipe and Filter Test platform is an accessory fixture for holding 37 mm personal exposure filters, larger contamination monitoring filters, and dust wipes (**Figures 4.02, 4.03**). The test platform snaps quickly and securely to your NITON—and detaches just as quickly. It also protects you from exposure to radiation.

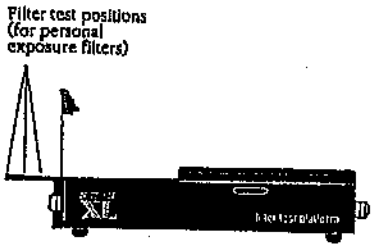

Figure 4.02
The NITON Thin Sample test platform

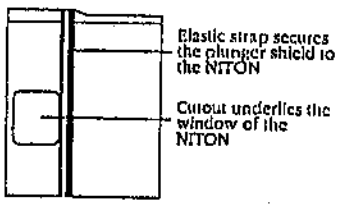

Figure 4.03
The NITON plunger shield protects PM and TSP filters from puncture

The front end of the platform is designed to facilitate testing 37 mm personal exposure filters. The test stand securely holds the filter in place in each of the three test positions required for these filters. The clamp holds the instrument.

To test larger TSP and PM filters, remove the front end of the platform. Use the plunger shield to protect the filter from being punctured by the NITON's plunger. The velcro strap on the filter test platform holds the instrument in place and loosens easily to permit you to reposition the filter between each reading.

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Before You Test

NITON provides a set of three thin film standards: lead, copper, and iron to check the calibration of the instrument.

Note: **Although the standards do not contain every element our multi-element analyzers test for, when an instrument correctly measures the standards you have have received with your 700, your NITON will correctly measure the other elements.**

Test the standards regularly. NITON recommends testing immediately after the instrument finishes self-calibration. Test the standard samples appropriate to the type of tests you are conducting, and once every 1–2 hours thereafter.

Note: **For defensible Quality Control, keep a record of the time and precision of every calibration, using the bar code system wherever possible.**

Caution: Never tamper with Test Standards. They should not be used unless they are completely intact.

During each test, the NITON looks at the full range of x-ray spectrum and continuously corrects for cross-element interference. Please refer to the section in Chapter 1 on user calibration on standard samples on page 1-14 for further information.

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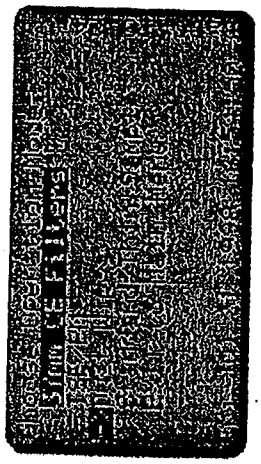

Figure 4.04
Setup Thin Sample Mode: 37mm CE filters

37mm CE and Fiberglass Filter Mode

Before testing 37mm filters

1. access the **Setup Menu**
2. select Setup **Thin Sample Mode**, then
3. select **37mm CE Filters** (**Figure 4.04**).

For details, see the "Setup" and "Setup Thin Sample Mode" section on pp. 1-19 to 1-20.

Preparing a filter

37 mm filters are often used for monitoring personal exposure. Dust vacuum measures (DVM) use the same size filters and are tested in much the same way. To prepare the filter for testing, remove it from the air sampling cassette and load it in a filter sleeve.

The plastic air sampling cassette (**Figure 4.05**) included in your kit is closed-face; an open-faced cassette would be missing the top section and plug. The filter sleeve is a piece of cardboard sandwiched between two layers of thin plastic film (**Figure 4.06**). The cardboard has a circular cutout of slightly larger cutout than the filter.

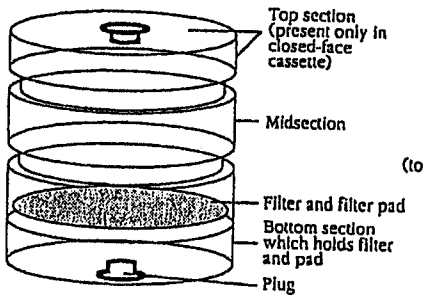

Figure 4.05
An Air sampling cassette

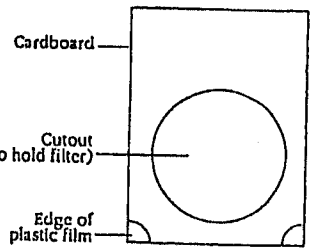

Figure 4.06
Placing the filter in the ardboard filter sleeve for testing

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Note: **To avoid contaminating the test results, wear clean surgical gloves. Take a sleeve. Peel back the top layer of film. Set the sleeve down on a clean surface.**

Remove the bottom plug from the air sampling cassette. Separate the sections of the cassette so you can reach the filter. Using tongs, poke the filter and filter pad through the plug hole to release it from its seat in the cassette. Touching only the edges of the filter and pad, gently separate one from the other with your finger. Then, using the tongs, lift the filter from the cassette and place it on the sleeve in the cutout. Close the sleeve. It doesn't matter if the sleeve wrinkles some.

Note: **It is advisable to practice with several blank filter cassettes before using real samples.**

Positioning a filter

Place the sleeve on the test platform. The test platform has a built-in filter holder, designed to hold 37 mm filters securely under the test window of the instrument.

You must take three readings, each from a different area of the filter (**Figure 4.07**) to accurately determine the concentration of elements on the filter. The 300*Series* or 700*Series* will automatically calculate the total loading, in µg, when you complete the three readings. The filter holder has ridges that hold the filter in position for each of the three required readings.

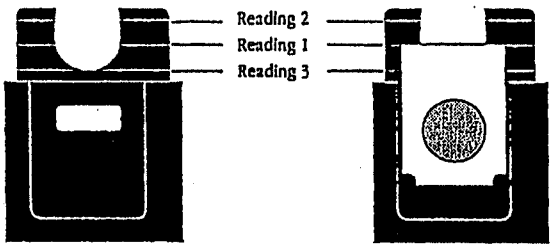

Figure 4.07 (left)
Detailed diagram of filter test platform from above. Note the three test positions

Figure 4.08 (right)
Filter sleeve on the middle position (the first reading) with filter in the sleeve cutout.

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Taking a reading

Order is important. You must measure the center of the filter first (Figure 4.08). Place the filter against the middle ridge of the filter holder. This reading is multiplied by a different coefficient than either of the other readings.

1 Take the first measurement

a. Set the test platform on a flat, solid surface.

b. Holding the NITON in your hand, place it on the test platform so that the filter is under the test window. Squeeze the shutter release, pull back the latch on the platform with your left hand, and firmly press the instrument flat against the platform surface. You must squeeze the shutter release for the plunger to depress. If the plunger is not fully depressed, the window will not open fully, and the NITON cannot measure accurately. The window opening must be flush with the test platform to get an accurate reading.

The test platform latch will continue to hold the NITON flush against the sample until you lift it off.

Note: **You do not need to hold the NITON or squeeze the shutter release continuously while measuring. Your NITON will continue to test until you lift the instrument from the test platform.**

c. Watch for indications of lead on the screen to decide when the test has reached the desired level of accuracy. The instrument will beep at 60 nominal (or source) seconds, a typical test time for the quantitative measurement of lead.

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d. After the desired interval, pull back on the platform latch to release the NITON and lift from the test platform to end the test. The shutter will close automatically. The plunger should be fully extended.

Warning: In the unlikely event that the plunger gets stuck in the open position, simply push it closed. Then call the NITON Service Department at (401) 294-1234.

Note: **Remember, order is important: The middle-of-the-filter reading must be done first.**

2 Slide the filter to the outermost ridge.
Take the **second** measurement (the top of the filter).

3 **Slide the filter to the innermost ridge.**
Take the **third** measurement. The order of these last two measurements may be reversed.

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Reading the display

The Measurement screen

The Measurement screen is displayed during each test and is accessible after the test is complete. For the 300*Series*, the screen shows each of the three measurements (in µg/cm²) of lead (**Figures. 4.09 a-c**).

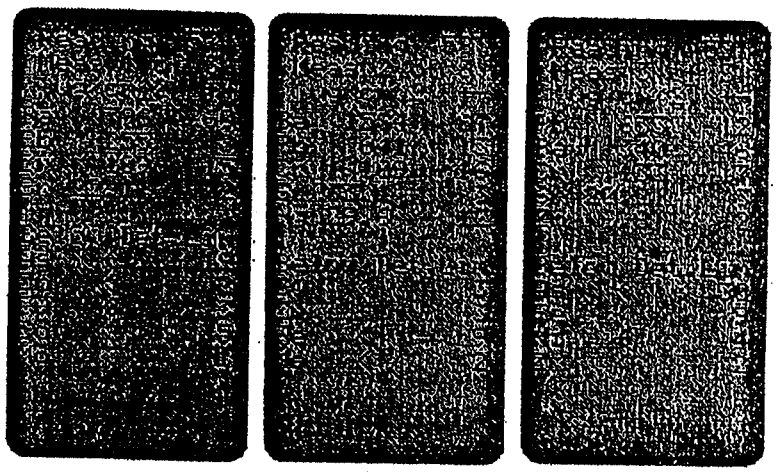

Figure 4.09 a, b, c.
Example of measurement screens for Readings 1, 2, and 3
The 300Series or 700Series instruments will automatically calculate the total loading, in µg, when you complete the three readings

Note: **On multi-element models, the initial Measurement Screens always show lead because lead is the element most commonly measured in Thin Sample mode. The element with the next highest concentration, in µg/cm² is also shown. To see the other elements, press and hold** Clear/Enter **for two seconds. Use the** Arrow buttons **to scroll through the list of results for all elements.**

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The Final Result Screen

The **Final Result Screen** (**Figure 4.10**) is displayed only after all three measurements are complete. Final results are in units of µg. On 700*Series* instruments, the screen shows 14 elements, whether they were detected, and how much of each element was detected on the filter (in µg). The **Final Result** screen is automatically given the next reading number.

Figure 4.10
The Final Result Screen showing two parts of the screen. Use the arrow buttons to scroll up or down the screen.

This screen is divided into three parts. The first lists the metals detected. For the 300*Series*, only lead is listed. For the 700*Series*, all of the detected elements are listed, in order of decreasing amounts.

The second part of the screen lists elements where the result was less than the calculated detection limit. The 300*Series* (for lead) and the 700*Series* calculate the detection limit for every sample. Each is shown as being less than a number, representing the detection limit for that element, for that sample. The detection limit is calculated using EPA protocols, that the detection limit is three times the standard deviation.

The third part of the screen lists these same undetected elements displaying for each the weighted sum and twice the standard deviation (95% confidence level) that the instrument calculated.

These three lists will not fit on the Final Results Screen at one time. Use the **Arrow buttons** to scroll up or down the screen.

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TSP and PM Filter Mode

TSP and PM filters are often used for air monitoring. They are about 8 x 10 inches in size. The samplers are designed for uniform filter deposition. The purpose of the XRF measurement is to determine total µg of lead and other metals on the filters. Because the samplers are designed for uniform deposition onto the filters, two measurements are taken on these filters. The choice of two measurements is the result of original testing conducted by NITON Corporation, Galson Corporation, and the New York State Department of Transportation (NYSDOT). Because deposition on the filter is presumed uniform, the NITON averages the two readings.

Testing TSP and PM filters on the sampler

One of two methods may be used to test high volume TSP and PM10 filters. The filters can be tested while still mounted on the air sampler (a Graseby sampler, for example), or the filters can be removed from the air sampler and placed on the NITON filter test platform. The official protocol for this procedure is under evaluation by the NYSDOT. At the current time, the favored method is to test with the filters still mounted on the air samplers.

Method 1

This method allows routine measurements of high volume air filters. Validation studies performed by the New York State Department of Transportation utilized hourly tests on the filters. To follow this method:

1. Turn off the pump on the sampler.
2. Place the plunger guard over the NITON. The NITON (with plunger guard) will fit <u>inside</u> of the frame holding the filter. Make sure that the bottom of the guard does not block the window of the NITON.

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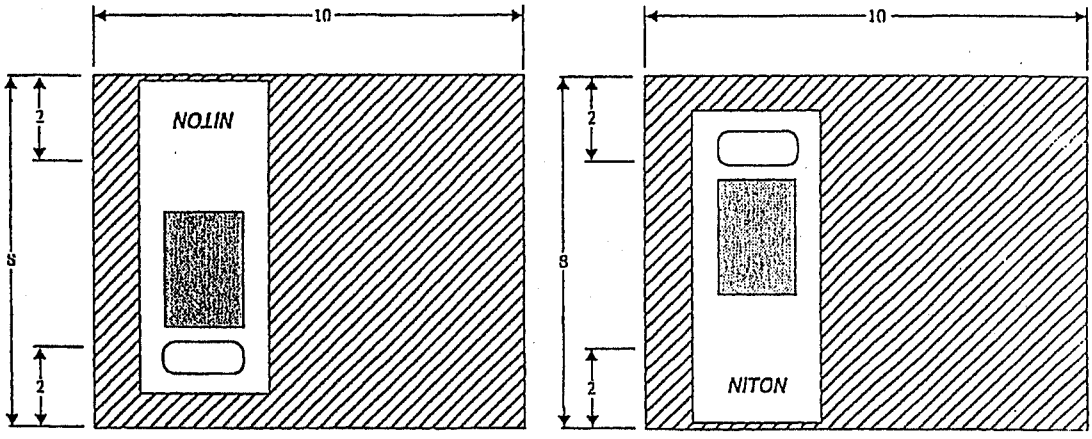

Figure 4.11
Measurement positions for TSP and PM filters for Reading 1 and Reading 2

3 Place the NITON XRF onto one side of the filter, as shown in **Figure 4.11**. It is important to place the NITON onto the first side of the filter without allowing it to touch the other side. This precaution is taken to prevent the NITON from removing any loose dust from the filter.

4 With the instrument in Thin Sample Mode for TSP and PM10 filters, take a 2-minute reading with the XRF in this position. Hold the NITON against the filter for the length of each test. The test will end when you lift the NITON from the filter.

5 Rotate the NITON by 180 degrees and take a second, 2-minute reading

6 The NITON will average the two readings, multiply the average by the area of the filter (404cm^2) and report the total number of micrograms of lead, or other metals, present on the filter.

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7 Once you have finished testing, clean the capton window at the bottom of the NITON (See page 1-39) to remove any loose dust. The amount of loose dust removed will be generally insignificant compared to the mass of dust on the filter.

Note: **Only test for lead, zinc, and arsenic when testing filters directly on a sampler. The steel grid supporting the filters makes it impossible to measure small concentrations of other elements.**

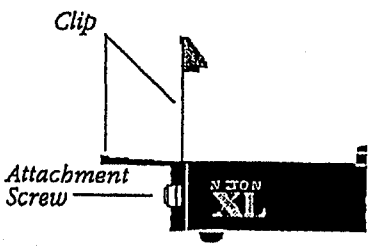
Note: **Initial studies have shown that, after two readings, about 1% to 2% of the lead on a filter is removed from the filter and redeposited on the instrument. To avoid compromising future tests wipe the bottom of the instrument. You may want to have the wipes analyzed.**

Method 2

1 Wear clean surgical gloves.

2 Remove the front end (clip) of the filter test platform (**Figure 4.12**) by loosening the attachment screws.

Figure 4.12
Filter Test Platform
Before testing TSP or PM filters, take off the front part of the test platform by removing the two attachment screws.



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3 Place the plunger guard over the NITON. The elastic strap of the plunger guard should be between the buttons and screen of the instrument.

4 Place one corner of filter over the hole in filter test stand (which corresponds to the position of the test window on the NITON). Measure about two inches in from the edge of the contamination on the filter. Take the first measurement.

5 Take one reading from one quadrant of the filter (**Figure 4.12a**). Clean the capton window on the bottom of the instrument (See page 1-40) and test guard after testing each filter.

6 Take a second reading as shown in Figure 4.12a. Your NITON will average the two readings, multiply the average by the area of the filter (404cm²) and report the total number of micrograms of lead, or other metals, present on the filter.

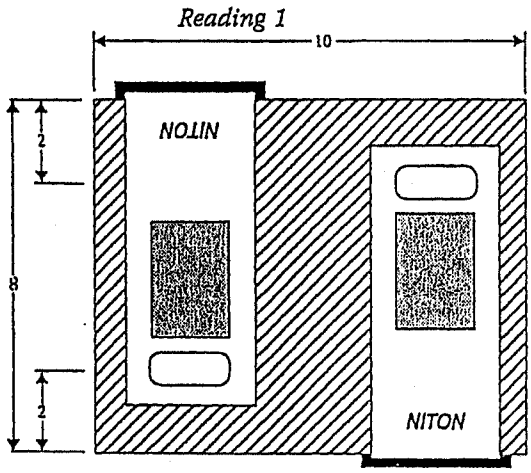

Figure 4.12a
Measurements positions for TSP and PM filters, Method 2

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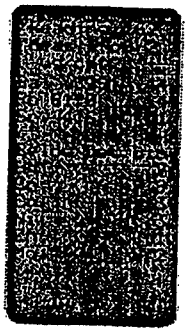

Figure 4.13a Measurement Screen: end of 1st measurement

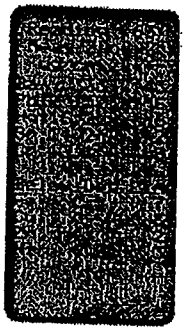

Figure 4.13b Measurement Screen: end of 2nd measurement

Figure 4.13c Final Result Screen

Reading the display

The Measurement screen

The Measurement Screen is displayed during each test and is accessible after the test is complete. The screen shows each of the two measurements in µg/cm² of lead (**Figure 4.13 a,b**).

When the two measurements are complete, the NITON automatically averages the results to yield the average loading in µg/cm². This average is multiplied by 404 cm² to yield the total lead and other metals, in µg. These results are displayed on the **Final Result** screen (**Figure 4.13c**).

Note: **Even on multi-element analyzers, lead is always displayed on the first screen because lead is the element most commonly measured in Thin Sample mode. To display the next screen, which shows the results for other elements, press and hold** Clear/Enter **for two seconds. Use the** Arrow buttons **to scroll through the list of results for all elements.**

The Final Result screen

The Final Result Screen (**Figure 4.13c**) is displayed only after both measurements are complete. Final results are in units of µg. On 700Series instruments, the screen shows

- 14 elements
- whether they were detected, and
- how much of each element that was detected on the filter (in µg).

The Final Result screen is given the next reading number.

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This screen is divided into three parts. The first shows the metals detected. For the 300*Series*, only lead is listed. For the 700*Series*, all of the detected elements are listed, in order of decreasing amounts.

Next is a list of elements where the result was less than the calculated detection limit. Using EPA protocols, the 300*Series* (for lead) and the 700*Series* calculate the detection limit for every sample. The detection limit is three times the standard deviation.

Finally, there is a list of these same undetected elements displaying for each the weighted sum and twice the standard deviation (95% confidence level) that the instrument calculated.

These three lists will not fit on the screen at one time. Use the **Arrow buttons** to scroll up or down the screen.

Other air-monitoring filters

Low-volume air-sampling techniques use 47 mm diameter filters. The NITON can test these as well. The filters are usually very uniform, so taking a single measurement of the center of the filter is a viable option for which you can use the **Standard Thin Sample Mode** (See page 4-21). Results are given in $\mu g/cm^2$. The operator should multiply by the area of the filter to obtain results in μg. Sum or average several readings, or have the results automatically multiplied by using the **User-defineable Thin Sample Mode** to specify a protocol that satisfies your requirements (See page 4-23).

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Dust Wipes

This section describes the testing of dust wipes. Dust wipe replacements (part # 187-472) are available from NITON Sales. Please call (800) 875-1578.

NITON has developed a procedure for measuring dust wipes that is currently under review for regulatory approval. The following instructions, therefore, will work for your testing purposes but may be revised as part of the approval process. The NITON displays levels of contamination in µg per wipe. The wipe reflects the contamination of the area wiped. Current regulations require lead contamination below 100 µg/ft² on floors, 500 µg/ft² on window sills, and 800 µg/ft² in window wells.

Note: **For the current software release (Version 5.2) the 300*Series* and 700*Series* provide quantitative results <u>for lead only</u>. You may use the 700 Series for screening of other metals on dust wipes, but element-specific correction factors must be implemented in the firmware to make non-lead measurements quantitative. Please contact NITON regarding timetables for new firmware releases that will offer this feature.**

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Taking a Dust Wipe Sample

NITON assumes that the operator will follow the HUD guidelines for taking a dust wipe that are summarized here in Steps 1-4 below:

1. Measure a known area of the surface, preferably one square foot
2. Wear clean surgical gloves. Wipe the measured square with parallel strokes
3. Fold the wipe in half. Wipe in strokes 90° to the original direction.
4. Fold the wipe in half again.

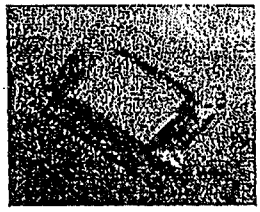

Figure 4.15a
Dust wipes in plastic baggie

For more information on taking dustwipes, please refer to "*Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing*," Chapter 7.

Now, follow Steps 6-7 to prepare the wipe for testing with your NITON.

5. Fold the wipe in half three more times (**Figure 4.14**). You will now have a pad measuring about 1 x 1.5 inches (2.5 x 3.7 cm). **It is important to fold the wipe neatly, so that the final wipe is very nearly a neat square measuring about 1 x 1.5 inches.**
6. Place the folded wipe in one of the plastic baggies provided (**Figure 4.15a**).
7. Position the wipe, in the baggie, in the metal dust wipe holder (**Figure 4.15b**).

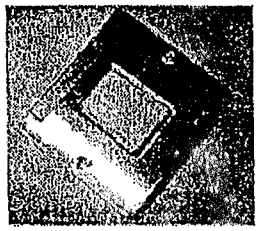

Figure 4.15b
Metal Dust Wipe holder

The dust wipe is now ready to test. NITON recommends that the plastic bags NOT be re-used, to eliminate the chance of cross-contamination of subsequent wipes.

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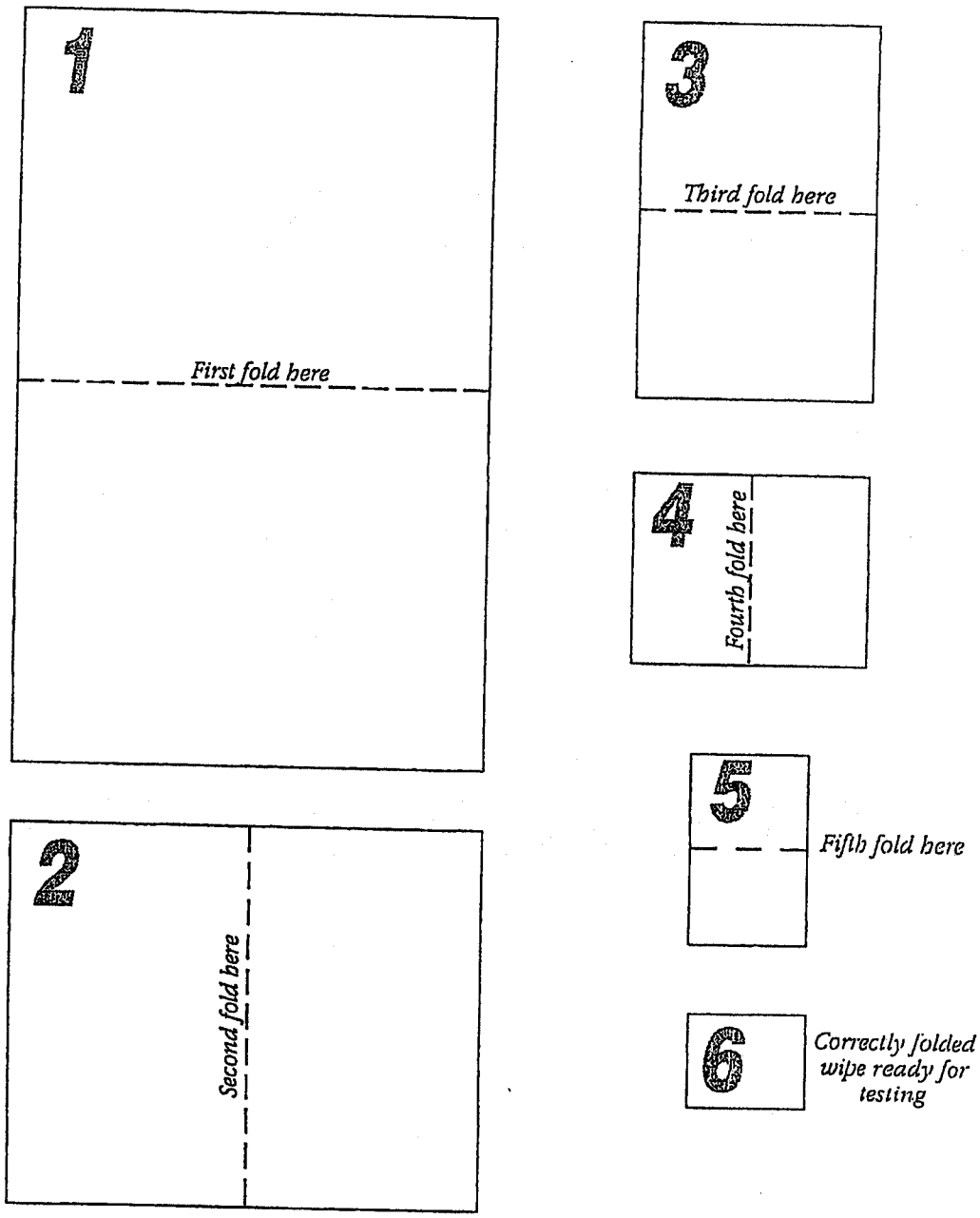

Figure 4.14
Dust wipe folding. Start at the top left and proceed as shown, making five folds

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Taking Measurements of Your Dust Wipe Sample

Following the procedure below (**Figure 4.16a,b,c,d**), take four measurements:

1. Position the metal dust wipe holder on the number one position of the test stand.
2. Take the first measurement.
3. Place the wipe in the number two position of the test stand. Take the second measurement.
4. Rotate the dust wipe holder 180 degrees (without turning the holder over).
5. With the wipe in the number one position, take the third measurement.
6. Change the wipe to the number two position. Take the fourth measurement.

This procedure assures that the entire area of the folded dust wipe is measured by the analyzer.

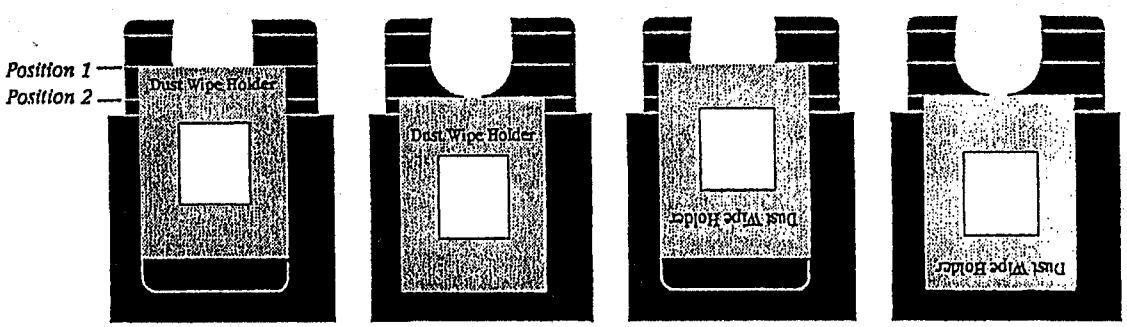

Figure 4.16a Filter test Platform Dust wipe in 1st position

Figure 4.16b Filter test Platform Dust wipe in 2nd position

Figure 4.16c Filter test Platform Dust wipe in 3rd position

Figure 4.16d Filter test Platform Dust wipe in 4th position

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Taking a reading

Follow the procedures for **Taking a Reading** for 37mm Filters (See Page 4-6).

Reading the display

The Measurement screen

The Measurement Screen is displayed during each test and is accessible after each test is complete. For the 300*Series*, the screen will show each of the four measurements in µg/cm² of lead (**Figure 4.17a-d**). When all four measurements are complete, the NITON will automatically sum the four test results to achieve the correct reading. This result is given in the **Final Result** screen (**Figure 4.17e**).

Note: **For all 700Series instruments, only two elements will be displayed on the first screen: lead and the element with the highest concentration (other than lead).**

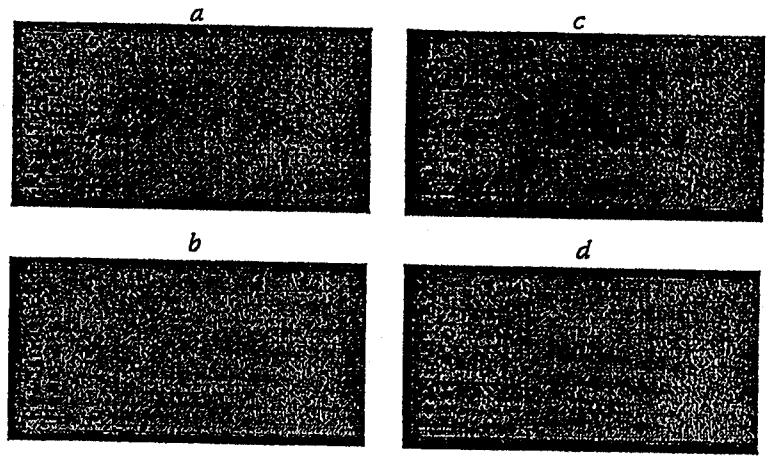

Figure 4.17 a-d
Examples of measurement screens: Dust Wipe measurements

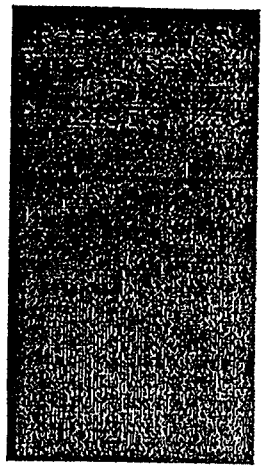

Figure 4.17e
Final Result Screen: Dust Wipes

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To display the next screen, which shows the results for other elements, press and hold **Clear/Enter** for two seconds. Use the **Arrow buttons** to scroll through the list of results for all elements.

The Final Result screen

The Final Result Screen (**Figure 4.17e**) is displayed only after all four measurements are complete. Final results are in units of µg. On 700Series instruments, the screen will show 14 elements, whether or not they were detected, and how much of each detected element was present on the filter (in µg). The Final Result screen is given the next consecutive reading number after the last Measurement Screen number.

The Final Result Screen is divided into three lists.

The first list shows the metals detected. For the 300*Series*, only lead is listed. For the 700*Series*, all of the detected elements are listed, in order of decreasing amounts.

The second list is a list of elements where the result was less than the calculated detection limit. The 300*Series* (for lead) and the 700*Series* calculate the detection limit for every sample. Each detection limit is shown as being less than a number, representing the detection limit for that element, for that sample. The detection limit is calculated using EPA protocols—three times the standard deviation.

Finally, there is a list of the same undetected elements as those on the second list, displaying for each the weighted sum and twice the standard deviation (95% confidence level) that the instrument calculated.

Note: **These three lists will not fit on the screen at one time. Use the** Arrow buttons **to scroll up or down the screen.**

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Standard Thin Sample Mode

The **Standard Thin Sample Mode** should be used to test thin samples that have uniform contamination or deposition. These include many filters for liquids and gases, various types of coatings, and the leaves of plants. Operators who want to make a single measurement and obtain a result in units of $\mu g/cm^2$ should use Standard Thin Sample Mode.

Caution: The Standard Thin Sample Mode should not be used for quantitative lead-paint testing. Use only the three Paint Testing modes to test lead-based paint.

In the Standard Thin Sample Mode, each measurement is a separate test. For this reason, there is no **Final Result** screen in this mode. The results of each test are given in $\mu g/cm^2$ for lead only (300*Series*) or for up to 14 elements (700*Series*).

Note: **Using Standard Thin Sample Mode to test any coating may yield lower-than-actual test results.**

Standard Thin Sample Mode does not correct for shielding caused by the presence of overlaying coatings. Thus, for coatings testing, the results should be viewed as the *minimum* amount of contaminants present. If an element is not detected, it may be that the element is present but entirely shielded by overlaying coatings.

Beware: Do not rely on negative results when test testing paints and other coatings in this mode.

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The Measurement Screen

The **Measurement Screen** is displayed during each test and is accessible after each test is complete. For the 300*Series*, the screen shows the measurements in µg/cm² of lead (**Figure 4.18**). For the 700*Series* the screen displays lead and the element with the highest concentration other than lead, in µg/cm². When the measurement is concluded, the display will change to show all the elements, in µg/cm² (**Figure 4.19**). Use the **Arrow buttons** to scroll through the list of elements.

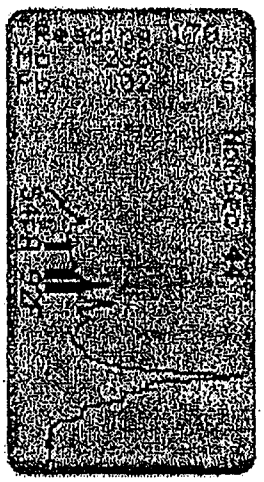

Figure 4.18
Measurement Screen
Standard
Thin Sample Mode

The Measurement screen is divided into three lists.

The first list shows the metals detected. For the 300*Series*, only lead is listed. For the 700*Series*, *all* of the detected elements are listed, in order of decreasing amounts.

The second list is of those elements where the result was less than the calculated detection limit. Both the 300*Series* (for lead) and the 700*Series* calculate the detection limit for every sample. Each is shown as being less than a number, representing the detection limit for that element, for that sample. The detection limit is calculated using EPA protocols—three times the standard deviation.

The third list shows these same undetected elements, displaying for each the weighted sum and twice the standard deviation (95% confidence level) that the instrument calculated.

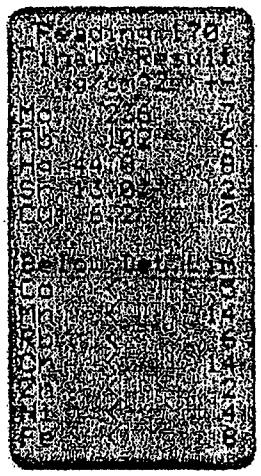

Figure 4.19
Final Result Screen
Standard
Thin Sample Mode

Note: **In Standard Thin Sample mode all results are in units of µg/cm².**

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User-definable Thin Sample Testing

User-definable Thin Sample Mode allows you to set up your own protocol for testing thin samples. The user can define the number of measurements that constitute a set, the coefficient applied to each, and whether the measurements are to be summed or averaged.

Specifying a Protocol

When you select User-Definable from the **Setup Thin Sample Mode menu**, the screen (**Figure 4.20a**) will be displayed. Using this screen's setup menu, you can customize how readings are summed or averaged for a particular application—your choice of up to 9 readings.

In most custom applications, where deposits on a thin sample are not uniformly spread across the sample, readings should be averaged or summed.

Note: **When you select the User-Definable mode, the configuration you enter will be saved in the NITON's memory. the last configuration entered will be recalled.**

To Define a Protocol:

- **Avg or Sum:**

1. Use the **Arrow buttons** to select either Avg or Sum.
2. Press **Clear/Enter**. Your choice will be shaded. If Avg is chosen, your NITON will average the number of readings you have specified. If Sum is chosen, the number of readings specified will be summed instead of averaged

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- **# readings:** To tell the instrument how many readings to use when calculating an average or sum:

  1. Use the **Arrow buttons** to increase or decrease the number of readings you wish to average or sum.
  2. Press **Clear/Enter**. The number must be between 1 and 9.

- **Range:** This field allows the operator to set the numeric range of the coefficents, from 0.0001 to 9999. **You must use the same range for all coefficients.**

  1. Set the decimal place by using the **Arrow buttons**. The decimal place determines the range of possible values for the coefficients.
  2. When the decimal place is set, press **Clear/Enter.**

- **Coefficients:**
  To set coefficients:

  1. Enter each coefficient.
  2. Moving from left to right, set the value of each digit that constitutes the coefficient by using the **Arrow buttons.**
  3. Press **Clear/Enter** to move to the next digit to the right. To move to the next digit without changing the current digit, press **Clear/Enter**.
  4. Repeat this process until every digit of the coefficient has been set.

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5 After every digit has been set, press **Clear/Enter** to move to the next coefficient.

6 When finished with the last coefficient, press **Clear/Enter** to return to the **Main Menu**.

By setting coefficients, you can calculate a *weighted sum*, in which the result of each reading is multiplied by the coefficient entered for that reading. For a simple (un-weighted) sum, set each coefficient to 1.0. All unused coefficients should be set to 0.0 (0.0 is the **default** setting).

7 From the **Main Menu**, enter Calibrate and Test. When the NITON is finished self-calibrating, you may begin testing.

Note: **The units of measurement will be determined by the coefficients you have chosen. In "User-Definable" Mode, the units are not necessarily µg.**

Example:

Suppose you would like to perform a weighted sum of three consecutive measurements, using the formula:

(2.800 x Measurement 1) + (4.5 x Measurement 2) + (1.2 x Measurement 3)

The screen for setting up the protocol should appear as follows:

Sum .
# of Rdgs = 3
Range: X.XXX
Coef 1: 2.800
Coef 2: 4.500
Coef 3: 1.200

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Note: **In User-Definable Thin Sample mode, you must take exactly the number of readings that you have specified for each test in this mode before proceeding to the next test.**

When you conclude each measurement within the protocol, the analyzer will display the results, in µg/cm² (**Figure 4.20a**). When the protocol is complete, the analyzer will display a **Final Result** screen (**Figure 4.20b**).

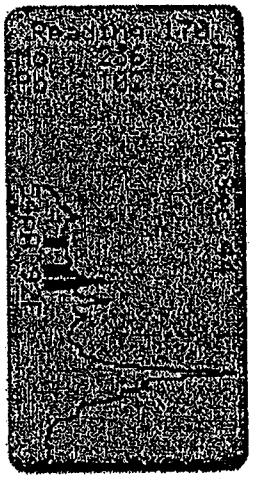

Figure 4.20a
Measurement Screen
Standard
Thin Sample Mode

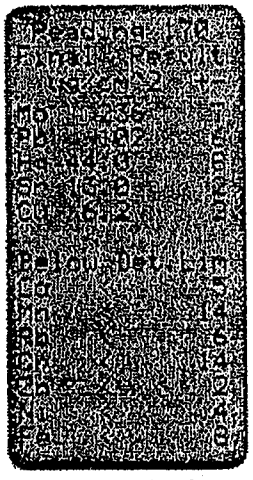

Figure 4.20b
Final Result Screen
Standard
Thin Sample Mode

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Analyzing lead paint

Overview

Note: **You do not need the 15-minute warmup to test in lead paint mode.**

The three **Paint Test Modes** are standard on NITON 300*Series*, 701-A, 702-A and 703-A Spectrum Analyzers.

Caution: The Standard Thin Sample Mode (on 701, 701-A, 703 and 703-A analyzers, and available as an option on 300*Series*) should not be used for quantitative lead-paint testing. Use only the three Paint Testing Modes (on 701-A, 702-A, 703-A, and 300*Series* analyzers) to test lead-based paint.

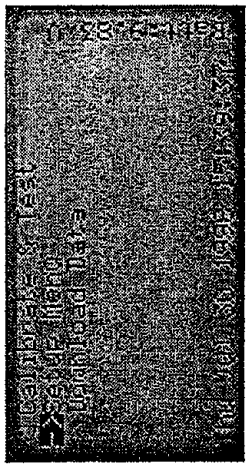

Figure 5.01
Main Menu:
Setup Menu

Getting started in Paint Mode

1. Turn on your NITON Analyzer
2. Use the **Arrow buttons** to select Setup menu from the **Main menu**. Press **Clear/Enter** (**Figure 5.01**).
3. Use the **Arrow buttons** to select Setup Paint mode from the **Setup menu**. Press **Clear/Enter** (**Figure 5.02**).
4. If you do not want to change the **Action-level** or ***beep* time** settings, go to *step 5*. If they are not changed, the NITON will default to the last settings entered.

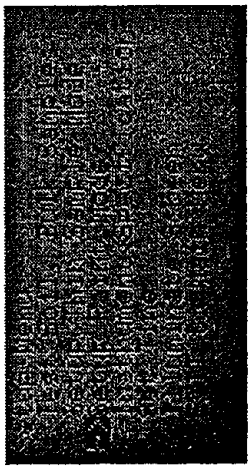

Figure 5.02
Setup Menu:
Setup Paint Mode

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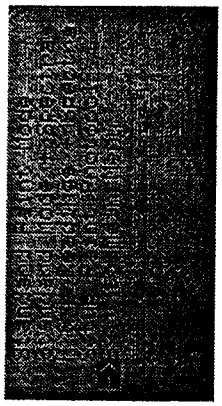

Figure 5.03
Paint Protocol Screen

If you do want to change the settings, enter Setup Paint Protocol from the **Setup Paint screen**. The **Setup Paint Protocol screen** allows you to set the **Action-level** and ***beep* times** (**Figure 5.03**). When you have set the paint protocol, the instrument will return automatically to the **Setup Paint** screen.

5

From the **Setup Paint** screen (**Figure 5.04**), select one of the three paint testing modes: **Standard Paint Mode**, **Standard Mode + Spectra** or **K & L Readings + Spectra**. When you have selected a paint testing mode, the instrument will return automatically to the **Main Menu**.

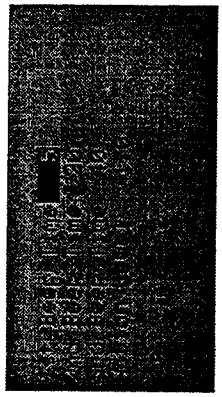

Figure 5.04
Setup Paint Screen

6

Select **Calibrate and Test.** The instrument will then initiate its auto-calibration sequence. This will take one to two minutes. When calibration is complete, the instrument will beep and display the **Ready to Test** screen for whichever of the three paint modes you selected in *Step 5* (**Figure 5.05**). The **Ready to Test** screen will display

- the paint testing mode you have selected
- the date and time,
- the instrument serial number
- the action-level
- the instrument energy resolution, and
- the current source strength.

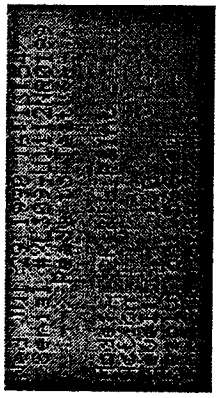

Figure 5.05
Ready to Test:
Standard Paint Mode

Caution: Check the Date **and** Time **displayed on the Ready to Test screen. If they are not correct, reset them <u>before</u> taking any measurements. Your readings will not be accurate unless the date and time are correct.**

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Before you test

User Calibration on Standard Lead Paint Samples

NITON provides a set of government-traceable lead paint films for Lead Paint Testing Mode. These are used to check the calibration of the instrument:

Test the paint Standards frequently. NITON recommends testing immediately after the instrument finishes self-calibration, and once every 1–2 hours thereafter.

Note: **For defensible Quality Control, keep a record of the time and precision of every calibration, using the bar code system wherever possible.**

Warning: Keep all standards out of reach of children.

Caution: Never tamper with Test Standards. They should not be used unless they are completely intact.

During each test, the NITON looks at the full range of x-ray spectrum and continuously corrects for cross-element interference and, in paint modes, continuously corrects for substrates, comparing K- and L-shell x-rays to determine when a 95% "confident" positive or negative reading vs. the user-set action level is reached.

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Lead Paint Standards

1. Set your NITON in K & L +Spectra Mode.

2. Place the NITON standard with the colored side face up. Choose the RED strip labelled 1.0 ± 0.1. Take a reading of that standard. Place the instrument on the standard so that the instrument window is fully on the standard. Your NITON should display a value between 0.9 and 1.2 mg/cm² and should indicate surface lead.

3. Place the same standard with the colored side down so that the instrument window is fully on the standard. Take a reading of the standard (buried beneath the equivalent of 5–6 coats of non-lead paint). Your NITON should still display a value between 0.9 and 1.2 mg/cm2 and should not display Surface lead.

Note: **If your instrument is testing high on Standard samples, check only the surface the Standards are resting on. That surface may contain lead.**

When you test the Standard samples, your instrument should give readings that approximate the certified values. Your instrument should give consistent readings for each sample.

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Taking a measurement

Warning: Always treat radiation with respect. Do not put your hand on the end plate of the NITON while measuring. Never point the NITON at yourself or anyone else when the shutter is open.

Caution: When testing the *exterior* of a window sash from the inside of a room, avoid standing in the path of the NITON's radiation beam. The direction of the beam is drawn on the cover of the instrument (Figure 5.06 a,b). It is easier to avoid the radiation beam if you hold the instrument in your right-hand.

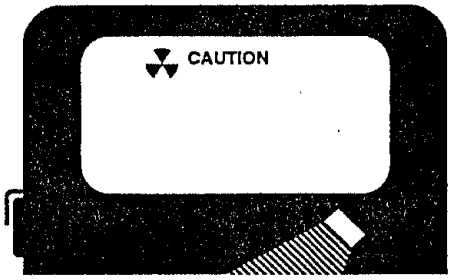

Figure 5.06
Direction of radiation beam shown on NITON cover.

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How to take a measurement

1 Push the safety slide (that locks the shutter release) out from under the shutter release. When the slide is in place, you cannot press in the release (**Figure 5.07**).

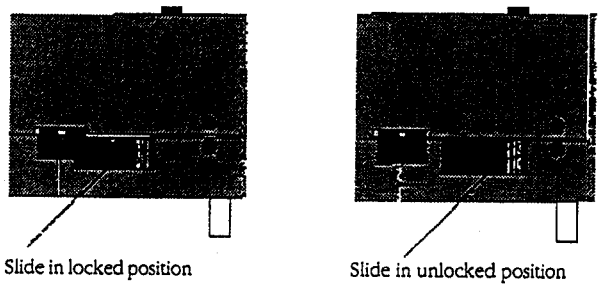

Figure 5.07
Slide lock shown in locked (left) and unlocked (right) positions

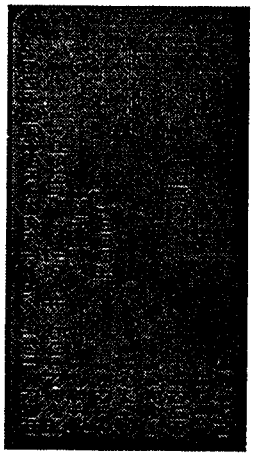

Figure 5.08
Barcode
Data Entry Screen

2 **When you are using the Barcode Data Entry System**: Attach the light pen barcode reader and wrist-mounted bar codes. Flick the **Barcode Reader** across one of the bar codes to display the **Data Entry screen (Figure 5.08)**. Enter the test location and other test information with the **Barcode Reader**.

3 Place the NITON on the painted surface, squeeze the shutter release, and continue to hold the NITON to the surface you are testing.

Note: The shutter-release trigger must be activated and the window at the back of the instrument must be <u>flush</u> against the surface for instrument to take reliable readings. The instrument must be held against the surface throughout each measurement. You do not need to hold the shutter release continuously.

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4 Please refer to **Reading the display (see Page 5-10)** for screen descriptions in each paint mode.

5 When the test is finished, lift the NITON from the surface. The shutter will close automatically.

Warning: In the unlikely event that the plunger gets stuck in the open position, simply push it closed. Then call the NITON Service Department at (401) 294-1234.

6 Your NITON Analyzer can average up to 100 readings at a time. To set up the **Averaging Screen**, hold down the **Clear/Enter** button to toggle through the testing and data entry screens to the **Reading Averaging** screen (**Figure 5.09**). If you select Yes to average readings, you will be prompted to select the number of readings you wish to average. To take additional readings, simply repeat steps 3 through 5. Your NITON will display both the average of the current and previous readings and the number of readings being averaged.

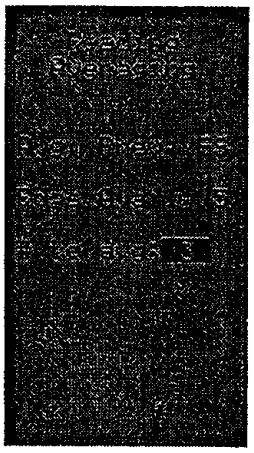

Figure 5.09 Reading Averaging Screen

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Using the NITON on flat and curved surfaces

Using your NITON, you can take measurements of almost any surface a child can mouth; only 5/8 inch (1.6 cm) is required.

A sketch of the window is printed on the front of the NITON's case so you can position the instrument properly (**Figure 5.10**) The window of the instrument must be flat against the paint surface or it cannot read properly.

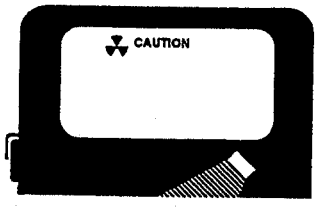

Figure 5.10
Sketch of the front of your NITON

Your NITON Analyzer can accurately measure many curved surfaces. However, you must position the instrument so that its window is flat on the surface. The rest of the instrument doesn't need to lie flat. E.g., on slightly rounded clam shell trim, turn the NITON at right angles to the trim so that its window runs parallel with the length of the trim (**Figure 5.11**). On a cast iron radiator, find a spot against which the NITON's window can lie flat.

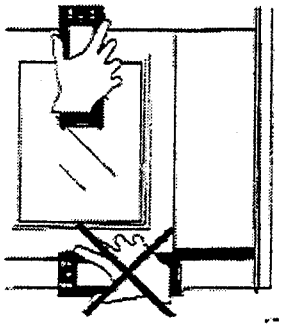

Figure 5.11
Positioning your NITON to measure a clamshell trim

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Note: **On *very* highly curved surfaces (such as quarter-round moldings or balusters) the NITON will tend to underestimate the amount of lead present. On very highly curved surfaces, your NITON can only be used to positively identify high concentrations of lead.**

Test Duration

In any of the three paint testing modes, your NITON can measure paint samples in as little as one second. The testing time will depend primarily on the amount of lead in the sample that you are testing compared to the action level you have set. The closer the actual lead concentration in the sample is to the action level, the longer it will take the NITON to make a 95% confident "Positive" or "Negative" determination.

In **Standard Paint Mode** and **Standard Paint Mode + Spectra**, the instrument will measure the paint sample only until a 95% confident reading of "Positive" (greater-than-or-equal-to) or "Negative" (less-than) versus the action-level you have set has been attained. In **K & L + Spectra Mode**, the instrument will also display a "Positive" or "Negative" result and will beep as soon as a 95% confident reading is attained. You then have the option to continue readings until you have achieved a given reading time or degree of precision.

Note: **For all paint testing modes, if you terminate a test *before* a "Positive" or "Negative" determination is attained by the instrument, it will display a "Null" test result.**

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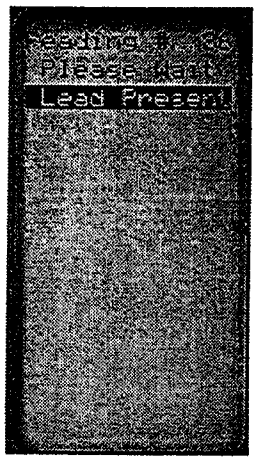

Figure 5.12a
Lead present indicated on the Please Wait Screen

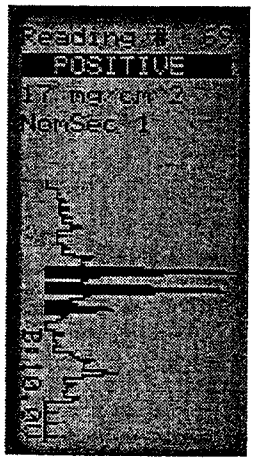

Figure 5.12b
Standard Mode + Spectra

Figure 5.13
Depth Index

Reading the display

In **Standard Paint Mode**, the instrument will display the "Please Wait" message until a 95% confident reading is achieved. When there is lead in the sample, the instrument will indicate **Lead present** on the **Please Wait** screen (**Figure 5.12a**).

When a 95% confident reading is achieved, the instrument will display:

- the reading number
- either a "Positive" or "Negative" reading
- the result in mg/cm^2
- the reading time in nominal (source) seconds, and
- the **"Surface Lead"** message for all positive readings where the lead is not shielded by layers of non-leaded paint.

Standard Mode + Spectra is identical to Standard Mode except that the x-ray spectra is displayed with each reading (**Figure 5.12b**).

In **K & L + Spectra Mode**, the instrument will display the following information, updated continuously during each reading:

- the **reading number**
- the **nominal seconds**
- the **L-shell reading** (displayed as L) with the two-sigma confidence interval
- the **K-shell reading** (displayed as K) with the two-sigma confidence interval
- the **combined reading** (displayed as Pb) with the two-sigma confidence interval
- the **full x-ray spectrum**, and
- the **Depth Index** (**Figure 5.13**).

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Note: **During each reading in K & L + Spectra mode, *before* a 95% confident Positive or Negative determination has been made, the instrument will display a "Null" test result** (Figure 5.14a). **When a 95% confident determination has been made, the instrument will beep, and the reading classification will switch from** Null **to either** Positive **or** Negative (Figure 5.14b).

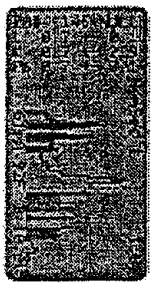

Figure 5.14a
"Null" test result

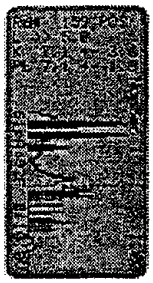

Figure 5.14b
"Positive" test result

The Depth Index (K & L + Spectra mode)

The **Depth Index** (DI) is a numerical indication of the amount of non-leaded paint covering the lead detected by the instrument. The position of the DI on the screen is indicated by an arrow painted on the front of the NITON (**Figure 5.15**). A DI of less than 1.5 indicates lead very near the surface layer of paint. A DI between 1.5 and 4.0 indicates moderately covered lead. A DI greater than 4 indicates deeply buried lead.

Figure 5.15
Depth Index indicated by arrow on case

Averaging readings

Two or more readings may be averaged by specifying the parameters in the **Averaging Screen** (**Figure 5.16**). To start or stop averaging, go to the **Averaging Screen** by holding down the **Clear/Enter** button until the screen appears. You may enter the **Averaging Screen** whenever the instrument is in one of the paint testing modes. Once in the **Averaging Screen**, press **Clear/Enter** *briefly* to move the cursor between lines on the screen. Press the **Arrow buttons** to change averaging parameters. If, for example, you set the # to average at two, subsequent tests will be grouped in twos and averaged.

You may add the next measurement to the current average, by entering **Avg YES**; if you select **Avg NO**, the next reading will <u>not</u> be averaged. Use the **Arrow buttons** to toggle between **Avg YES** and **Avg NO**.

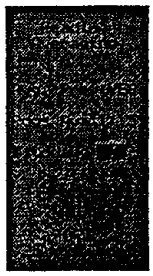

Figure 5.16
Averaging Screen

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Toggling between paint modes

At any time when a reading is displayed, you may toggle from the paint mode you are in to one of the other paint modes by pressing briefly on the Clear/Enter button one or more times. Press **Clear/ Enter** until the paint reading is displayed in the desired paint mode.

Note: **If you hold down the Clear/Enter button continuously, you will toggle from the Paint Testing Mode Result Screen to the SpectraView Screen (standard in 700*Series*, optional for the 300*Series*); the averaging screen; the barcode Data Entry Screen; and back to the Paint Testing Result Screen.**

Note: **Your NITON will continue to take readings in the most recently displayed paint mode until another paint mode is selected. If you scroll to previous readings using the** Arrow buttons, **the instrument will also display the readings in the *current* paint mode being displayed, regardless of the paint mode selected when the readings were taken. Toggle between paint modes after any reading by pressing and holding down the** Clear/Enter **button until the paint mode you want to see appears on the screen.**

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Appendix A
Summary of Warnings

Warning: Always treat radiation with respect. Do not put your hand on the end plate of the NITON while measuring. Never point the NITON at yourself or anyone else when the shutter is open.

Warning: Wearing a dosimeter badge does not protect you against current exposure. A dosimeter measures your exposure after the fact. If, at any time, you find measurable exposure, call NITON immediately at (401) 294-1234.

Warning: Pregnant female workers may want to take special precautions to reduce their exposure to radiation. Qualified scientists have recommended that the radiation dose to pregnant women should not exceed 500 mR/year because of possible increased risk to the fetus.

Warning: In the unlikely event that the plunger gets stuck in the open position, simply push it closed. Then call the NITON Service Department at (401) 294-1234.

Warning: Tampering with the 5,500 ppm lead-in-soil standard may cause exposure to lead dust. Keep all standards out of reach of children.

Warning: Always use gloves and respiration equipment for your protection when taking samples from a site where toxic chemicals may be present.

Warning: Grinding and sieving dried samples produces dust. Even clean soil contains silica, which may be hazardous when airborne. Prepare all samples in a ventilated area; wear a mask, gloves, and an apron; and spread a drop cloth.

Warning: Do not hold bagged bulk samples in your hand during testing.

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Appendix B
Summary of Cautions

Caution: Do not attempt to make repairs yourself. All Service except exterior cleaning must be performed by NITON Corporation. Any attempt to open your NITON instrument will void the instrument warranty.

Caution: Do not return your NITON without the carrying case. You will void the instrument warranty. You will also be billed for a replacement case plus any repairs resulting from improper shipping.

Caution: Do not return your instrument to NITON without a current leak test. NITON's license prohibits us from repairing or upgrading our instruments without a current leak test certificate. If you return an instrument without a current leak test certificate, NITON will perform a leak test and bill you for the leak test.

Caution: Do not ship your instrument back to NITON for any reason without first notifying NITON Corporation and receiving a Return Authorization Number.

Caution: Do not store the battery packs or battery charger in direct sunlight.

Caution: Do not leave battery packs on the battery charger longer than necessary.

Caution: If the red Temp light comes on repeatedly when a battery pack is on the Battery Charger in the Full Charge cycle, call NITON Customer Service at (401) 294-1234.

Caution: NITON's Nickel Metal Hydride battery packs discharge at a rate of about 2% per day when not in use.

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Caution: If you try to calibrate the instrument and it does not calibrate successfully, push the Reset Button on the bottom of the instrument and recalibrate. If your NITON does not calibrate successfully in three attempts, please call the NITON Service Department at (401) 294-1234.

Caution: All user-defined custom barcodes created for use with NITON XRF analyzers must be written in Code 39 (3 of 9) format.

Caution: Check the Date and Time displayed on the Ready to Test screen. If they are not correct, reset them before taking any measurements. Your readings will not be accurate unless the date and time are correct.

Caution: Never tamper with Test Standards. They cannot be used unless they are intact.

Caution: The Standard Thin Sample Mode should not be used for quantitative lead-based paint testing. Use only the three Paint Testing modes to test lead-based paint.

Caution: When testing the *exterior* of the window sash from the inside of a room, avoid standing in the path of the NITON's radiation beam. The direction of the beam is drawn on the cover of the instrument. It is easier to avoid the radiation beam if you hold the instrument in your right-hand.

Caution: Keep all test equipment clean to prevent contaminated samples.

Caution: NITON's license prohibits us from repairing or upgrading any of our XRF instruments without a current leak test certificate. If you return an instrument without a current leak test certificate, NITON will perform a leak test and bill you.

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Appendix C
Tips for Better Testing

Define Data Quality Objectives (DQOs)

Before implementing a sampling and analysis program, consider the data quality objectives (DQOs) for the particular site and job. For what purpose is the data being collected? What types of decisions will be made as a result of the data? What are the action-levels for the analytes you are testing at the site? What is known about the extent and distribution of the contaminant? What are the implications of possible mis-classification of samples?

The answers will help to determine the precision and accuracy you need to attain for different phases of the program. These in turn will help you to determine sample-collection procedures, sample preparation methods, sample measurement times, and your requirements for quality assurance and laboratory support.

Standard Operating Procedures

To obtain good test data in your study, it is essential to develop a written Standard Operating Procedure for sampling, measuring, and reporting data. A systematic procedure will help you to produce data of uniform quality. Typically, the Standard Operating Procedure is a written document that details the steps to be taken in handling the samples, standards, equipment, and data, including quality assurance measures, such as calibration checks and laboratory confirmation.

Warm up and calibration checks

All Niton analyzers should be turned on at least 15 minutes prior to testing in **Thin Sample** or **Bulk Sample** modes. This procedure is not necessary in any of the paint testing modes.

Note: **Your instrument should be calibrated <u>before</u> and <u>after</u> testing and at least once per hour <u>during</u> testing.**

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Check your instrument by testing **Standard Samples** of known concentration every time you calibrate. Check both a low-level standard (or "blank"),and a high-level standard, (or "spike") of known concentration. Tests of **Standard Samples** should be recorded and kept with the sample test data.

Compare samples *with* and *without* preparation

When testing in Bulk Sample Mode, set aside part of a sample and prepare the rest. Measure both the prepared and the unprepared portions. Differences of up to ±30% of prepared versus unprepared samples are typical.

Send samples to a lab for confirmation

Have some samples measured by atomic absorption spectrophotometry by a certified laboratory. This will verify the correctness of your technique and alert you to any site-specific biases.

Split some samples and analyze each sample with both the XRF and with atomic absorption spectrophotometry in a lab. Your Standard Operating Procedure should specify the number of confirmatory samples (e.g. 10 percent of all samples), what actions will be taken in response to the results, and what records will be kept.

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Appendix D
Range, precision and limits

Range of accurate measurement

NITON XRFs are calibrated to give accurate values for most elements in concentrations of 10,000 ppm or less. This is because the linear range of the Compton Normalization Method is from 0 ppm to approximately 10,000 ppm (1%). For actual concentrations of 10,000 ppm to 20,000 ppm (1% to 2%), NITON XRF's may overstate the elemental concentration. For content above 20,000 ppm (2%), readings may exhibit even greater deviation.

It may be possible to develop a calibration curve for a specific sample matrix with a very high concentration of heavy elements. If you wish to measure heavy elements in such matrices, please contact Dr. Don Sackett at NITON Corporation for further information at (781) 275-9275.

95% confidence intervals

The precision of a measurement is expressed as the uncertainty or error of the measured result. For every measurement, the NITON gives an uncertainty range that represents a 95% (or "2-sigma") confidence interval. The 95% confidence interval is the interval between the measured-result-minus-the-uncertainty-range to the measured-result-plus-the uncertainty-range. For example, if you took 100 measurements of a sample, you would expect 95 of the measurements to fall within the 95% confidence interval.

Detection limits (DLs)

The detection limit (DL) is the lowest concentration of analyte in a sample that can reliably be distinguished from zero concentration in a sample. In XRF, the DL is usually defined as three times the standard deviation (sigma) of fluctuation in the background.
A estimate of the DL can be obtained by measuring a blank standard. Use a standard measurement time (e.g. 60 source seconds). The estimated DL is 1.5 times the two-sigma precision of the measurement.

The method detection limit (MDL) may be a more realistic measure of sensitivity in actual field conditions. The MDL can be determined by replicate analysis of a blank or low level

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soil standard. This procedure may be carried out in the laboratory or field. The number of replicate blank measurements should be at least 7. If the replicate blanks are interspersed with the regular measurements as part of the continuing calibration verification (CCV), then the MDL will include the error resulting from instrument drift. Calculate the mean and standard deviation of the replicate measurement series. The bias is the mean minus the standard's known concentration. The MDL is 3 times the standard deviation. The MDL should be reasonably close to the estimated DL. Conservatively, one should report the DL to be the largest value among the estimated DL, MDL, and bias.

In actual usage, a measurement result that exceeds the DL is considered strong evidence of the analyte's presence in the sample. A measurement result that does not exceed the DL for an analyte is reported as "not detected."

Quantitation limit (QLs)

The quantitation limit (QL) is the lowest concentration of analyte that can be reliably measured at high enough precision to allow comparisons among measurements. The XRF industry usually defines QL as 10 times the standard deviation (or "10-sigma") or fluctuation in the background level. QL is therefore 3.33 times the DL. Similarly, the method quantitation limit (MQL) is simply 3.33 times the MDL.

Regulatory bodies often require analytical methods used to establish compliance with a standard or action level to achieve a quantitation limit (QL) equal to or below the standard or action level.

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Appendix E

Multi-element analysis (700*Series* only)

Overview

700Series analyzers can quantify concentrations of many elements. With a cadmium-109 source, the normally displayed elements are: arsenic, barium, chromium, cobalt, copper, iron, lead, manganese, mercury, molybdenum, nickel, rubidium, strontium, zinc and zirconium. The best detection limits are for molybdenum, rubidium, strontium and zirconium, as well as niobium and yttrium, which are not ordinarily displayed. 700's also have excellent detection limits for lead and mercury, as well as for gold, tungsten and uranium, which are not ordinarily displayed. 700's detect barium, chromium, cobalt, iron, manganese, and nickel with somewhat less sensitivity; the same applies to calcium, scandium, titanium, and vanadium, which are not ordinarily displayed. Finally, 700's detect arsenic, copper and zinc, but there are sometimes problems associated with the measurement of these elements due to cross-element interference. In particular, when zinc and copper are both present in a sample, the element with the higher concentration of the two can be measured more accurately.

Cross-Element Interference

700 Series users should be aware that interference between elements can reduce the sensitivity of the 700 to certain elements in certain situations. Interference occurs when the spectra of two or more elements partially or totally overlap (that is, the elements have nearly identical x-ray flourescent energies).

Note: **All NITON analyzers correct automatically for cross-element interference in all modes. These corrections are performed automatically and continuously, throughout each test.**

NITON instruments correct for these cross-element interferences in all modes. In some instances, however, these corrections will worsen the detection limits and precision of the instrument in **Bulk Sample** and **Thin Sample** modes. For example, in the presence of high concentrations of zinc (>10,000 ppm), the 700 Series analyzer will be unable to detect slight trace concentrations of copper that would be detected if a large amount of zinc was not present. Another example: Very high concentrations of iron (>30,000 ppm) may produce false-positive readings for very small concentrations of manganese and/or cobalt.

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Appendix F
Warranty

NITON will warranty parts and labor for any manufacturer's defects for 15 months. No precision instrument is warranted if crushed, dropped on the floor or in a bucket of water. All service, including repair, maintenance and source replacements, must be performed by NITON Corporation. Any attempt to open the metal case of your NITON instrument will nullify this warranty.

Limited Warranty Provision for Use with Purchase and License Agreement for NITON Corporation XRF Detection instruments:

(a) Except as otherwise agreed in writing, NITON Corporation warrants, under normal conditions of operation, each product sold (except for components not of its manufacture) against defects of material and workmanship, provided that such product has been properly utilized. This warranty applies to the original purchaser only and shall commence to run from the date of shipment and shall continue for a period of fifteen (15) months. In any event, NITON Corporation's liability for any such defects of material and workmanship shall not exceed the cost of replacement of defective parts upon timely notification of such defect in writing delivered to NITON Corporation's home office. NITON Corporation shall not be liable for damage or destruction caused during delivery or caused other than by employees of NITON Corporation.

(b) Material, accessories, parts, or items of equipment furnished by suppliers to NITON Corporation and used in the manufacture of NITON Corporation products are guaranteed by NITON Corporation only to the extent of the original manufacturer's express warranty to NITON Corporation for a period not to exceed the warranty period described in paragraph (a) above and provided that the purchaser shall have notified NITON Corporation so as to enable NITON Corporation to avail itself of its rights under such original manufacturer's express warranty.

(c) NITON Corporation shall, at its option, repair such defects or replace the parts or products found defective. All defective parts are to be returned, freight prepaid, immediately to NITON Corporation for inspection and credit. NITON Corporation will make no allowance for repairs or alterations made by the purchaser unless made with the advance written consent of NITON Corporation. NITON Corporation assumes no liability for costs of disassembly of defective parts and equipment. Shipment by purchaser of all repairs and replacements under this warranty are F.O.B. NITON Corporation's factory or authorized service representative and method of shipment will be determined by NITON Corporation. The purchaser will pay shipping costs and insurance in both directions of products, parts, or components shipped for warranty service hereunder. The purchaser will be responsible for risk of loss in both direction. Replaced parts or components will become the property of NITON Corporation. Replacement parts or components may contain recycled, refurbished, or remanufactured parts equivalent to new parts and shall be warranted for the remainder of the original warranty period for the products.

(d) NITON Corporation shall not be liable for delays, deprivation of use, or any other damages, direct or indirect, which may result to the purchaser because of defects in the product or because of the purchaser's inability to operate it or use it to his satisfaction. NITON Corporation will not be liable to anyone for special or consequential damages of any kind. NITON Corporation neither assumes nor authorizes any person to assume for it, any other obligation or liability with respect to NITON Corporation products.

Except for the foregoing express warranty, there are no warranties, representations, or guarantees, express or implied, except as are expressly set forth herein. The foregoing warranty is the only warranty made by NITON Corporation. Any implied warranty of merchantability or fitness for a particular purpose on this product is limited in duration to the two year duration of this written warranty. Some states do not allow limitations on how long an implied warranty lasts or the exclusion of limitation of incidental or consequential damages so the above limitations or exclusions may not apply to you. This warranty gives you specific legal rights and you may also have other rights which vary from state to state.

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Appendix G

X-ray emission energies arranged by element, by atomic number

For elements titanium (22) through molybdenum (42) and elements tellurium (52) through uranium (92)

Element	Symbol	Atomic Number	Weight	Average Energy of X-ray Fluorescence (keV) Kα	Kβ	Lα	Lβ	Lγ
titanium	Ti	22	47.90	4.5	4.9			
vanadium	V	23	50.94	4.9	5.4			
chromium	Cr	24	52.00	5.4	5.9			
manganese	Mn	25	54.94	5.9	6.5			
iron	Fe	26	55.85	6.4	7.1			
cobalt	Co	27	58.93	6.9	7.6			
nickel	Ni	28	58.70	7.5	8.3			
copper	Cu	29	63.55	8.0	8.9			
zinc	Zn	30	65.38	8.6	9.6			
gallium	Ga	31	69.72	9.2	10.3			
germanium	Ge	32	72.59	9.9	11.0			
arsenic	As	33	74.92	10.5	11.7			
selenium	Se	34	78.96	11.2	12.5			
bromine	Br	35	79.90	11.9	13.3			
krypton	Kr	36	83.80	12.6	14.1			
rubidium	Rb	37	85.47	13.4	15.0			
strontium	Sr	38	87.62	14.1	15.8			
yttrium	Y	39	88.91	14.9	16.8			
zirconium	Zr	40	91.22	15.7	17.7			
niobium	Nb	41	92.91	16.6	18.6			
molybdenum	Mo	42	95.94	17.4	19.6			
tellurium	Te	52	127.60	27.4	31.1	3.8	4.0	4.6
iodine	I	53	126.90	28.5	32.4	3.9	4.2	4.8
xenon	Xe	54	131.30	29.7	33.8	4.1	4.4	5.0
cesium	Cs	55	132.91	30.9	35.1	4.3	4.6	5.3
barium	Ba	56	137.33	32.1	36.6	4.5	4.8	5.5
lanthanum	La	57	138.91	33.3	38.0	4.7	5.0	5.8
cerium	Ce	58	140.12	34.6	39.5	4.8	5.3	6.0
praseodymium	Pr	59	140.91	35.9	41.0	5.0	5.5	6.3
neodymium	Nd	60	144.24	37.2	42.5	5.2	5.7	6.6
promethium	Pm	61	(145)	38.5	44.0	5.4	6.0	6.9
samarium	Sm	62	150.35	39.9	45.6	5.6	6.2	7.2
europium	Eu	63	151.96	41.3	47.3	5.8	6.5	7.5
gadolinium	Gd	64	157.25	42.8	48.9	6.1	6.7	7.8

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X-ray emission energies arranged by element, by atomic number

(Continued)

Element	Symbol	Atomic Number	Weight	Average Energy of X-ray Fluorescence (keV) Kα	Kβ	Lα	Lβ	Lγ
terbium	Tb	65	158.92	44.2	50.7	6.3	7.0	8.1
dysprosium	Dy	66	162.50	45.7	52.4	6.5	7.2	8.4
holmium	Ho	67	164.93	47.3	54.2	6.7	7.5	8.7
erbium	Er	68	167.26	48.8	56.0	6.9	7.8	9.1
thulium	Tm	69	168.93	50.4	57.8	7.2	8.1	9.4
ytterbium	Tb	70	173.04	52.0	59.7	7.4	8.4	9.8
lutecium	Lu	71	174.97	53.7	61.6	7.7	8.7	10.1
hafnium	Hf	72	178.49	55.4	63.6	7.9	9.0	10.5
tantalum	Ta	73	180.95	57.1	65.6	8.1	9.3	10.9
tungsten	W	74	183.85	58.9	67.6	8.4	9.7	11.3
rhenium	Re	75	186.2	60.7	69.7	8.7	10.0	11.7
osmium	Os	76	190.2	62.5	71.8	8.9	10.4	12.1
iridium	Ir	77	192.2	64.3	73.9	9.2	10.7	12.5
platinum	Pt	78	195.09	66.2	76.1	9.4	11.1	12.9
gold	Au	79	196.97	68.2	78.4	9.7	11.4	13.4
mercury	Hg	80	200.59	70.2	80.7	10.0	11.8	13.8
thallium	Tl	81	204.37	72.2	83.0	10.3	12.2	14.3
lead	Pb	82	207.19	74.2	85.4	10.5	12.6	14.8
bismuth	Bi	83	208.98			10.8	13.0	15.2
polonium	Po	84	(210)			11.1	13.4	15.7
astatine	At	85	(210)			11.4	13.9	16.2
radon	Rn	86	(222)			11.7	14.3	16.8
francium	Fr	87	(223)			12.0	14.8	17.3
radium	Ra	88	(226)			12.3	15.2	17.8
actinium	Ac	89	(227)			12.7	15.7	18.4
thorium	Th	90	232.04			13.0	16.2	19.0
protactinium	Pa	91	(231)			13.3	16.7	19.6
uranium	U	92	238.03			13.6	17.2	20.2

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Appendix H

X-ray emission energies arranged by element, alphabetically

Element	Symbol	Atomic No.	Atomic Wgt.	Average Energy of Fluorescence				
				Kα	Kβ	Lα	Lβ	Lγ
actinium	Ac	89	(227)			12.7	15.7	18.4
arsenic	As	33	74.92	10.5	11.7			
astatine	At	85	(210)			11.4	13.9	16.2
barium	Ba	56	137.33	32.1	36.6	4.5	4.8	5.5
bismuth	Bi	83	208.98			10.8	13.0	15.2
bromine	Br	35	79.90	11.9	13.3			
cerium	Ce	58	140.12	34.6	39.5	4.8	5.3	6.0
cesium	Cs	55	132.91	30.9	35.1	4.3	4.6	5.3
chromium	Cr	24	52.00	5.4	5.9			
cobalt	Co	27	58.93	6.9	7.6			
copper	Cu	29	63.55	8.0	8.9			
dysprosium	Dy	66	162.50	45.7	52.4	6.5	7.2	8.4
erbium	Er	68	167.26	48.8	56.0	6.9	7.8	9.1
europium	Eu	63	151.96	41.3	47.3	5.8	6.5	7.5
francium	Fr	87	(223)			12.0	14.8	17.3
gadolinium	Gd	64	157.25	42.8	48.9	6.1	6.7	7.8
gallium	Ga	31	69.72	9.2	10.3			
germanium	Ge	32	72.59	9.9	11.0			
gold	Au	79	196.97	68.2	78.4	9.7	11.4	13.4
hafnium	Hf	72	178.49	55.4	63.6	7.9	9.0	10.5
holmium	Ho	67	164.93	47.3	54.2	6.7	7.5	8.7
iodine	i	53	126.90	28.5	32.4	3.9	4.2	4.8
iridium	Ir	77	192.2	64.3	73.9	9.2	10.7	12.5
iron	Fe	26	55.85	6.4	7.1			
krypton	Kr	36	83.80	12.6	14.1			
lanthanum	La	57	138.91	33.3	38.0	4.7	5.0	5.8
lead	Pb	82	207.19	74.2	85.4	10.5	12.6	14.8
lutecium	Lu	71	174.97	53.7	61.6	7.7	8.7	10.1
manganese	Mn	25	54.94	5.9	6.5			
mercury	Hg	80	200.59	70.2	80.7	10.0	11.8	13.8
molybdenum	Mo	42	95.94	17.4	19.6			

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X-ray emission energies arranged by element, alphabetically

(Continued)

Element	Symbol	Atomic No.	Atomic Wgt.	Average Energy of Fluorescence Kα	Kβ	Lα	Lβ	Lγ
neodymium	Nd	60	144.24	37.2	42.5	5.2	5.7	6.6
nickel	Ni	28	58.70	7.5	8.3			
niobium	Nb	41	92.91	16.6	18.6			
osmium	Os	76	190.2	62.5	71.8	8.9	10.4	12.1
platinum	Pt	78	195.09	66.2	76.1	9.4	11.1	12.9
polonium	Po	84	(210)			11.1	13.4	15.7
praseodymium	Pr	59	140.91	35.9	41.0	5.0	5.5	6.3
promethium	Pm	61	(145)	38.5	44.0	5.4	6.0	6.9
protactinium	Pa	91	(231)			13.3	16.7	19.6
radium	Ra	88	(226)			12.3	15.2	17.8
radon	Rn	86	(222)			11.7	14.3	16.8
rhenium	Re	75	186.2	60.7	69.7	8.7	10.0	11.7
rubidium	Rb	37	85.47	13.4	15.0			
samarium	Sm	62	150.35	39.9	45.6	5.6	6.2	7.2
selenium	Se	34	78.96	11.2	12.5			
strontium	Sr	38	87.62	14.1	15.8			
tantalum	Ta	73	180.95	57.1	65.6	8.1	9.3	10.9
tellurium	Te	52	127.60	27.4	31.1	3.8	4.0	4.6
terbium	Tb	65	158.92	44.2	50.7	6.3	7.0	8.1
thallium	Tl	81	204.37	72.2	83.0	10.3	12.2	14.3
thorium	Th	90	232.04			13.0	16.2	19.0
thulium	Tm	69	168.93	50.4	57.8	7.2	8.1	9.4
titanium	Ti	22	47.90	4.5	4.9			
tungsten	W	74	183.85	58.9	67.6	8.4	9.7	11.3
uranium	U	92	238.03			13.6	17.2	20.2
vanadium	V	23	50.94	4.9	5.4			
xenon	Xe	54	131.30	29.7	33.8	4.1	4.4	5.0
ytterbium	Yb	70	173.04	52.0	59.7	7.4	8.4	9.8
zinc	Zn	30	65.38	8.6	9.6			
zirconium	Zr	40	91.22	15.7	17.7			

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Appendix I

X-ray emission energies arranged by element, by increasing energy (keV)

keV	Element	Symbol
3.8	tellurium	Te
3.9	iodine	I
4.0	tellurium	Te
4.1	xenon	Xe
4.2	iodine	I
4.3	cesium	Cs
4.4	xenon	Xe
4.5	titanium	Ti
4.5	barium	Ba
4.6	cesium	Cs
4.6	tellurium	Te
4.7	lanthanum	La
4.8	cerium	Ce
4.8	barium	Ba
4.8	iodine	I
4.9	vanadium	V
4.9	titanium	Ti
5.0	praseodymium	Pr
5.0	lanthanum	La
5.0	xenon	Xe
5.2	neodymium	Nd
5.3	cerium	Ce
5.3	cesium	Cs
5.4	chromium	Cr
5.4	vanadium	V
5.4	promethium	Pm
5.5	praseodymium	Pr
5.5	barium	Ba
5.6	samarium	Sm
5.7	neodymium	Nd
5.8	europium	Eu
5.8	lanthanum	La
5.9	manganese	Mn
5.9	chromium	Cr
6.0	promethium	Pm
6.0	cerium	Ce
6.1	gadolinium	Gd
6.2	samarium	Sm
6.3	terbium	Tb
6.3	praseodymium	Pr
6.4	iron	Fe
6.5	manganese	Mn
6.5	dysprosium	Dy
6.5	europium	Eu
6.6	neodymium	Nd
6.7	holmium	Ho
6.7	gadolinium	Gd
6.9	cobalt	Co
6.9	erbium	Er
6.9	promethium	Pm
7.0	terbium	Tb
7.1	iron	Fe
7.2	thulium	Tm
7.2	dysprosium	Dy
7.2	samarium	Sm
7.4	ytterbium	Yb
7.5	nickel	Ni
7.5	holmium	Ho
7.5	europium	Eu
7.6	cobalt	Co
7.7	lutecium	Lu
7.8	erbium	Er
7.8	gadolinium	Gd
7.9	hafnium	Hf
8.0	copper	Cu
8.1	tantalum	Ta
8.1	thulium	Tm
8.1	terbium	Tb
8.3	nickel	Ni
8.4	tungsten	W
8.4	ytterbium	Yb
8.4	dysprosium	Dy
8.6	zinc	Zn
8.7	rhenium	Re
8.7	lutecium	Lu
8.7	holmium	Ho
8.9	copper	Cu
8.9	osmium	Os
9.0	hafnium	Hf
9.1	erbium	Er
9.2	gallium	Ga
9.2	iridium	Ir
9.3	tantalum	Ta
9.4	platinm	Pt
9.4	thulium	Tm
9.6	zinc	Zn
9.7	gold	Au
9.7	tungsten	W
9.8	ytterbium	Yb
9.9	germanium	Ge
10.0	mercury	Hg
10.0	rhenium	Re
10.1	lutecium	Lu
10.3	gallium	Ga
10.3	thallium	Tl
10.4	osmium	Os
10.5	arsenic	As
10.5	lead	Pb
10.5	hafnium	Hf
10.7	iridium	Ir
10.8	bismuth	Bi
10.9	tantalum	Ta
11.0	germanium	Ge
11.1	polonium	Po
11.1	platinum	Pt
11.2	selenium	Se
11.3	tungsten	W
11.4	astatine	At
11.4	gold	Au
11.7	arsenic	As
11.7	radon	Rn

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X-ray emission energies arranged by element, by increasing energy (keV)

(Continued)

keV	Element	Symbol
11.7	rhenium	Re
11.8	mercury	Hg
11.9	bromine	Br
12.0	francium	Fr
12.1	osmium	Os
12.2	thallium	Tl
12.3	radium	Ra
12.5	selenium	Se
12.5	iridium	Ir
12.6	krypton	Kr
12.6	lead	Pb
12.7	actinium	Ac
12.9	platinum	Pt
13.0	thorium	Th
13.0	bismuth	Bi
13.3	bromine	Br
13.3	protactinium	Pa
13.4	rubidium	Rb
13.4	polonium	Po
13.4	gold	Au
13.6	uranium	U
13.8	mercury	Hg
13.9	astatine	At
14.1	strontium	Sr
14.1	krypton	Kr
14.3	radon	Rn
14.3	thallium	Tl
14.8	francium	Fr
14.8	lead	Pb
14.9	yttrium	Y
15.0	rubidium	Rb
15.2	radium	Ra
15.2	bismuth	Bi
15.7	zirconium	Zr
15.7	actinium	Ac
15.7	polonium	Po
15.8	strontium	Sr
16.2	thorium	Th
16.2	astatine	At
16.6	niobium	Nb
16.7	protactinium	Pa
16.8	yttrium	Y
16,8	radon	Rn
17.2	uranium	U
17.3	francium	Fr
17.4	molybdenum	Mo
17.7	zirconium	Zr
17.8	radium	Ra
18.4	actinium	Ac
18.6	niobium	Nb
19.0	thorium	Th
19.6	molybdenum	Mo
19.6	protactinium	Pa
20.2	uranium	U
27.4	tellurium	Te
28.5	iodine	I
29.7	xenon	Xe
30.9	cesium	Ce
31.1	tellurium	Te
32.1	barium	Ba
32.4	iodine	I
33.3	lanthanum	La
33.8	xenon	Xe
34.6	cerium	Ce
35.1	cesium	Cs
35.9	praseodymium	Pr
36.6	barium	Ba
37.2	neodymium	Nd
38.0	lanthanum	La
38.5	promethium	Pm
39.5	cerium	Ce
39.9	samarium	Sm
41.0	praseodymium	Pr
41.3	europium	Eu
42.5	neodymium	Nd
42.8	gadolinium	Gd
44.0	promethium	Pm
44.2	terbium	Tb
45.6	samarium	Sm
45.7	dysprosium	Dy
47.3	holmium	Ho
47.3	europium	Eu
48.8	erbium	Er
48.9	gadolinium	Gd
50.4	thulium	Tm
50.7	terbium	Tb
52.0	ytterbium	Yb
52.4	dysprosium	Dy
53.7	lutecium	Lu
54.2	holmium	Ho
55.4	hafnium	Hf
56.0	erbium	er
57.1	tantalum	Ta
57.8	thulium	Tm
58.9	tungsten	W
59.7	ytterbium	Yb
60.7	rhenium	Re
61.6	lutecium	Lu
62.5	osmium	Os
63.6	hafnium	Hf
64.3	iridium	Ir
65.6	tantalum	Ta
66.2	platinum	Pt
67.6	tungsten	W
68.2	gold	Au
69.7	rhenium	Re
70.2	mercury	Hg
71.8	osmium	Os
72.2	thallium	Tl
73.9	iridium	Ir
74.2	lead	Pb
76.1	platinum	Pt
78.4	gold	Au
80.7	mercury	Hg
83.0	thallium	Tl
85.4	lead	Pb

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Appendix J
Chemical composition of NIST samples

Non-certified value standards

Non-certified values are provided for ***information*** only. All non-certified values are listed in parentheses. Standards for many elements do not have certified values. This occurs because:

- some bias is suspected in one or more of the methods used for certification, or
- two independent methods of certification are not available.

As more data becomes available, certified-value standards will likely become available for some of these elements.

Table D-1. High standard certified values

Element	wt. %	Element	µg/g
Aluminum	6.440 ± 0.08	Antimony	38.4 ± 3.0
Calcium	1.250 ± 0.03	Arsenic	626.0 ± 38.0
Iron	3.380 ± 0.10	Barium	707.0 ± 51.0
Magnesium	0.853 ± 0.042	Cadmium	21.8 ± 0.2
Manganese	1.010 ± 0.04	Copper	2,950.0 ± 130.0
Phosphorus	0.106 ± 0.015	Lead	5,532.0 ± 80.0
Potassium	2.110 ± 0.11	Mercury	32.6 ± 1.8
Silicon	28.970 ± 0.18	Nickel	14.3 ± 1.0
Sodium	1.140 ± 0.06	Silver	35.3 ± 1.5
Sulfur	0.240 ± 0.006	Vanadium	76.6 ± 2.3
Titanium	0.283 ± 0.010	Zinc	6952.0 ± 91.0

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Table D-2. High standard non-certified values

Element	wt. %	Element	µg/g
Carbon	(3)	Bromine	(6)
		Cerium	(57)
		Cesium	(107)
		Chromium	(39)
		Cobalt	(10)
		Dysprosium	(5.4)
		Europium	(1)
		Gallium	(34)
		Gold	(0.6)
		Hafnium	(3.2)
		Holmium	(0.6)
		Indium	(5.1)
		Lanthanum	(34
		Molybdenum	(19)
		Neodymium	(23)
		Rubidium	(2)
		Samarium	(7.8)
		Scandium	(8.7)
		Strontium	(240)
		Thallium	(1.3)
		Thorium	(13)
		Tungsten	(93)
		Uranium	(25)
		Ytterbium	(1.3)
		Yttrium	(23)

Table D-3. Low standard certified values

Element	wt. %	Element	µg/g
Aluminum	7.50 ± 0.06	Antimony	7.9 ± 0.6
Calcium	1.89 ± 0.05	Arsenic	17.7 ± 0.8
Iron	3.50 ± 0.11	Barium	968 ± 40
Magnesium	1.51 ± 0.05	Cadmium	0.38 ± 0.01
Phosphorus	0.062 ± 0.005	Chromium	130 ± 4
Potassium	2.03 ± 0.06	Cobalt	13.4 ± 0.7
Silicon	29.66 ± 0.23	Copper	34.6 ± 0.7
Sodium	1.16 ± 0.03	Lead	18.9 ± 0.5
Sulfur	0.089 ± 0.002	Manganese	538 ± 17
Titanium	0.342 ± 0.024	Mercury	1.40 ± 0.08
		Nickel	88 ± 5
		Selenium	1.57 ± 0.08
		Silver	0.41 ± 0.03
		Strontium	231 ± 2
		Thallium	0.74 ± 0.05
		Vanadium	112 ± 5
		Zinc	106 ± 3

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Table D-4. Low standard non-certified values

Element	wt. %	Element	mg/g
Carbon	(1.2)	Cerium	(42)
		Cesium	(5.3)
		Dysprosium	(3.5)
		Europium	(0.9)
		Gallium	(14)
		Gold	(0.3)
		Hafnium	(3.7)
		Holmium	(0.54)
		Iodine	(5)
		Lanthanum	(23)
		Molybdenum	(2.0)
		Neodymium	(19)
		Rubidium	(96)
		Samarium	(3.8)
		Scandium	(12)
		Thorium	(11)
		Tungsten	(2)
		Uranium	(3)
		Ytterbium	(1.6)
		Yttrium	(18)
		Zirconium	(160)

Table D-5. Medium standard certified values

Element	wt. %	Element	µg/g
Aluminum	6.53 ± 0.09	Antimony	19.4 ± 1.8
Calcium	2.88 ± 0.08	Arsenic	105.0 ± 8.0
Iron	2.89 ± 0.06	Barium	726.0 ± 38.0
Magnesium	1.05 ± 0.03	Cadmium	41.7 ± 0.25
Phosphorus	0.086 ± 0.007	Copper	114.0 ± 2.0
Potassium	2.45 ± 0.08	Lead	1162.0 ± 31.0
Silicon	30.44 ± 0.19	Manganese	638.0 ± 28.0
Sodium	1.14 ± 0.03	Mercury	6.25 ± 0.19
Sulfur	0.042 ± 0.001	Nickel	20.6 ± 1.1
Titanium	0.306 ± 0.023	Selenium	1.52 ± 0.14
		Silver	4.63 ± 0.39
		Strontium	245.3 ± 0.7
		Thallium	2.47 ± 0.15
		Vanadium	81.6 ± 2.9
		Zinc	350.4 ± 4.8

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Table D-6. Medium standard non-certified values

Element	wt. %	Element	µg/g
Carbon	(2)	Bromine	(5)
		Cerium	(69)
		Cesium	(6.1)
		Chromium	(47)
		Cobalt	(10)
		Dysprosium	(5.6)
		Europium	(1.1)
		Gallium	(15)
		Gold	(.03)
		Hafnium	(7.3)
		Holmium	(1)
		Indium	(1.1)
		Iodine	(3)
		Lanthanum	(40)
		Molybdenum	(1.6)
		Neodymium	(31)
		Rubidium	(110)
		Samarium	(5.9)
		Scandium	(9)
		Thorium	(14)
		Tungsten	(3)
		Uranium	(2.6)
		Ytterbium	(2.7)
		Yttrium	(25)
		Zirconium	(230)

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ATTACHMENT C

Performance Characteristic Sheet for

Niton 300 and 700 Series XRF Spectrum Analyzer

Performance Characteristic Sheet

EFFECTIVE DATE: April 17, 1998 **EDITION NO.: 4**

MANUFACTURER AND MODEL :
Make: *Niton Corporation*
Models: *XL-309, 701-A, 702-A, and 703-A Spectrum Analyzers*
Source: ^{109}Cd (10 - 40 mCi initial source strength)
Note: This Performance Characteristic Sheet (PCS) is applicable to the listed Niton XRF instruments which have an operating software version of 5.1 (or equivalent) using a variable-time mode, and to Niton instruments having an operating software version of 1.2C (or equivalent) using a fixed-time mode. This sheet supersedes all previous sheets for the XRF instruments made by the Niton Corporation and the 1993 testing of XL prototypes reported in the document titled: *A Field Test of Lead-Based Paint Testing Technologies*: *Technical Report* (EPA Report No. 747-R-95-002b, May 1995).

FIELD OPERATION GUIDANCE

This PCS provides supplemental information to be used in conjunction with Chapter 7 (Lead-Based Paint Inspection) of the HUD *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing* ("HUD Guidelines"). Performance parameters shown in this sheet are applicable only when operating the instrument using the manufacturer's instructions and the procedures described in Chapter 7 of the HUD Guidelines.

OPERATING PARAMETERS :

Use of variable-time paint test mode ("K & L + Spectra" mode) on instruments running software version 5.1 (or equivalent) using the "Combined Lead Reading" with the instrument's display of a 95%--confident (2-sigma) *Positive* or *Negative* determination versus the action-level as the stopping point of the measurement.

Use of nominal 20-second readings for L -shell results or 120-second readings for K -shell results on instruments running software version 1.2C (or equivalent) in a fixed-time mode.

XRF CALIBRATION CHECK LIMITS :

0.9 to 1.2 mg/cm^2 (inclusive) for instruments running software version 5.1 (or equivalent)
0.9 to 1.1 mg/cm^2 (inclusive) for instruments running software version 1.2C (or equivalent)

SUBSTRATE CORRECTION :
(applicable to instruments running software versions 5.1 (or equivalent) or 1.2C (or equivalent))

For XRF results below 4.0 mg/cm^2, substrate correction recommended for:

None.

Substrate correction is <u>not</u> recommended for:

Brick, Concrete, Drywall, Metal, Plaster, and Wood

THRESHOLDS:
(applicable to instruments running software versions 5.1 (or equivalent) or 1.2C (or equivalent))

DESCRIPTION	SUBSTRATE	THRESHOLD* (mg/cm^2)
Results not corrected for substrate bias	Brick Concrete Drywall Metal Plaster Wood	1.0 1.0 1.0 1.0 1.0 1.0
*For instruments running software version 1.2C (or equivalent), application of the decision making methodology recommended in this PCS can result in inconclusive results regardless of whether decisions are based on L-shell readings, K-shell readings, or both.		

BACKGROUND INFORMATION

EVALUATION DATA SOURCE AND DATE :

Performance parameters shown on this sheet are calculated from the EPA/HUD evaluation using archived building components. Three rounds of tests were conducted on approximately 150 test locations in each round.

One round of testing was conducted March 1995 using a single instrument with an October 1994 source at 10 mCi initial strength while running software version 1.2C in a fixed-time mode with nominal 20-second readings for L-shell results or 120-second readings for K-shell results.

The two other rounds of testing were conducted December 1997 using three different instruments, each running software version 5.1. Two of these instruments had new sources installed November 1997, the other instrument had a new source installed December 1997, all with 10 mCi initial strength. The December 1997 testing was performed in the variable-time paint test mode "K & L + Spectra" using the "Combined Lead Reading" with 2-sigma confidence interval as the stopping point of the measurement.

XRF CALIBRATION CHECK:

The calibration of the XRF instrument should be checked using the paint film nearest 1.0 mg/cm^2 in the NIST Standard Reference Material (SRM) (e.g., for NIST SRM 2579, use the 1.02 mg/cm^2 film). Measurements should be bracketed by successful XRF calibration check readings. XRF calibration checks are performed at the beginning and end of the day's inspections or at extended delays in testing, and (at least) every four hours during inspections or at a frequency recommended by the manufacturer, whichever is more stringent. If readings are outside the acceptable calibration check range, follow the manufacturer's instructions to bring the instrument into control before XRF testing proceeds. Measurements which are not bracketed by successful calibration checks should be considered suspect.

EVALUATING THE QUALITY OF XRF TESTING :

Randomly select ten testing combinations for re-testing from each house or from two randomly selected units in multifamily housing. (A testing combination is a location on a painted surface as defined in Chapter 7 of the HUD Guidelines.) For testing combinations involving up to four walls in a room, each wall is classified on its individual XRF reading. (See Chapter 7 for testing procedures if there are more than four walls in a room, and for testing exterior walls.)

For instruments running software version 5.1 (or equivalent), conduct the test in the variable-time paint test mode "K & L + Spectra" using the "Combined Lead Reading" with 2-sigma confidence interval as the

stopping point of the measurement. For instruments running software version 1.2C (or equivalent) in the fixed-time mode, use either 20-second readings for the L-shell results or 120-second readings for the K-shell results, as described in the "Classifications of Results" section below.

Conduct XRF re-testing at the ten testing combinations selected for re-testing.

Determine if the XRF testing in the units or house passed or failed the test by applying the steps below.

Compute the Retest Tolerance Limit by the following steps:

Determine XRF results for the original and retest XRF readings. Do not correct the original or retest results for substrate bias. In single-family and multifamily housing, a result is defined as a single reading. Therefore, there will be ten original and ten retest XRF results for each house or for the two selected units.

Calculate the average of the original XRF result and retest XRF result for each testing combination.

Square the average for each testing combination.

Add the ten squared averages together. Call this quantity C.

Multiply the number C by 0.0072. Call this quantity D.

Add the number 0.032 to D. Call this quantity E.

Take the square root of E. Call this quantity F.

Multiply F by 1.645. The result is the Retest Tolerance Limit.

Compute the average of all ten original XRF results.

Compute the average of all ten retest XRF results.

Find the absolute difference of the two averages.

If the difference is less than the Retest Tolerance Limit, the inspection has passed the retest. If the difference of the overall averages equals or exceeds the Retest Tolerance Limit, this procedure should be repeated with ten new testing combinations. If the difference of the overall averages is equal to or greater than the Retest Tolerance Limit a second time, then the inspection should be considered deficient.

Use of this procedure is estimated to produce a spurious result approximately 1% of the time. That is, results of this procedure will call for further examination when no examination is warranted in approximately 1 out of 100 dwelling units tested.

BIAS AND PRECISION :

Bias and precision data were not computed for instruments using software version 5.1 and taking variable mode readings. (See Appendix B, Section B.3.2 of the document titled *Methodology for XRF Performance Characteristic Sheets*, EPA-747-R-45-008, September 1997). During the 1997 testing, there were 12 testing locations with laboratory-measured lead levels equal to or greater than 4.0 mg/cm ^{2} lead which were tested using two instruments in the variable-time paint test mode. None of these testing locations had XRF readings less than 1.0 mg/cm ^{2}. These data are for illustrative purposes only. Substrate correction is not recommended for this XRF instrument.

The bias and precision data given below are for instruments running software version 1.2C (or equivalent) and were computed without substrate correction using the 20 -second L-shell readings from samples with

reported laboratory results less than 4.0 mg/cm ^{2} lead. Readings reported by the instrument in the " *x*" or ">>*x*" format were not used in the computation. During the 1995 testing there were 15 test locations with a laboratory reported result equal to or greater than 4 .0 mg/cm^2 lead. Of these, 12 readings were reported in the ">*x*" or ">>*x*" format, but of the 3 remaining, 1 had an XRF reading less than 1.0 mg/cm ^{2}.

Bias & Precision Results for Niton Model XL-309 Instruments Using Software Version 1.2C (or equivalent)

MEASURED AT	SUBSTRATE	BIAS (mg/cm^2)	PRECISION* (mg/cm^2)
0.0 mg/cm^2	All	0.0	<0.1
0.5 mg/cm^2	All	0.0	0.2
1.0 mg/cm^2	All	0.0	0.3
2.0 mg/cm^2	All	-0.1	0.5
*Precision at 1 standard deviation			

CLASSIFICATION OF RESULTS :

This section describes how to apply information displayed by this instrument to determine the presence or absence of lead in paint using the procedures recommended in Chapter 7 of the HUD Guidelines. These guidelines recommend classifying XRF results as positive, negative, or inconclusive compared to the lead-based paint 1.0 mg/cm ^{2} standard.

For Niton Model XL-309, 701-A, 702-A, and 703-A instruments running software version 5.1 (or equivalent), XRF results are classified using a threshold. There is no inconclusive classification when using the threshold for instruments running software version 5.1. In single-family and multifamily housing, an XRF result is a single reading taken on each testing combination. (A testing combination is a location on a painted surface as defined in Chapter 7 of the HUD Guidelines.) For testing combinations involving up to four walls in a room, each wall is classified on its individual XRF reading. (See Chapter 7 for testing procedures if there are more than four walls in a room, and for testing exterior walls.) For computing the XRF result, use all digits that are displayed by the instrument as the "Combined Lead Reading." Results are classified as positive (i.e., $\geq$ 1.0 mg/cm^2), if greater than or equal to the threshold, or negative (< 1.0 mg/cm^2) if less than the threshold. Threshold values, provided in the tables above, were determined by comparing XRF test results to the 1.0 mg/cm^2 standard.

For Niton Model XL-309 instruments running software version 1.2C (or equivalent), additional procedures are needed to classify readings because this software displays readings <u>and</u> ancillary information useful for classification purposes. An algorithmic procedure is described that makes use of the XRF reading and other displayed information.

The algorithm for classifying results is first applied to 20-second nominal L -shell readings followed by 120-second nominal K-shell readings to resolve inconclusive results, or to recommend laboratory analysis of paint-chip samples, if necessary. A listing of laboratories recognized by the EPA National Lead Laboratory Accreditation Program (NLLAP) for the confirmational analysis of inconclusive results is available from the National Lead Clearinghouse at 1-800-424-LEAD.

XRF results are classified using threshold values for the Model XL-309 software version 1.2C (or equivalent). Results are classified as positive if greater than or equal to the threshold, and as negative if less than the threshold. There is no inconclusive classification when using threshold values. However, in some cases, inconclusive results still may be obtained regardless of whether decisions are based on L-shell readings, K-shell readings, or both, as described below. Use all digits that are reported by the instrument. Threshold values, which were determined for comparing results to the 1 .0 mg/cm^2 standard, are provided in the table above.

This instrument displays its lead-based paint measurements as both L -shell and K-shell readings based on

the corresponding L-shell and K-shell X-ray fluorescence (refer to Chapter 7 of the HUD Guidelines for more details). The L-shell readings (or L-readings) are displayed as a numerical result alone, or as a numerical result preceded by either one greater-than symbol (">") or preceded by two greater-than symbols (">>"). The two greater-than symbols will only be displayed when the detected lead level is greater than 5.0 mg/cm^2. Since the maximum lead level reported by this instrument is 5.0 mg/cm^2, lead levels greater than 5.0 mg/cm^2 are displayed as ">>5.0". Other examples of how L-readings can be displayed (in mg/cm^2 units) are "0.6" and ">0.9". The numerical display alone implies that the instrument measured the lead in the paint at the displayed level using L-shell X-ray fluorescence ; 0.6 mg/cm^2 in the example. A number preceded by a single greater-than symbol indicates that the measurable lead is deeply buried in the paint and the detected lead level is greater than the displayed value. In the example, >0.9 indicates that the instrument detected lead deeply buried in paint at a level greater than 0.9 mg/cm^2. K-shell readings (or K-readings) are displayed in one of two ways: 1) as a single K-reading plus and minus a "precision" value or 2) as an upper K-reading and lower K-reading.

The same method is used for testing in single-family and multifamily housing. The HUD Guidelines recommend taking a single XRF reading on a testing combination. (A testing combination is a location on a painted surface as defined in Chapter 7 of the HUD Guidelines.) For testing combinations involving up to four walls in a room, each wall is classified on its individual XRF reading. (See Chapter 7 for testing procedures if there are more than four walls in a room, and for testing exterior walls.)

A. Take a single 20-second nominal reading on each testing combination.

B. Classify the L-reading based on the type of information displayed.

<u>If two greater-than symbols are displayed then</u>:

- Classify the >>5.0 L-reading as POSITIVE

<u>If one greater-than symbol is displayed then</u>:

- Classify the L-reading as POSITIVE if the numerical result that follows the greater than symbol is equal to or greater than 1.0.

- Classify the L-reading as INCONCLUSIVE if the numerical result that follows the greater than symbol is less than 1.0.

<u>If the numerical L-reading is displayed alone (that is, without any preceding greater-than symbols) then</u>:

- Classify the L-reading as POSITIVE if the numerical result is equal to or greater than 1.0.

- Classify the L-reading as NEGATIVE if the numerical result is less than 1.0.

C. Resolution of results classified as inconclusive.

All results classified as inconclusive above require further investigation. Take a 120-second nominal XRF reading and use the K-shell reading. In multifamily housing, resolve the inconclusive classification with a single K-shell reading or laboratory analysis as described below.

- Classify the result as POSITIVE if either the K-reading minus the displayed precision value <u>or</u> the lower K-reading is equal to or greater than 1.0.

- Classify the result as NEGATIVE if either the K-reading plus the displayed precision value <u>or</u> the upper K-reading is less than 1.0.

- Classify the result as INCONCLUSIVE if neither of the above decision rules using the K-reading provided a classification which can occur when the upper K-reading is equal to or greater than 1.0 or the lower K-reading is less than 1.0.

- To resolve a remaining INCONCLUSIVE classification, remove a paint-chip sample as described in Chapter 7 of the HUD Guidelines and have it analyzed by a qualified laboratory as described in Chapter 7.

TESTING TIMES (FOR SOFTWARE VERSION 5.1) :

For the variable-time paint test mode "K & L + Spectra," the instrument continues measuring until a positive or negative result is indicated relative to an action level (1.0 mg/cm ^{2} for archive testing) and the current precision, or until the reading is terminated by moving the instrument away from the testing surface. None of the variable mode readings were terminated because of the two-minute limit used for archive testing. The following table provides testing time information for this testing mode. Source strength and type of substrate will affect actual testing times.

Testing Times for Instruments Running Software Version 5.1						
Variable mode testing times (seconds)						
	All data			Median for laboratory—measured lead levels (mg/cm ^{2})		
Substrate	25th Percentile	Median	75th Percentile	Pb < 0.25	0.25 <= Pb < 1.0	1.0 <= Pb
Wood Drywall	6	8	15	6	20	5
Metal	6	13	20	13	20	6
Brick Concrete Plaster	6	11	20	9	18	6

DOCUMENTATION :
This PCS was developed in accordance with the methodology in the EPA report titled *Methodology for XRF Performance Characteristic Sheets* (EPA 747-R-95-008, September 1997). This report provides an explanation of the statistical methodology used to construct the data in the sheets, and provides empirical results from using the recommended inconclusive ranges or thresholds for specific XRF instruments. For a copy of this document call the National Lead Clearinghouse at 1-800-424-LEAD.

This XRF Performance Characteristic Sheet was developed by the Midwest Research Institute (MRI) under a grant from the U. S. Environmental Protection Agency and a separate contract between MRI and the XRF manufacturer. The U.S. Department of Housing and Urban Development (HUD) has determined that the information provided here is acceptable when used as guidance in conjunction with Chapter 7, Lead-Based Paint Inspection, of HUD's *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing*. While MRI reserves the right to revise this XRF Performance Characteristic Sheet at any time, HUD's statement of acceptance would not apply to a revision until HUD has reviewed the revision and made a determination of its acceptability.

TECHNICAL STANDARD OPERATING PROCEDURE

Date: March 21, 2003 SOP No. MFG-VBI70-03

Title: **Dust Wipe Sampling**

APPROVALS:

MFG, Inc.

Author: K. Tegtmeyer Date: 3/24/03

SYNOPSIS: Provides procedures and instructions for the location and collection of dust wipe samples for laboratory analysis.

REVIEWS:

TEAM MEMBER	SIGNATURE/TITLE	DATE
EPA Region 8	[signature] /RPM	3/25/03
MFG, Inc.	[signature]	3/25/03

REV.	DATE	REVISION DESCRIPTION
1	3/21/2003	Updated for use by Community Health Program

VASQUEZ BOULEVARD & INTERSTATE 70 SITE
COMMUNITY HEALTH PROGRAM PILOT STUDY

STANDARD OPERATING PROCEDURE FOR DUST WIPE SAMPLING

1.0 PURPOSE AND SCOPE

These procedures apply to dust wipe sampling performed at the Vasquez Boulevard and Interstate 70 (VB/I-70) Superfund Site during the community health program.

2.0 TRAINING AND QUALIFICATIONS

All personnel performing these procedures must be trained, Colorado-certified risk assessors for lead-based paint hazards, in accordance with Colorado's Air Pollution Prevention and Control Act, Regulation 19 – Requirements for Lead-Based Paint Abatement.

3.0 PROCEDURES

Dust wipe samples will be collected from the interior of individual residences. Dust samples will be collected from window components (sill and trough) and hard-surface floors for lead analysis. Dust samples may also be collected from exterior wood surfaces for arsenic analysis. The same procedures will be used for both types of dust wipe sampling.

3.1 Equipment

The following is a list of equipment needed to collect dust wipe samples.

- Masking tape.
- 50-mL resealable plastic centrifuge tube
- Tape measure or ruler
- Disposable wipes (thin, pre-moistened wipe, approximately 6 inches by 6 inches)
- Non-powdered plastic gloves

Other equipment needed to follow this procedure include:

- Field form for Dust Sampling
- Clipboard
- Indelible ink marker
- Plastic bags for trash
- Camera and film

3.2 Sample Collection Procedures

Dust wipe samples will be collected from window sills and troughs and from hard-surface floors in areas of the home where children are likely to come in contact with dust. A minimum of three dust wipe samples will be collected in each home. As described in the work plan, the risk assessor will select areas for dust sampling.

USEPA protocols for dust wipe sampling (EPA, 1995) will be used to collect dust wipe samples. These procedures are consistent with those provided by HUD in Appendix 13.1 of the HUD Guidelines for Evaluation and Control of Lead-Based Paint Hazards (HUD, 1995).

1. Don clean gloves.
2. Carefully mark the sampling area using masking tape (a minimum of 0.1 ft^2 for windows)
3. Open a disposable wipe. The top wipe may be discarded if dry.
4. First wipe side to side. Hold one edge of the wipe between the thumb and forefinger and press the towelette over the sampling area starting at one corner. Using a slow side-to-side sweeping motion wipe the entire surface of the sampling area. Fold the towelette in half with the collection area facing together.
5. Second wipe. Follow the same procedure as the first pass, but wipe the area in the reverse direction. Fold the towelette in half again.
6. Third wipe. Wipe around the perimeter of the sampling area. Roll the towelette to secure dust within the wipe.
7. Insert the towelette into the sample collection container.
8. Label the sample collection container.
9. Using a tape measure, measure the sampling area.
10. Record all sample locations and area measurements.
11. Photograph the sampling area.
12. Remove tape and dispose of tape and gloves.
13. Pack the samples along with chain-of-custody information and ship to an NLLAP-recognized analytical laboratory. Follow the sample handling and chain-

of-custody procedures given in SOP for Sampling Handling and Shipping.

3.3 Documentation

Whenever dust wipe samples are taken, the following information will be recorded on the Dust Sampling form for each sample:

- Room location (i.e. main living area)
- Surface being sampled (e.g., window sill, floor)
- Location within the room or on exterior
- Color/material of surface sampled
- Date and time of sampling
- Sample number
- Notes from the visual inspection.

4.0 QUALITY ASSURANCE SAMPLES

Field blanks, laboratory blanks and spike samples will be collected to assess the quality assurance procedures of the analytical laboratory .

The **field blank** is collected by following the sampling procedure given above except that no area is wiped. The sampler opens a wipe, handles the wipe with gloved hands and folds and refolds the wipe as if sampling. The wipe is contained as a regular sample and shipped to the lab for lead analysis.

The **laboratory blank** is an unused and unhandled wipe that the laboratory analyzes for lead content using identical procedures as for wipe samples.

The **spike** sample is a laboratory-prepared wipe spiked with a known amount of lead. The spike sample is resubmitted to the lab blindly as a routine wipe sample and is analyzed for lead to determine the lead recovery from the wipe material.

At least one field blank, laboratory blank and wipe spike will be analyzed for each brand of wipe used. In addition, one spike sample will be analyzed for every 20 samples submitted to the laboratory. Procedures for spike sample handling are provided in the HUD (1995) guidelines, Appendix 13.1, which is attached to this procedure.

5.0 REFERENCES

Colorado Air Pollution Prevention and Control Act, Regulation 19, Lead-Based Paint Abatement, 1998.

U.S. Department of Housing and Urban Development, 1995. Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing, June 1995.

U.S. Environmental Protection Agency, 1995. Residential Sampling for Lead: Protocols for Dust and Soil Sampling. EPA Doc. No. 747-R-95-001, March 1995.

VB/I-70 Community Health Program

Dust Sampling Worksheet

Date: _____ Risk Assessor(s)/Technician(s) _____ _____

Property Address: _____ Property No. _____ Air Pump No. _____

Sample No.	Wipe or Cassette #	Time	Room	Color	Type of Floor Covering	Location and Area

Notes: _____

Beginning Rotometer reading _____ Pump reading _____ End Rotometer reading _____ Pump reading _____

TECHNICAL STANDARD OPERATING PROCEDURE

Date: March 24, 2003

SOP No. MFG-VBI70-04

Title: **Vacuum Dust Sampling**

APPROVALS:

MFG, Inc.

Author: K. Teytmeyer Date: 3/24/03

SYNOPSIS: Provides procedures and instructions for use of a vacuum to collect dust samples for laboratory analysis.

REVIEWS:

TEAM MEMBER	SIGNATURE/TITLE	DATE
EPA Region 8	Bonnie Lamb / RPM	3/27/03
MFG, Inc.	[illegible]	3/24/03

REV.	DATE	REVISION DESCRIPTION
1	3/21/03	Updated for use by Community Health Program

VASQUEZ BOULEVARD & INTERSTATE 70 SITE COMMUNITY HEALTH PROGRAM

STANDARD OPERATING PROCEDURE FOR VACUUM DUST SAMPLING

1.0 PURPOSE AND SCOPE

These procedures apply to vacuum dust sampling performed at the Vasquez Boulevard and Interstate 70 (VB/I-70) Superfund Site as part of the community health program.

2.0 TRAINING AND QUALIFICATIONS

All personnel performing these procedures must be trained, Colorado-certified risk assessors or inspectors for lead-based paint hazards, in accordance with Colorado's Air Pollution Prevention and Control Act, Regulation 19 – Requirements for Lead-Based Paint Abatement.

3.0 PROCEDURES

Floor dust samples will be collected from the interior of each residence using a hand-held air-sampling pump and filter cassettes.

3.1 Equipment

The following is a list of equipment needed to collect vacuum dust samples:

- Air-sampling pump – A portable, battery-powered air pump that is capable of the flow rate of 2.5 L/min through an attached filter cassette.
- Collection nozzle – molded tubing that fits tightly on the inlet side of the filter cassette.
- Filter cassette – a pre-weighed 37-mm filter cassette, preloaded with 0.8 µm, pore-size Mixed-Cellulose Ester Filters and backup support pad (laboratory analyzing samples supplies pre-weighed cassettes).
- Calibrated rotameter equipped with inlet and outlet fittings sized for tubing used to connect filter cassette with air-sampling pump.
- Sampling template – A thin (less than 1/8 inch) template that is either disposable or

reusable and inside dimensions measuring 1 foot by 1 foot square.

- Masking tape for holding down sampling templates
- Tubing – Tight fitting flexible tubing for the inlet and outlet of the filter cassette and inlet of air-sampling pump.
- Disposable wipes – for cleaning the template between samples.
- Non-powdered plastic gloves
- Resealable plastic bags for sample filters

Other equipment needed to follow these procedures include:

- Site plan of property (Diagram of Property Interior form) including interior rooms of the main residence (if not recorded during the paint testing).
- Field form: Dust Sampling Worksheet
- Clipboard
- Indelible ink marker
- Plastic bags for trash
- Container for holding and transporting the filter cassettes.

3.2 Sample Collection Procedures

Dust samples will be collected from the floors in areas of the home where children are likely to come in contact with dust. A minimum of three floor-dust samples will be collected in each home. As described in the work plan, the risk assessor will select areas for dust sampling.

The following procedures from USEPA's *Protocols for Dust and Soil Sampling* (EPA, 1995) will be used to collect dust for lead analyses. Samples collected using these methods may be used to determine dust lead loading (µg/ft^2) and dust lead concentrations (mg/Kg).

1. Sketch a plan of the interior of the house that includes all rooms, sample locations, and other information for that residence and record on Diagram of Property Interior form.
2. Don latex gloves.
3. Place a clean 1 foot by 1 foot square template on the sample surface. Place tape on the outside edges to prevent it from moving during sampling.
4. Remove the sampling cassette's inlet and outlet plugs and place in a resealable plastic bag.
5. Connect collection tubing to the inlet end of the sample cassette and connect additional tubing from the outlet end to the inlet of the air pump.

6. Hold the collection tubing at a 45-degree angle to the surface being sampled and move it back and forth from one side of the template to the other using 3 inch to 4 inch strokes moving the nozzle at a rate of 2 to 4 inches per second. Once the entire surface has been vacuumed in one direction, repeat the procedure vacuuming at 90 degrees from the initial direction. Finally, vacuum the area again in the same direction as the initial coverage.
7. After collecting the sample, remove the cassette from the tubing. Remove and dispose of the collection tubing from the inlet side of the filter. Replace the cassette inlet and outlet plugs.
8. Place the cassette in a container that will hold the cassette securely.
9. Record all sample locations and sample data on the Dust Sampling Worksheet.
10. Pack the samples along with chain-of-custody information and ship to the analytical laboratory. Following the sample handling and chain-of-custody procedures discussed in SOP for Sample Handling and Documentation.

3.3 Documentation

When dust samples are taken, the following information will be recorded on the Dust Sampling Worksheet, for each sample:

- Room location (i.e. main living area)
- Floor surface being sampled (i.e. carpet, area rug, throw rug)
- Location within the room
- Color of the floor covering
- Type of floor covering
- Date and time of sampling
- Cassette number
- Sample number

4.0 QUALITY ASSURANCE/QUALITY CONTROL

Laboratory results will be checked by submitting a pre-weighed but unused dust cassette as a field blank once for every batch of cassettes (i.e., fifty samples). This field blank will be submitted for analysis without removing the cassette's inlet and outlet plugs to insure that it is not exposed to any field conditions. The field blank will be submitted as a regular dust cassette sample with sample identification indistinguishable from regular samples. Laboratory reporting of "insufficient sample" (or similar) will indicate proper quality control procedures during the

following events:

- preparation of the filter cassette prior to shipment,
- during the handling of the cassette in the field,
- during cassette handling and preparation prior to analysis,
- and during transport to and from the laboratory.

5.0 EQUIPMENT CALIBRATION AND MAINTENANCE

The air-sampling pump used for sampling will be fully charged. The air-sampling pump will be calibrated at the beginning and at the conclusion of each day of use for sampling. Calibration results (date, time, flow rate) will be recorded daily on the Air-Pump Calibration Record form. The procedure to calibrate the pump is as follows:

1. Label a filter cassette to distinguish it as one used for calibration (not sampling) and remove the inlet and outlet plugs.
2. Attach a collection nozzle to the inlet side of the filter cassette using a short section of tubing.
3. Insert a calibration rotameter between the air pump and the filter cassette.
4. Turn on the air pump and adjust the flow rate between 2.5-2.8 L/minute.
5. At completion of calibration, dispose of filter cassette and end plugs.
6. Document the calibration in field records (date, time, flow rate).

If the calibration verification performed at the end of the sampling day fails to reproduce the minimum flow rate of 2.5 L/minute, then the samples collected that day are not considered usable and should be discarded. Resampling with calibrated rotameter will be necessary for properties sampled that day.

The rotameter requires periodic calibration servicing in accordance with the instrument manufacturer's instructions. All maintenance instructions from the manufacturer will be followed and documented in instrument maintenance records and project field records.

6.0 REFERENCES

Colorado Air Pollution Prevention and Control Act, Regulation 19, Lead-Based Paint Abatement, 1998.

U.S. Department of Housing and Urban Development (HUD), 1995 rev. 1997. Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing, June 1995.

U.S. Environmental Protection Agency, 1995. Residential Sampling for Lead: Protocols for Dust and Soil Sampling. EPA Doc. No. 747-R-95-001, March.

TECHNICAL STANDARD OPERATING PROCEDURE

Date: March 26, 2003 SOP No. MFG-VBI70-05

Title: **Tap Water Sampling**

APPROVALS:

MFG, Inc.

Author: K. Tegtmeyer Date: 3/26/03

SYNOPSIS: Provides procedures and instructions for the collection of tap water samples for laboratory analysis.

REVIEWS:

TEAM MEMBER	SIGNATURE/TITLE	DATE
EPA Region 8	Bonnie Lamb / RPM	3/27/03
MFG, Inc.		3/26/03

REV.	DATE	REVISION DESCRIPTION

VASQUEZ BOULEVARD & INTERSTATE 70 SITE COMMUNITY HEALTH PROGRAM PILOT STUDY

STANDARD OPERATING PROCEDURE FOR TAP WATER SAMPLING

1.0 PURPOSE AND SCOPE

These procedures apply to investigation tap water sampling performed at the Vasquez Boulevard and Interstate 70 (VB/I-70) Superfund Site during the community health program pilot study.

2.0 TRAINING AND QUALIFICATIONS

Personnel performing these procedures must be trained in their use and approved by the project manager. Trained residents and property owners may also collect water samples in accordance with these procedures.

3.0 PROCEDURES

Tap water samples will be collected from the main tap used for drinking water in each home, typically at the kitchen sink. Two samples will be collected: one to represent water held in the faucet and nearby pipes for an extended period of time (i.e., overnight), and one to represent water flushed through the house pipes.

3.1 Equipment

The following types of equipment will be used for tap water sampling:

- Powderless plastic gloves
- Safety glasses
- Two, 1-liter plastic bottles, pre-preserved with nitric acid (bottles supplied by laboratory), one for each sample collected
- Sample labels

- Ink pen or indelible ink marker, blue or black
- "Directions For Residential Tap Water Sample Collection" form (attached)

3.2 Sample Collection Procedures

Prior to sample collection, water must have been stagnant in the pipes (no water use from the tap to be sampled) for a 6- to 8-hour period. Follow the steps below to collect water in bottles that contain nitric acid preservative:

1. Put on the disposable plastic gloves
2. Carefully remove the cap from the Sample 1 bottle
3. Place the Sample 1 bottle under the cold-water tap or faucet and slowly open the tap.
4. Fill the Sample 1 bottle to the base of the neck. Do not rinse the bottle before filling or over fill the bottle because it contains nitric acid.
5. Place the cap back on the Sample 1 bottle and tighten.
6. Flush the cold water tap for approximately 30 seconds.
7. Carefully remove the cap from the Sample 2 bottle
8. Place the Sample 2 bottle under the tap and fill to the base of the neck. Do not rinse the bottle before filling or over fill the bottle because it contains nitric acid.
9. Place the cap back on the Sample 2 bottle and tighten.
10. Complete the "Directions For Residential Tap Water Sample Collection" Form and complete sample labels (if not completed prior to sample collection).
11. Place the sample bottles in a cooler or secure container and maintain at a temperature of $4 \pm 2^{o}C$.
12. Ship samples to laboratory following chain-of-custody procedures.

When residents agree to collect water samples, the water will be collected into empty containers that do not contain the nitric acid for preservation. In these cases, follow the steps below:

1. Provide resident with instructions for collecting water samples, the attached "Directions for Residential Tap Water Sample Collection."
2. Provide resident with two empty containers marked Sample 1 and Sample 2.
3. Return following day to pick up filled containers.
4. Complete the sample labels and apply to containers while at the property.
5. Place the sample bottles in a cooler or secure container and maintain at a temperature of $4 \pm 2^{o}C$.

6. At a clean, indoor location with running water available, don gloves and eye protection.
7. Open the first container and add 5 mL of reagent-grade 4N nitric acid and then immediately close container and tighten cap.
8. Open the second container and add 5 mL of reagent-grade 4N nitric acid and then immediately close container and tighten cap.
9. Complete sample labels and apply to each container.
10. Place each container in its own sealable plastic bag and place them in a cooler or secure container and maintain at a temperature of $4 \pm 2^{o}C$.
11. Ship samples to laboratory following chain-of-custody procedures.

3.3 Documentation

The following information will be documented for each tap water sample collected:

- Property number
- Sample ID
- Resident's name
- Property address and telephone number
- Date and time of collection
- Approximate time that tap was last used prior to sampling
- Length of time tap flushed prior to collecting samples if different from the above procedures
- Sampler's signature and date
- Sample custody procedures (sample bottle delivery and pick-up information)

If residents collect the samples then the "Directions For Residential Tap Water Sample Collection" form will be completed, signed, kept with samples until they are shipped to the laboratory. These forms will then be stored in the project files.

Resident's Name
Property Address _____ Telephone_____

DIRECTIONS FOR RESIDENTIAL TAP WATER SAMPLE COLLECTION

These water samples are being collected to determine the contribution of faucet fixtures and household pipes and/or solder to the lead levels in tap water. This sampling is part of the Vasquez Boulevard / Interstate 70 Site. Results from the water sampling will be provided to you.

Generally a total of two samples will be collected at your household. One of the samples is to be collected after the water has been stagnant in the pipes for a six to eight hour period. Therefore, either early mornings or evenings, upon returning from work, are the best times for collecting this sample. The second sample is to be collected after allowing the water to run from the kitchen faucet for 30 seconds.

Sample 1 must be collected after a minimum period of **six to eight hours** during which there is no water use. Sample 1 will be collected from the kitchen tap.

Sample 2 will be collected from the kitchen tap **after** Sample 1. The kitchen tap will be flushed (allowed to run) from the cold water tap for 30 seconds before filling the sample bottle.

The following provides procedures to be followed when filling each bottle:

1. Put on latex gloves.
2. Remove the cap from the bottle marked **Sample 1**.
2. Fill the bottle directly from the faucet or tap by placing the open sample bottle under the tap or faucet and then slowly opening the cold-water tap. Fill the bottle to the base of the neck; do not over fill the bottle.
3. Place the cap back on the bottle and tighten the cap.
4. Place the sample bottle in the cooler along with the ice packs provided with the sampling kit.
5. Remove the cap from the bottle marked **Sample 2** and then run cold water from the tap for 30 seconds before starting to fill the bottle.
6. Fill the bottle directly from the faucet or tap by placing the open sample bottle under the tap or faucet. Fill the bottle to the base of the neck; do not overfill the bottle.
7. Place the cap back on the bottle and tighten the cap.
8. Place the sample bottle in the cooler along with Sample 1 and the ice packs provided.

Personnel will pick up the sampling kit as soon after sampling as practical and typically the next day.

If there is a problem when collecting the sample, **please call MFG (Dave Colvin) at (303) 447-1823** for another sample bottle or bottles).

TO BE COMPLETED BY RESIDENT

Water was last used Time: _____ Date:

Sample was collected Time: _____ Date:

I have read the above directions and have taken the tap water samples in accordance with these directions.

SIGNATURE: _____ Date:

TO BE COMPLETED BY EPA (or representative) PERSONNEL

Sample bottle delivered at Time: _____ Date: _____ Name: _____Sample bottle picked up at Time: _____ Date: _____ Name:

CONTENTS OF WATER SAMPLE KIT

1) Sample cooler

2) 2 sample bottles

3) Ice packs to be placed beside or on top of bottles after sample collection

4) Directions for Residential Tap Water Sample Collection

5) Latex gloves to be worn during sampling

TECHNICAL STANDARD OPERATING PROCEDURE

Date: March 21, 2003 SOP No. MFG-VBI70-06

Title: **Decontamination**

APPROVALS:

MFG, Inc.

Author: K. Tegtmeyer Date: 3/24/03

SYNOPSIS: Provides procedures and instructions for decontaminating sampling equipment.

REVIEWS:

TEAM MEMBER	SIGNATURE/TITLE	DATE
EPA Region 8	Bonnie Lab / RPM	3/25/03
MFG, Inc.		3/25/03

REV.	DATE	REVISION DESCRIPTION
1	3/21/03	Updated for use by Community Health Program

VASQUEZ BOULEVARD & INTERSTATE 70 SITE COMMUNITY HEALTH PROGRAM AND RESIDENTIAL SAMPLING PROGRAM

STANDARD OPERATING PROCEDURE FOR SOIL SAMPLING EQUIPMENT DECONTAMINATION

1.0 PURPOSE AND SCOPE

These procedures apply to soil sampling performed at the Vasquez Boulevard and Interstate 70 (VB/I-70) Superfund Site during the community health program and the residential sampling program. Methods for decontaminating soil sampling equipment are provided.

2.0 PROCEDURES

Equipment used to collect soil samples will be decontaminated prior to use and in between the collection of composite samples. The equipment requiring decontamination includes the stainless steel trowels or coring devices used to collect the samples and the stainless steel bowls, cups and spoons that may be used to contain or homogenize samples. Soil samples will be collected according to the procedures described in the Soil Sampling SOP.

2.1 Equipment

The following is a list of equipment needed to decontaminate soil sampling equipment.

- Non-phosphate detergent such as Alconox
- Tap water – several gallons probably necessary
- Deionized water
- Chemical-free towels or paper towels
- Cleaning containers – plastic and/or galvanized steel pans or buckets
- Stiff cleaning brushes
- Aluminum foil, plastic wrap or plastic bags.
- Plastic bags for trash
- Powderless plastic gloves

2.2 Equipment Decontamination Procedures

1. Add the non-phosphate detergent to the appropriate amount of tap water in one of the clean plastic or stainless steel containers. Stir to mix.
2. Put on a pair of powderless plastic gloves.
3. Using the stiff brush, scrub all soil sampling equipment with the detergent/tap water solution. Scrub the equipment until all visible remnants of soil are removed. During the decontamination process, do not lay any equipment being decontaminated on a surface other than a clean piece of plastic or aluminum foil.
4. Rinse each piece of equipment with clean tap water.
5. Rinse each piece of equipment with deionized water.
6. Place the cleaned equipment on clean aluminum foil or plastic wrap and allow to air dry or dry with clean chemical-free paper towels.
7. If not using the equipment immediately, place the clean dry equipment in plastic bags or wrap in aluminum foil for storage.
8. Contain and dispose of all decontamination water by pouring used solutions onto the ground surface at the sampling location.
9. Clean the container which had the detergent/tap water solution and the brush for future use.

2.3 Documentation

Field notes will describe the procedure used and the frequency of sampling equipment decontamination (this SOP may be referenced). Any procedure not in accordance with this SOP should be documented in the field notes.

TECHNICAL STANDARD OPERATING PROCEDURE

Date: March 21, 2003 SOP No. MFG-VBI70-07

Title: **Sample Handling**

APPROVALS:

MFG, Inc.

Author: K. Tegtmeyer Date: 3/24/03

SYNOPSIS: Provides procedures and instructions for sample identification, handling, chain-of-custody, and shipping for laboratory analysis.

REVIEWS:

TEAM MEMBER	SIGNATURE/TITLE	DATE
EPA Region 8	Bonnie Lobe / RPM	3/25/03
MFG, Inc.		3/25/03

REV.	DATE	REVISION DESCRIPTION
1	3/21/03	Updated for use by Community Health Program

VASQUEZ BOULEVARD & INTERSTATE 70 SITE COMMUNITY HEALTH PROGRAM AND RESIDENTIAL SAMPLING PROGRAM

STANDARD OPERATING PROCEDURE FOR SAMPLE HANDLING

1.0 PURPOSE AND SCOPE

These procedures apply to all sampling tasks performed at the Vasquez Boulevard and Interstate 70 (VB/I-70) Superfund Site during the community health program and residential sampling program.

2.0 SAMPLE HANDLING PROCEDURES

Under the Community Health Program, dust and soil samples will be collected and paint will be tested for lead at residential properties. Some soil samples will also be analyzed for arsenic. Samples will be collected according to the procedures described in the VB/I-70 Pilot Study Work Plan and specific sampling SOPs referenced therein.

Under the residential sampling program soil samples will be collected and analyzed for lead and arsenic. Samples will be collected according to the procedures described in the Sampling and Analysis Plan and specific sampling SOPs referenced therein.

2.1 Sample Identification

Each sample will be assigned a unique sample identification number. Each identification number assigned to an environmental sample will identify the property from which the sample was collected, the sample matrix, the date of sample collection and sample sequence or depth (if applicable). Sample identification numbers will have several components, as explained using the following example:

V138-W-CHP-1

The first character, V, stands for “VB/I-70” and all real-sample identification numbers will begin with the letter V.

The three numbers that follow the V are the property identification number (138). A

unique property identification number is assigned to each participating property prior to sample collection.

The next letter, W, indicates the sample matrix (W = water, S = soil, P = paint and D = dust).

The following letters indicate the sampling protocols that were used. Use CHP for the community health program pilot study samples (i.e., all dust, paint and water samples and some soil samples) and P3S for Phase III soil samples.

Additional information pertaining to the sample sequence may follow the procedure code. For water samples a "-1" or "-2" would indicate the sample sequence as described in the SOP for water sample collection. A description of any additional information included in the sample identification number will be documented in the field records.

QC samples may have a different sample identification number. For example, an equipment rinsate may be called V138-R-P3S-1 to indicate it is the first (-1) rinsate (R) of equipment used for Phase 3 soil sampling at property number 138.

2.1 Sample Containers and Preservation

Proper sample preparation practices will be observed to minimize sample contamination and avoid repeat analyses due to anomalous analytical results. Sample containers will either be commercially-cleaned bottles or other appropriate sample containers provided by the analytical laboratory or, for soil samples, clean unused plastic bags. Bottles for samples types that require preservation (i.e., water samples) will either be pre-preserved by the laboratory or the preservative will be shipped separately for addition to the samples in the field. Sample preservation should be performed immediately upon collection to ensure that laboratory results are not compromised by improper preservation.

2.2 Sample Chain-of-Custody

After samples have been collected, they will be maintained under strict chain-of-custody procedures. The procedures described below will be used to document the transfer of custody of the environmental samples from the field to the designated analytical laboratory. The field sampling personnel will complete a Chain-of-Custody Record and Request for Analysis (CC/RA) form or similar form supplied by a laboratory for each shipping container (i.e., cooler or other container) of samples to be sent each laboratory for analysis. The CC/RA for a shipping container will list only those samples in that shipping container. Information contained on the

triplicate carbonless CC/RA form includes:

- Project identification;
- Date and time of sampling;
- Sample identification;
- Sample matrix type;
- Sample preservation methods (if any);
- Number and types of sample containers;
- Sample hazards (if any);
- Analysis type requested;
- Sample turn-around time;
- Method of shipment;
- Carrier/waybill number (if any);
- Signature of sampling personnel;
- Signature, name and company of person relinquishing and person receiving the samples when custody is being transferred;
- Date and time of sample custody transfer; and
- Condition of samples upon receipt by laboratory.

The sample collector will cross out any blank space on the CC/RA below the last sample number listed (on the part of the form where samples are listed). A sample label will be affixed to each sample container and filled out using indelible ink. Labels will be protected with a layer of clear tape. Each container will be carefully packaged in a shipping container (typically an ice chest) and shipped to the appropriate laboratory, as described below (Section 2.4).

The sampling personnel whose signature appears on the CC/RA is responsible for the custody of the sample from the time of sample collection until the custody of the sample is transferred to a designated laboratory, a courier, or to another employee for the purpose of transporting the sample to the designated laboratory. The sample is considered to be in custody when the sample is: (1) in the direct possession of the sample custodian; (2) in plain view of the sample custodian; or (3) is securely locked in a restricted access area by the sample custodian.

Custody is transferred when both parties to the transfer complete the portion of the CC/RA under "Relinquished by" and "Received by." Signatures, printed names, company names, date and time are required. Upon transfer of custody, the sampling personnel who relinquished the samples will retain the third sheet (pink copy) of the CC/RA. When the samples are shipped by a common carrier, a Bill of Lading supplied by the carrier will be used to document the sample custody, and its identification number will be entered on the CC/RA. Copies, receipts or carbons of Bills of Lading will be retained as part of the permanent documentation in the project file. It is

not necessary for courier personnel to sign the CC/RA. When the samples are received by the laboratory, the CC/RA will be immediately signed along with the date and time of receipt. The top sheet (white copy) of the CC/RA (or a copy of it) will be returned to the Project Manager with the final analytical report.

2.3 Sample Shipping

All samples collected for laboratory analysis will be labeled and placed in an insulated cooler or other appropriate shipping container. If necessary for sample preservation, bags of ice will be placed around the samples to maintain a temperature of approximately 4°C. The ice in the cooler will be double-bagged. The coolers will be filled with packing material such as vermiculite or styrofoam to prevent sample breakage during shipment. The chain-of-custody forms (Section 2.3) will be placed in a sealed plastic bag and taped to the inside top of the cooler. The cooler will be taped shut and chain-of-custody seals will be attached to the outside of the cooler to ensure that the cooler cannot be opened without breaking the seal. Samples will be shipped via express delivery to the appropriate laboratory.

QUALITY ASSURANCE PROJECT PLAN
FOR SAMPLING, TESTING AND ANALYSIS ACTIVITIES
COMMUNITY HEALTH PROGRAM

VASQUEZ BOULEVARD/I-70 SUPERFUND SITE
DENVER, COLORADO

March 24, 2003

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TABLE OF CONTENTS

LIST OF TABLES iii

LIST OF ATTACHMENTS iii

LIST OF ACRONYMS iv

1.0 INTRODUCTION 1
- 1.1 Project Description 1
- 1.2 Project Responsibilities 1

2.0 QUALITY ASSURANCE OBJECTIVES 3
- 2.1 Soil Samples 3
- 2.2 Interior and Exterior Paint Samples 4
- 2.3 Dust Samples 4

3.0 SAMPLING PROCEDURES 5
- 3.1 Sampling Media and Collection Techniques 5
- 3.2 Decontamination Procedures 5
- 3.3 Sample Custody 5

4.0 ANALYTICAL PROCEDURES AND CALIBRATION 8
- 4.1 Analytical Parameters and Methods 8
- 4.2 Field Calibration Procedures 9
- 4.3 Preventive Maintenance 9

5.0 INTERNAL QUALITY CONTROL CHECKS 10
- 5.1 Field Quality Control Samples 10
  - 5.1.1 Soil Samples 11
  - 5.1.2 Interior/Exterior Paint Samples 11
  - 5.1.3 Dust Samples 12
- 5.2 Laboratory Quality Control Samples 12
  - 5.2.1 ICP Soil Analyses 13
  - 5.2.2 Dust Analyses 13

6.0 CALCULATION OF DATA QUALITY INDICATORS 14
- 6.1 Precision 14
- 6.2 Accuracy 14
- 6.3 Completeness 15
- 6.4 Representativeness 16

7.0 DATA REDUCTION, VALIDATION, AND REPORTING 17
- 7.1 Field XRF Data 17
- 7.2 Environmental Laboratory Measurement Data 17
- 7.3 Environmental Laboratory Data Review and Evaluation 18
- 7.4 Data Management and Reporting 19

8.0 TECHNICAL SYSTEM AUDITS 20
- 8.1 Systems Audits 20
- 8.2 Frequency and Scheduling 21
- 8.3 Audit Reports 21

9.0 CORRECTIVE ACTION 22
10.0 QUALITY ASSURANCE REPORTS 23
11.0 REFERENCES 24

LIST OF TABLES

Table	Title
2-1	Quantitative Measurement Objectives for Analyses of Soil, Paint, Dust and Water Samples
4-1	Analytical Methods, Holding Times, and Quantitative Limits
5-1	Types and Frequency of QC Samples Collected with Environmental Samples

LIST OF ATTACHMENTS

Attachments	Title
A	Standard Operating Procedure for Sample Preparation
B	Data Validation Checklists

LIST OF ACRONYMS

AA	Atomic Absorption
ASTM	American Society for Testing and Materials
CC/RA	Chain-of-Custody Record and Request for Analysis
EPA	United States Environmental Protection Agency
GFAA	Graphite Furnace Atomic Absorption
ICP	Inductively Coupled Plasma-Atomic Emission Spectometry
LCS	Lab Control Samples
LCSD	Lab Control Samples Duplicate
MS	Matrix Spikes
MSD	Matrix Spikes Duplicate
NLLAP	National Lead Laboratory Accredation Program
NTU	Nephelometric Turbidity Unit
QA	Quality Assurance
QAM	Quality Assurance Manager
QAOs	Quality Assurance Officers
QAPP	Quality Assurance Project Plan
QC	Quality Control
RPP	Relative Percent Difference
SOP	Standard Operating Procedures
VB/I-70	Vasquez Boulevard/Interstate 70
XRF	X-Ray Fluorescence

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) has been developed for sampling, testing and analysis activities to support the Community Health Program for evaluating sources of lead and arsenic exposure within the Vasquez Boulevard/I-70 (VB/I-70) Superfund Site. This QAPP is intended to supplement the Community Health Program Design Work Plan (the Work Plan) (EPA, 2003) and identifies the procedures and protocols to be followed during sample collection and analysis. Sampling will include the collection and analysis of soil, interior and exterior paint and dust samples.

1.1 Project Description

As described in the Work Plan, samples will be collected and analyzed to evaluate the potential sources of lead and arsenic exposure for young children within the VB/I-70 site. The purpose of each type of sample to be collected and the subsequent data uses are described below.

- Soil – Soil sampling will be conducted to identify potential sources of lead in yard soil. The data will be compared to a range of risk-based criteria for soil (400 to 540 milligrams per kilogram (mg/Kg) lead and 70 to 240 mg/Kg arsenic). The soil data will be used to evaluate levels of lead and arsenic that children may potentially be exposed to when using areas of the yard.
- Interior and Exterior Paint – Interior and exterior paint will be tested to determine if paint is a source of lead to the environment. The lead data will be compared to a value of 1 milligram per square centimeter (mg/cm^2) to identify lead-based paint.
- Dust – Interior dust samples will be collected to determine whether the dust is a lead source. Both vacuum-collected and wipe-collected dust samples will be analyzed for lead. The results will be compared to soil concentration data at the risk-based concentration levels and to criteria for identifying paint hazards (40 $\mu g/ft^2$ on floors, 250 $\mu g/ft^2$ on window sills, as weighted averages for the home).

1.2 Project Responsibilities

Key positions related to quality assurance include: the Project Manager, Quality Assurance Manager (QAM), the Program Administrator and the Chemist.

The Project Manager will oversee all aspects of the program implementation. The Project Manager will ensure that the Program Administrator is coordinating all project activities in accordance with the Work Plan, including implementation of this QAPP.

The QAM will be responsible for ensuring that the analytical procedures are performed in accordance with the QAPP and will consult with the Program Administrator to confirm that the field procedures are performed in accordance with the QAPP. The QAM's duties may include reviewing documentation of field sampling procedures, verifying that the laboratory is adhering to project specifications and working with the laboratory if corrective measures are necessary. The QAM may assist the Chemist in performing data evaluation or validation, if necessary. The QAM will discuss any systematic errors or other anomalous data with the Project Manger and Program Administrator. If corrective actions are necessary, the QAM will be responsible for confirming that they have been initiated.

The Program Administrator will coordinate various aspects of the pilot study, including the environmental testing component. The Program Administrator will also be the primary contact for participants in the program.

The Chemist will be responsible for coordinating with the laboratory regarding analytical requirements and scheduling. Upon receipt of the analytical data, the Chemist will perform the necessary data validation (the QAM may assist the Chemist in this function, if necessary). The Chemist will also provide support to the field team, QAM and Program Administrator regarding issues concerning sample collection, handling and storage.

The individual laboratory Quality Assurance Officers (QAOs) will also have key positions related to quality assurance and are responsible for all aspects of the sample analyses. The Laboratory QAOs will be responsible for ensuring that sample holding times and custody requirements are met, overseeing the analyses, confirming that the laboratory QA requirements are met, and reviewing the data packages prior to distribution. The Laboratory QAOs will coordinate with the Chemist regarding any issues related to the sample analyses.

2.0 QUALITY ASSURANCE OBJECTIVES

The project quality assurance (QA) objectives are directly tied to the data needs and data uses described in the Work Plan and summarized in Section 1.0. The QA objectives for each type of data, including acceptable levels of precision, accuracy, representativeness and comparability, are described below. Sampling and analysis procedures necessary to meet the QA objectives are described in Sections 3 and 4, respectively. The types of field and laboratory Quality Control (QC) samples to be collected and analyzed are detailed in Section 5. Definitions of precision, accuracy, respresentativeness and comparability are provided in Section 6. Data that meet their stated QA objectives will be of appropriate quality for supporting remedial design activities at the VB/I-70 site.

2.1 Soil Samples

Soil samples will be collected at each property according to a site-specific sampling plan developed for that property. The sampling plans will be developed using the guidelines provided in Section 7 of the Work Plan and sampling will be performed in accordance with Standard Operating Procedures (SOPs) for environmental data collection. Each sampling plan will provide a sufficient number of samples from which to describe the soil conditions in bare areas, play areas, gardens and yard areas. Samples will be collected using consistent methods (SOP for Soil Sampling) to provide comparable results.

As described in Section 4 of this QAPP, soil samples will be composited in the field and then dried and sieved at the laboratory for homogenization prior to analysis. A contract laboratory will analyze the samples for lead and/or arsenic using inductively coupled plasma-atomic emission spectrometry (ICP) methods.

Table 2-1 provides the precision, accuracy, quantitation limit, and completeness objectives for lead analyses of soil samples by ICP. The precision and accuracy of the data will be evaluated relative to the measurement objectives given in Table 2-1. Because some soil samples are expected to be heterogeneous, sample heterogeneity will be considered when evaluating comparability of results from field duplicate samples. The representativeness of laboratory analyses will be evaluated from analyses of blanks, including equipment rinsates and method blanks.

2.2 Interior and Exterior Paint Samples

Deteriorated interior and exterior paint will be tested in the interior and on the exterior of residences. Testing will be performed using the guidelines provided in Section 7 of the Work Plan and in accordance with the SOPs for environmental data collection. Consistent methods (SOP for Paint Testing and Assessment) will be used to provide comparable results.

Paint will be analyzed for lead on site using a portable X-Ray Fluorescence (XRF) instrument. All analyses will be performed by an individual who has been properly trained to use the XRF instrument. Table 2-1 provides the precision, accuracy, quantitation limit, and completeness objectives for lead analyses of paint by XRF.

2.3 Dust Samples

Dust samples will be collected from within each residence by both dust wipe and vacuum collection methods, as described in Section 7 of the Work Plan, and in accordance with the SOPs for environmental data collection. Consistent methods (SOP for Dust Wipe Sampling and SOP for Vacuum Dust Sampling) will be used to provide comparable results.

Dust samples will be analyzed for lead by an National Lead-Laboratory Accredation Program (NLLAP) approved laboratory. The laboratory will analyze both vacuum-collected and wipe dust samples using atomic absorption (AA) methods (EPA Method 7420 or Method 7421). If any dust wipe samples are submitted for arsenic analysis, the analyses will be performed by the laboratory using AA methods (EPA Method 7060 or 7061A).

Table 2-1 provides the precision, accuracy, quantitation limit, and completeness objectives for lead analyses of dust filter and wipe samples. The representativeness of laboratory analyses will be evaluated from analyses of filter blanks, wipe blanks and method blanks.

3.0 SAMPLING PROCEDURES

3.1 Sampling Media and Collection Techniques

Environmental samples collected or analyzed to support the Community Health Program include:

- Soil samples;
- Interior/exterior paint;
- Dust samples (filter and wipe).

Sample collection procedures are described in the SOPs provided for each sampled matrix. Procedures for documenting sampling activities and labeling and handling samples are also provided in the SOP for Sample Handling and Documentation.

3.2 Decontamination Procedures

Field equipment and supplies that will be used at more than one sampling location will be decontaminated prior to use and between sampling locations to minimize the potential for cross-contamination of samples. The general decontamination procedures will consist of:

- Scrubbing the sampling equipment with a stiff brush in a solution of tap water and non-phosphate detergent until all visible remnants of the sampled media are removed from the equipment during this step;
- Rinsing the sampling equipment with tap water, followed by a second rinse with deionized water; and
- Disposing of the decontamination fluids.

Specific decontamination procedures are specified in the SOPs.

3.3 Sample Custody

After samples have been collected, they will be maintained under strict chain-of-custody procedures. Chain-of-custody procedures are discussed in the SOP for Sample Handling and

Documentation and are summarized below. The procedures described below are used to document the transfer of custody of the environmental samples from the field to the designated analytical laboratory and the associated documentation requirements. The field sampling personnel will complete a Chain-of-Custody Record and Request for Analysis (CC/RA) form or similar form supplied by a laboratory (refer to SOP for Sample Handling and Documentation) for each shipping container (i.e., cooler or other container) of samples to be sent to each laboratory for analysis. The CC/RA for a shipping container will list only those samples in that shipping container. Information contained on the triplicate carbonless CC/RA form includes:

- Project identification;
- Date and time of sampling;
- Sample identification;
- Sample matrix type;
- Sample preservation method (if any);
- Number and types of sample containers;
- Sample hazards (if any);
- Analysis type requested;
- Sample turn-around time;
- Method of shipment;
- Carrier/waybill number (if any);
- Signature of sampling personnel;
- Signature, name and company of person relinquishing and person receiving the samples when custody is being transferred;
- Date and time of sample custody transfer; and
- Condition of samples upon receipt by laboratory.

The sample collector will cross out any blank space on the CC/RA below the last sample number listed (on the part of the form where samples are listed). A sample label will be affixed to each sample container. The label will be protected with a layer of clear tape. Each container will be carefully packaged in a shipping container (typically an ice chest) with Styrofoam peanuts, vermiculite or other packing material, if necessary, to prevent breakage during shipment. Custody seals will be signed and dated by the sample custodian prior to shipment. If the custody seal is broken, the laboratory will immediately notify the Chemist or Program Administrator.

The sampling personnel whose signature appears on the CC/RA is responsible for the custody of the sample from the time of sample collection until the custody of the sample is transferred to a designated laboratory, a courier or to another employee for the purpose of transporting the sample to the designated laboratory. The sample is considered to be in custody when the sample is: (1) in the direct possession of the sample custodian; (2) in plain view of the sample custodian; and (3) securely locked in a restricted access area by the sample custodian.

Custody is transferred when both parties to the transfer complete the portion of the CC/RA under "Relinquished by" and "Received by". Signatures, printed names, company names, date and time are required. Upon transfer of custody, the sampling personnel who relinquished the samples will retain the third sheet (pink copy) of the CC/RA. When the samples are shipped by a common carrier, a Bill of Lading supplied by the carrier will be used to document the sample custody, and its identification number will be entered on the CC/RA. Copies, receipts or carbons of Bills of Lading will be retained as part of the permanent documentation in the project file. It is not necessary for courier personnel to sign the CC/RA. When the samples are received by the laboratory, the CC/RA will be immediately signed along with the date and time of receipt. The top sheet (white copy) of the CC/RA (or a copy of it) will be returned to the Program Director with the final analytical report.

4.0 ANALYTICAL PROCEDURES AND CALIBRATION

4.1 Analytical Parameters and Methods

Soil samples will be collected for analysis of lead and/or arsenic. Dust (filters and wipes) and water samples will be collected for analysis of lead. Paint will be tested in situ for lead content. Table 4-1 provides the analytical methods, preservation and storage requirements, holding times, and quantitation limits required for the analysis of these samples. The specified methods provide data of appropriate quality for comparison to the applicable trigger criteria.

Soil samples will be prepared for ICP analysis (EPA Method 6010 B) in accordance with the Sample Preparation SOP included as Attachment A. The samples will be dried and sieved by the laboratory and then subject to a complete digestion procedure (EPA Method 3052) prior to ICP analysis.

Interior/exterior paint samples will be analyzed in the field using a portable XRF instrument. Sample preparation is not required because the paint is analyzed in situ. The XRF instrument will be operated in accordance with the manufacturer's instructions and using matrix-specific calibration models to measure the lead content of paint, as described in the SOP for Paint Testing and Assessment.

Vacuum dust samples will be obtained in filter cartridges using a vacuum collection method and then analyzed by an NLLAP-approved laboratory (e.g., Reservoirs Environmental Services, Inc., Denver, CO). Prior to use for collecting dust samples, the laboratory will weigh and record the weight of the filters. After the samples are collected, the filters will be re-weighed, digested (EPA Method 3050B) and analyzed by AA (EPA Method 7420 or Method 7421). Results for dust samples collected using the vacuum collection method will be reported as mg/Kg and may also be used to compute dust lead loading in $\mu g/ft^2$.

Dust wipe samples will be completely digested (EPA Method 3050B) and analyzed for lead by EPA Method 7420 or 7421 or for arsenic analysis by EPA Method 7060 or 7061A. Results for dust wipe samples will be reported by the laboratory in μg and converted to $\mu g/ft^2$ by the sampler upon receipt of analysis results.

4.2 Field Calibration Procedures

It is anticipated that the only calibrated field instruments that will be used for the environmental sampling will be the field XRF instrument used for interior/exterior paint analysis and the air-sampling pump used for the collection of dust samples. The field XRF and air-sampling pump will be calibrated prior to use and at prescribed intervals while in use, if necessary. Frequency of calibration is specified in the SOPs for Paint Testing and Assessment and Vacuum Dust Sampling. Procedures for calibration of instruments will be the standard operating procedures as outlined in the owner's manuals for the specific field instruments.

The portable XRF instrument will be calibrated using empirical methods. Prior to use of the instrument at the site, calibration models will be developed for a wide range of lead concentrations (0 to 20 mg/cm^2) on a variety of substrate surfaces. Calibration check samples, having a known lead concentration in the mid-range of the model's concentration range, will also be measured twice daily. Calibration requirements are described in the SOP for Paint Testing and Assessment.

The air-sampling pump will be calibrated by inserting a calibration rotameter between the air pump and a filter cassette and adjusting the flow rate accordingly. If the calibration verification performed at the end of the sampling day fails to reproduce the minimum flow rate of 2.5 liters/minute, than the samples collected that day are not considered usable and will be discarded. The air-sampling pump calibration requirements are described in the SOP for Vacuum Dust Sampling.

4.3 Preventive Maintenance

At a minimum, field equipment will be inspected, visually and functionally, prior to each day's use. Preventive maintenance activities will be documented in records maintained by the instrument operator and filed with the project's other field records. These records will identify the equipment and specify the maintenance tasks completed. The field XRF instrument and air-sampling pump will be cleaned according to the manufacturer's instructions. The XRF instrument will undergo maintenance by the manufacturer annually, including source replacement, as needed. The rotameter used to calibrate the air-sampling pump requires periodic servicing. All field equipment will be kept clean and free of particulate matter to the extent possible.

5.0 INTERNAL QUALITY CONTROL CHECKS

Internal QC will be achieved by collecting and/or analyzing a series of field and laboratory QC samples to assist in confirming that the analytical results meet the measurement objectives detailed in Section 2. Results from analyses of QC samples are used to quantify precision and accuracy and identify any problems or limitation of those data.

5.1 Field Quality Control Samples

Field QC will be controlled by compliance with standard sample collection and handling methods and by the periodic collection of field QC samples. QC samples will not be identified to the laboratory. The appropriate types and frequency of field QC samples depend on the sample type, sample matrix and intended data use. The measurement objectives for the QC samples are included in Table 2-1. A summary of the field QC samples to be collected is provided in Table 5-1.

Five types of quality control samples will be collected during environmental sampling: equipment rinsates, field duplicates, filter blanks, wipe blanks and field blanks.

> **Equipment rinsates** consist of analyte-free reagent water (i.e., American Society for Testing and Materials [ASTM] Type II) poured through the sampling device or equipment, collected in a clean sampling bottle, preserved as needed, and analyzed with the samples. Equipment rinsates may be used to demonstrate that sampling devices have been adequately cleaned between uses and provide representative samples.
>
> A **field duplicate** sample is a second sample collected at the same location as the original sample. Duplicate samples are collected simultaneously with or in immediate succession to the original sample using identical recovery techniques and are treated in identical manner during storage, transportation and analysis. Field duplicate sample results may be used as a measure of method variability, including both sampling and analytical precision.
>
> A **filter or wipe blank** sample consists of an unused air filter or wipe. The filter blank is prepared from an unused filter that has been pre-weighed by the laboratory. The filter is submitted for analysis in an identical manner as the filters used for sampling. The wipe blank is an unopened wipe that is submitted for analysis with the wipes used for sampling. Filter/wipe blank results describe the background lead concentration of the filters/wipes used to collect the dust samples and may be used to assess bias introduced by the filters/wipes.

A **field blank** sample consists of an unused dust wipe. An unused wipe is opened, handled with gloved hands and submitted for analysis in an identical manner as the wipe samples except that no surface is wiped. Field blank results describe the background lead concentration of wipes under ambient field conditions and may be used to assess bias introduced by the wipes.

A **dust-wipe spike sample** is a wipe containing a known weight of lead-based paint dust. The dust spike is prepared by the laboratory and then submitted blindly to the laboratory with other dust samples to determine if there is adequate quality control of the digestion process for recovery of lead.

5.1.1 Soil Samples

Equipment rinsates and field duplicates will be collected with soil samples. Equipment rinsates associated with soil samples will be collected by pouring reagent water through the decontaminated re-usable equipment used to obtain soil samples (e.g., soil scoops and mixing bowls). Field duplicate samples will be collected at the same location as the soil samples, and will be splits of the homogenized samples. The duplicate sample will be assigned a separate sample identification number and will be a blind duplicate to the laboratory. One equipment rinsate and one field duplicate will be collected each day of sampling and submitted for laboratory analysis for lead and/or arsenic.

5.1.2 Interior/Exterior Paint Samples

One sample per residence will be selected for triplicate analysis as a measure of analytical precision. Whenever possible, the triplicate reading will be performed using a sample with a lead concentration greater than 1 mg/cm^2. This one sample will be analyzed three times for lead without moving the probe. The standard deviation of the three measurements must be within $\pm$ 0.1 mg/cm^2. For results greater than 7 mg/cm^2, the relative standard deviation for the three measurements must be within 25 percent. If these objectives are not met, the paint surface will be examined for anomalies and the procedure will be repeated. If the precision objectives are not obtained, the instrument will be recalibrated and the procedure will be repeated.

Precision and accuracy will also be routinely evaluated using reference standard samples. Standard reference checks will be performed at the beginning of each day and approximately every 4 hours thereafter. At the beginning of the day all methods will undergo a standard reference check, but only those methods used on that day will be subjected to routine (every 4 hours) rechecks. Standard

reference checks will be measured in the normal analysis mode and will use the standards closest to 1 mg/cm^2 and 6 mg/cm^2. These standards will be measured five times for 30 seconds each. The average assay value will be compared to the check sample values obtained during method calibration. For 1 mg/cm^2 measurements, the method will be recalibrated if the difference between the average assay and the check sample assay is >0.1 mg/cm^2 and greater than three times the relative standard deviation. For 6 mg/cm^2 measurements, the method will be re-calibrated if the difference between the average assay and the check sample assay is >0.3 mg/cm^2 and greater than three times the relative standard deviation.

5.1.3 Dust Samples

Filter blanks and field duplicates will be collected with the vacuum dust samples. Filter blanks will be collected by containing an unused, pre-weighed filter and submitting to the laboratory for lead analysis.

Field blanks, laboratory blanks and spike samples will be collected with the dust wipe samples. Wipe blanks will be collected by submitting an un-opened wipe to the laboratory for lead analysis. Field blanks will be collected by opening a wipe, handling it with gloved hands and submitting it for analysis in an identical manner as other wipe samples.

A minimum of one filter blank, field wipe blank, laboratory wipe blank and spike will be analyzed with each brand of filter or wipe used for dust collection. In addition, filter blanks and vacuum dust field duplicates will be collected at a frequency of one per 20 dust (filter) samples. Wipe spike samples will be collected at a frequency of one per 20 dust wipe samples.

5.2 Laboratory Quality Control Samples

Laboratory quality control is necessary to control the analytical process, assess the precision and accuracy of analytical results and identify assignable causes for atypical analytical results. Each laboratory's standard operating procedures and QC practices vary depending on the analysis performed, as described below. The measurement objectives for the QC samples are included in Table 2-1.

5.2.1 ICP Soil Analyses

For soil analyses by ICP, initial and continuing calibration verifications will be performed. Calibration results must meet the laboratory's acceptance criteria. Accuracy will be confirmed through analysis of performance evaluation samples. The performance evaluation samples will be submitted blind to the laboratory and handled using the same preparation and analysis procedures as used for soil samples from the site. In addition, the laboratory will analyze and report the results from method blanks, laboratory control samples (LCS), analytical duplicates and post-digestion matrix spike (MS) samples.

5.2.2 Dust Analyses

For AA analyses (EPA Method 7420 or 7421) of dust samples, initial and continuing calibration verifications will be performed. The precision and accuracy of dust analyses will be controlled through the analysis of method blanks, calibration standard, LCS, MS and duplicates. The scale used to weigh filters will be calibrated, and calibration checks will be performed at least daily.

6.0 CALCULATION OF DATA QUALITY INDICATORS

The parameters that will be used to assess data quality include accuracy, precision, completeness, and representativeness. Definitions of these parameters are provided below. Since the data will be used to evaluate whether response actions are necessary, the accuracy and representativeness of the data will be considered the data quality parameters of most importance. The field and laboratory QC samples and methods which will be employed to assess the data quality are discussed in Section 5.

6.1 Precision

Precision (analytical error) is the level of agreement among repeated measurements of the same characteristic. Data precision will be assessed by determining the agreement among replicate measurements of the same sample and measurements of duplicate samples. As discussed in Section 5, these samples may include MS/MSD samples, LCS/LCSD samples, and analytical and field duplicates. The comparison is made by calculating the relative percent difference (RPD) given by:

$$RPD(\%) = \frac{|S_1 - S_2|}{(S_1 + S_2)/2} \times 100$$

where: $\mathbf{S_1}$ = measured sample concentration; and
$\mathbf{S_2}$ = known sample or duplicate concentration.

The goals for precision are provided in Section 2, Quality Assurance Objectives. When analytes are present at concentrations below or near the quantitation limit, precision will be evaluated using duplicates of a matrix-spike sample (if available).

6.2 Accuracy

Accuracy (bias) is the degree of difference between a measured or calculated value and the true value. Data accuracy will be evaluated using sample recoveries, expressed as the percentage of the true (known) concentration, from laboratory-spiked (including matrix spikes) and from standard reference

materials (i.e., laboratory control standards) generated by the analytical laboratory. Equipment rinsates and laboratory blanks will be analyzed to quantify artifacts introduced during sampling, transport, or analysis which may affect the accuracy of the data. The percentage recovery for spiked samples will be used to evaluate the accuracy of analyses as given by:

$$Recovery(\%) = \frac{A - B}{T} \times 100$$

where A = measured concentration of the spiked sample;
B = concentration of unspiked sample; and
T = amount of spike added.

In addition, the calibration results will be reviewed, if available, to verify that the sample concentrations are accurately measured by the analytical instrument. The project goals for accuracy are provided in Section 2, Quality Assurance Objectives.

6.3 Completeness

Completeness is the percentage of valid measurements (data points) obtained, as a proportion of the number of measurements (data points) planned for the investigation. Completeness is affected by such factors as sample-bottle breakage, and acceptance/non-acceptance of analytical results. Percentage completeness (C) is given by:

$$C(\%) = \frac{V}{P} \times 100$$

where V = number of valid measurements (data points) obtained by the investigation; and

P = number of measurements (data points) planned for the investigation.

Completeness goals are provided in Section 2, Quality Assurance Objectives.

6.4 Representativeness

Representativeness is a qualitative objective, defined as the degree to which data accurately and precisely represent the medium being studied. Representativeness is achieved by collecting a sufficient number of unbiased samples as specified in a sampling plan. Potential bias introduced by sampling methods will be evaluated based on blank results (equipment rinsate, field blanks, filter blanks and wipe blanks). Samples will be collected in accordance with the methods described in the Work Plan and this QAPP to ensure that the samples are representative of the environmental conditions. The samples will be contained, preserved, and stored appropriately, as discussed in Section 4. Laboratory blanks, calibration standards and methods, and QC sample results will also be reviewed, as described in Section 7, to ensure accurate and representative analytical results.

7.0 DATA REDUCTION, VALIDATION, AND REPORTING

Analytical and test results will be reviewed prior to entry into the project database. Review procedures for each type of data are given below.

7.1 Field XRF Data

Field measurements will be obtained from the field XRF instrument used to analyze interior/exterior paint samples. The documentation records will be reviewed for completeness by the operator of the XRF instrument following analysis and once their completeness has been confirmed the results will be reviewed by the Chemist or QAM to verify precision and accuracy of the results. Field duplicates and triplicate measurements, calibration records and results from reference-standard analyses will also be evaluated by the Chemist or QAM to assess whether the precision goals were obtained.

7.2 Environmental Laboratory Measurement Data

Environmental laboratory data will be obtained for the soil, dust and water samples. Laboratory calculations and data review will be performed by the laboratory in accordance with the specified analytical methods. The laboratory will review the results of laboratory QC analyses, instrument calibration and maintenance records, calibrations, and the record of sample custody (including holding times) within the laboratory. The laboratory data packages for soil, dust and water samples will include, at a minimum:

- Copies of the Chain-of–Custody records;
- Sample results and units;
- Date analyzed;
- Sample preparation and analytical method;
- Quantitation limits;
- Laboratory QC results (laboratory control samples, matrix spikes, analytical duplicate, as required by referenced methods); and
- Method blank result (if applicable).

The data package for the ICP data used to confirm the accuracy of soil XRF analyses will also include back-up information concerning instrument calibration, sample preparation, sample run logs, and analytical raw data.

Analytical data packages will be sent directly from the laboratory, in a hard-copy format, to the Chemist. Sample results will also be faxed or e-mailed to Study Director. The data will be reviewed by the Chemist, as described below, and will be reported as described in Section 7.5.

7.3 Environmental Laboratory Data Review and Evaluation

Upon receipt of the soil, dust and water analytical results and data packages from the laboratories, the data will be reviewed by the Chemist or the QAM for accuracy, precision, and completeness. The data will be validated using the Data Validation Checklists provided in Attachment B.

The validation process will include the review of the following items:

- Analyses performed and sample identifications conform to the information on the Chain-of-Custody record;
- Sample holding times met;
- Specified quantitation limits achieved;
- Laboratory QC results (laboratory control samples, matrix spikes, analytical duplicates, XRF standard) meet measurement objectives;
- Target analyte concentrations in method and equipment rinsates; and
- Reproducibility of field duplicate results.

Data that satisfy the quality assurance objectives for this project will be considered usable for comparison to the appropriate trigger criteria. If anomalies or nonconformances are discovered, the laboratory will be instructed to review the submitted data and the methods used to obtain the data. Laboratory QC or field QC sample results that do not meet the QA objectives will be evaluated to determine whether the sample data are usable. Corrective actions, as necessary, will be implemented per the procedures described in Section 9.

7.4 Data Management and Reporting

The electronic database will be the primary tool for tracking environmental testing results and the property's remediation status. Information to be included in the electronic database is described in Section 8 of the Work Plan. Field measurements and laboratory analytical results that have been checked and validated, respectively, will be entered into an electronic database and will include the following:

- Sample location;
- Sample identification;
- Date of sample collecton;
- Analytical method;
- Analytes and concentrations;
- Quantitation limits;
- Laboratory qualifiers; and
- Validation qualifiers (soil, dust and water samples only).

This information, with exception of the validation qualifiers, will either be hand-entered into the database or imported using electronic files supplied by the laboratories. The validation qualifiers will be hand-entered from the validation checklists prepared be the Chemist or QAM. All hand-entered entries will be checked (100 percent) for accuracy. All data merged from electronic files will also be reviewed for accuracy and completeness.

The database will be routinely updated and will allow for data to be used for statistical analyses or calculations. Hard copies of the data packages and validation checklists will also be kept in the individual property file.

8.0 TECHNICAL SYSTEM AUDITS

The purpose of a quality assurance audit is to provide an assessment of the ability of the measurement system to produce data of a quality commensurate with the project's measurement objectives. In addition to documenting the performance of the sampling, analytical and data management systems, the audit provides a mechanism whereby inadequacies in the measurement systems can be identified and necessary corrective actions implemented in a timely manner.

Internal technical systems audits of field and/or laboratory activities may be performed during the course of the project. Internal audits will be performed by the QAM.

An individual audit plan will be developed to provide a basis for each audit. This plan will identify the audit scope, activities to be audited, audit personnel, any applicable documents, and the schedule. Checklists will be prepared by the auditors to structure the review process and document the results of the audit.

8.1 Systems Audits

A technical systems audit is an on-site, qualitative review of the various aspects of a total sampling and/or analytical system. It consists of observations and documentation of all aspects of the measurement effort, including adherence to approved sampling and analysis plan, quality assurance plans and standard operating procedures. A systems audit includes review of record keeping and data handling systems, including:

- Calibration documentation;
- Completeness of data forms and notebooks;
- Data review and validation procedures;
- Data storage and filing procedures;
- Sample custody procedures;
- Documentation of QC data;
- Documentation of maintenance activities;
- Corrective action reporting procedures.

A technical systems audit will include an audit plan, schedule, audit scope and checklists. An audit report will be prepared for the construction oversight manager with recommendations for corrective action, if needed.

8.2 Frequency and Scheduling

The necessity for internal systems audits will be determined by the QAM. Audits will be scheduled at intervals appropriate to assure quality control for the activity type or task in progress and will be planned to coincide with appropriate activities on the project calendar. Such scheduled audits may be supplemented by additional audits for one or more of the following reasons:

- When significant changes are made in the QA/QC plan;
- When it is necessary to verify that corrective action has been taken on a nonconformance reported in a previous audit; or
- When requested by the Study Director.

8.3 Audit Reports

During an audit and upon its completion, the auditor may discuss the findings with the individuals audited, and discuss and agree on corrective actions to be initiated. Minor administrative findings that can be resolved to the satisfaction of the auditor during an audit may not be cited as items requiring corrective action. Findings that are not resolved during the course of the audit, and findings affecting the overall quality of the project, will be noted on the audit checklists and included in the audit report.

Audit results will be reported to the Program Administrator and filed with project records. The Program Administrator will submit a reply to the audit report addressing each finding cited, the corrective action(s) to be taken and a schedule for implementation. This reply will be sent to the auditor and will be filed in the project file. The findings cited in the audit and addressed in the reply will be treated as nonconformances and will become subject to review at the time of the next audit.

9.0 CORRECTIVE ACTION

Nonconforming equipment, items, activities, conditions and unusual incidents that could affect compliance with project quality assurance goals will be identified, controlled and reported in a timely manner. For the purpose of this QAPP, a nonconformance is defined as a malfunction, failure, deficiency, or deviation which renders the quality of an item unacceptable or indeterminate. Project staff, a project subcontractor, or analytical laboratory personnel will inform the Program Administrator or Chemist (as applicable) immediately when a nonconformance is identified or suspected. The Chemist or Program Administrator will in turn notify the QAM to discuss the nonconformance and identify an appropriate response (i.e., "corrective action").

If the analytical results of laboratory control samples fall outside of the project's control limits, corrective actions will be initiated by the laboratory. The QAM will also review field data and narrative records related to the samples in question for the potential source of the error. If the laboratory cannot correct the situation that caused the nonconformance and an out-of-control situation continues to occur or is expected to occur, the laboratory will immediately contact the Study Director or the QAM. Completion of corrective action should be evidenced by data once again falling within prescribed quality control limits. If an error in laboratory procedures or sample collection and handling procedures cannot be found, the Study Director, or designee, will review the results and assess whether reanalysis or resampling is required.

10.0 QUALITY ASSURANCE REPORTS

Effective management of the environmental sampling effort requires timely assessment and review of field activities which in turn requires effective interaction and feedback between the Program Administrator, Project Manager and QAM.

The Program Administrator will be responsible for documenting any conditions or situations that might adversely affect data quality. These conditions should be communicated in writing to the QAM. In addition, routine quality assurance reports may be prepared by the Program Administrator for the QAM. These reports will include elements such as project activities, modifications to or deviations from the Work Plan and any corrective actions taken, status of unresolved problems and audit results. These reports may be provided as informal memos or other documented presentations.

11.0 REFERENCES

EPA, 2003. Community Health Program Design Work Plan, prepared by MFG, Inc. and Tetra Tech EMI for U.S. EPA, Region 8, Denver, CO, March 2003.

EPA, 1998. EPA Test Methods for Evaluating Solid Waste Physical/Chemical Methods, SW-846, Draft Update IVA.

EPA, 1997. EPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Update III.

EPA, 1983. Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020.

TABLES

TABLE 2-1

QUANTITATIVE MEASUREMENT OBJECTIVES FOR ANALYSES OF SOIL, PAINT, DUST AND WATER SAMPLES

Sample Matrix (Parameter)	Analytical Method	Precision	Accuracy	Quantitation Limit	Completeness
Soil (Lead and Arsenic)	ICP (EPA Methods 3052 and 6010B)	LCS duplicate RPD<20% MS duplicate RPD <25%	PE sample recovery = 80 to 120% LCS recovery = 80 to 120% MS recovery = 75 to 125%	Pb: 10 mg/Kg As: 5 mg/Kg	95%
Paint (Lead)	XRF (Field)	Triplicate measurement standard deviation $\pm$0.1 mg/cm^2. Reference standard sample replicate deviation less than 0.1 mg/cm^2 or less than 0.3 mg/cm^2 (see Section 5.1.3).	Mean of reference standards within 25% of true value Refer to SOP for Paint Testing and Assessment for calibration verification specifications	0.3 mg/cm^2	90%
Dust collected with air-sampling pump (Lead)	AA (EPA Method 7420 or 7421)	Analytical duplicate RPD <15% Field duplicate RPD <50%	Calibration Verification 90 to 110% LCS recovery = 85 to 115% Filter blank non-detect	400 mg/Kg	90%
Dust wipes (Lead)	AA (EPA Method 7420 or 7421)	Analytical duplicate RPD <15%	Calibration Verification 90 to 110% LCS recovery = 85 to 115% Spike recovery = 80 to 120 %	25 µg/ft^2	90%
Dust Wipes (Arsenic)	AA (EPA Method 7060 or 7061A)	Analytical duplicate RPD <15%	Calibration Verification 90 to 110% LCS recovery = 85 to 115%	10 µg/ft^2	90%

TABLE 4-1

ANALYTICAL METHODS, HOLDING TIMES, AND QUANTITATION LIMITS

Sample Type	**Parameter**	**Analytical Method** (digestion/analysis)	**Target Quantitation Limit**	**Container & Preservation**	**Storage**	**Holding Time**
Soil[1]	Arsenic	EPA 3052/6010B[2]	5 mg/Kg	clean bags or glass jars; 200 grams	N/A	6 months
	Lead	EPA 3052/6010B[2]	10 mg/Kg			
Interior/Exterior Paint	Lead	EPA 6200[3]	0.3 mg/cm^2 (low-range calibration model)	N/A	N/A	6 months
Dust (filters and wipes)	Lead	EPA 3050B[2]/EPA 7420 or 7421[2]	2,000 mg/Kg (filters)	filter cassettes w/in plastic bags	N/A	6 months
			25 µg/ft^2 (wipes)	wipe container; plastic bag or tube		
Dust (wipes)	Arsenic	EPA 3050B[2]/EPA 7060 or 7061A[2]	15 µg/ft^2 (wipes)	wipe container; plastic bag or tube	N/A	6 months

[1] Soil samples will be dried and sieved prior to splitting for analysis.

[2] EPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Update III, 1997. A complete (hydrofluoric acid) digestion will be performed prior to ICP analysis of soil samples.

[3] EPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Draft Update IVA, 1998.

N/A = Not applicable

TABLE 5-1

TYPES AND FREQUENCY OF QC SAMPLES COLLECTED WITH ENVIRONMENTAL SAMPLES

Environmental Sample Type	QC Sample Type					
	Equipment Rinsate	**Filter/ Wipe Blank**	**Performance Evaluation Sample**	**Spike**	**Field Blank**	**Field Duplicate**
Soil Samples	1 per property	NA	1 per 20 samples	NA	NA	1 per property
Interior/Exterior Paint	see Section 5.1.3					
Dust (filter)	NA	1 per batch of 50	NA	NA	1 per batch of 50	1 per 20 samples
Dust (wipe)	NA	1 per brand	NA	1 per 20 samples	1 per brand	NA

NA = Not applicable/not necessary to collect for the sample type.

ATTACHMENT A

Standard Operating Procedure for Soil Sample Preparation

TECHNICAL STANDARD OPERATING PROCEDURE

Date: August 26, 1999 SOP No. MK-VBI70-05

Title: **Sample Preparation**

APPROVALS:

Author: Morrison Knudsen Corporation Date: August 26, 1999

SYNOPSIS: Provides procedures and instructions for the preparation of soil samples for on-site XRF and off-site laboratory analysis.

Received by QA Unit

REVIEWS:

TEAM MEMBER	SIGNATURE/TITLE	DATE
EPA Region 8	[illegible] / RPM	8/27/99
Morrison Knudsen Corp.	[illegible] / QA Coordinator	8/26/99

REV.	DATE	REVISION DESCRIPTION
1	8/4/99	Grinding of bulk soil prior to XRF analysis added
2	8/26/99	Sieving sample to be performed after drying instead of prior to drying

TECHNICAL STANDARD OPERATING PROCEDURE
SAMPLE PREPARATION

1.0 PURPOSE

The purpose of this procedure is to provide instructions to Morrison Knudsen personnel assigned to the VB/I-70 Project and their subcontractors for the preparation of soil samples.

2.0 SCOPE

This procedure covers activities associated with preparation of soil samples for subsequent analysis by X-ray fluorescence spectrometry, inductively coupled plasma spectroscopy, and/or bioavailability tests.

3.0 REFERENCES

Method 6200 Field Portable X-Ray Fluorescence Spectrometry For The Determination Of Elemental Concentrations In Soil And Sediment

Spectrace QuanX Laboratory X-Ray Fluorescence Analyzer Standard Operating Procedure

Standard Operating Procedure for Chain of Custody and Sample Handling, SOP No. MK-VBI70-02

Standard Operating Procedure for Equipment Decontamination, SOP No. MK-VBI70-07

Standard Operating Procedure for Investigation Derived Waste Management, SOP No. MK-VBI70-04

4.0 DEFINITIONS

None

5.0 RESPONSIBILITIES

The **Sample Preparation Technician** will be responsible for overseeing sample receipt and chain of custody both before and after the preparation process, and implementation of the sample preparation process.

The **Field Supervisor** will be responsible for quality and production of field laboratory operations.

The **Site Health and Safety Officer** will be responsible for verifying implementation of this procedure using safe laboratory practices.

The **Field Quality Assurance Coordinator** will be responsible for overseeing proper implementation of the quality control procedures, including tracking of blind standard samples, tracking of confirmation samples for off-site laboratory analysis, and specification of sample labels to be used for blind split samples.

The **Site Manager** will be responsible for ensuring that personnel are properly trained to this procedure.

6.0 REQUIREMENTS

6.1 General

6.1.1 Sample preparation activities shall be performed only in areas designated for each activity.

6.1.2 Eating and smoking are prohibited in all areas of the sample preparation area.

6.1.3 Samples generally will be prepared in batches consisting of twenty field samples.

6.1.4 All non-dedicated equipment used during sample preparation must be decontaminated prior to use as described in the Decontamination SOP (MK-VBI70-07).

6.2 Equipment

Sample drying trays
Permanent Marking pen
General purpose laboratory oven
#10 mesh stainless steel sieve
#60 mesh stainless steel sieve
Sample bags
XRF cups
Mylar
Spatulas
Stainless steel spoon
Analytical balance accurate to 0.1 g, range of 0.1 g to 1000 g
Mortar and pestle, 140 mL or greater (or mill equipped with Burundum cylinders)

6.3 Soil Mixing

6.3.1 Select samples to be prepared. Prior to opening the sample bag, knead the contents to break up soil clumps and mix approximately two minutes or until the soil appears to be well homogenized. If the kneading process produces cohesive clumps, that observation will be noted in the Preparation Log.

6.3.2 Mix by turning the bag end over end slowly a minimum of ten times, then using a large stainless steel spoon, stir the contents of the sample bag thoroughly.

6.4 Bulk Soil Drying

6.4.1 Set the oven temperature to 103-105 C (not to exceed 115 C). Record the oven temperature at least once daily in the Sample Preparation logbook.

6.4.2 Pour approximately 6 ounces of the sample into a pre-labeled (3-XXXXX-R) drying pan and pour the remainder of the soil into a pre-labeled bag for archiving (3-XXXXX-RA) under chain of custody documentation. Spread the sample on the drying tray in an even layer to promote even drying.

6.4.3 Check the oven temperature to verify proper temperature has been reached. Place the drying trays containing the samples into the oven(s). Leave the samples in the oven until completely dry as defined by a stable sample weight. Establish the drying time initially by recording weights for samples with varying soil moisture: 1) before drying, 2) at estimated completion, and 3) following an additional 15 minute drying time to confirm stable weight. Verify sample dryness for all samples by squeezing a portion of the sample between a gloved thumb and forefinger. Sample dryness is indicated by a lack of cohesiveness in the soil. Document the sample drying time for each sample on the Sample Preparation Log.

6.4.4 When samples are dry, remove from the oven and place in the ventilation area. **Before placing samples at the ventilation area, verify that the blower is turned on.**

6.5 Bulk Sieving

6.5.1 Pour the sample from the drying pan onto a #10 sieve attached to a catch pan. Shake the sieve to pass the sample through the sieve into the catch pan. Dispose of any sample that did not pass through the sieve into the waste soil receptacle.

6.5.2 Place the sieved sample into a pre-labeled (3-XXXXX-B) sample bag. Completely seal the bag, then mix by turning the bag end over end slowly a minimum of ten times.

6.5.3 Document the date sieving was performed for each sample in the Sample Preparation Log Sheet.

6.6 Bulk Soil Grinding and Cupping

6.6.1 Using a spatula, stir the contents of the sample bag thoroughly, then transfer approximately 10 grams to the mortar.

6.6.2 Grind the soil using the pestle for ten minutes or until all material is evenly ground to a powder. If larger grained vegetation or soil materials remain, sieve the sample through a #60 sieve.

6.6.3 Using a spatula, fill the pre-labeled (3-XXXXX-B) XRF cup with soil from the mortar, filling cup ½ to ¾ full. Secure a piece of Mylar film over the top of the cup to seal.

6.6.4 Prepare XRF quality control samples as described in Section 6.8.2. Dispose of any unused ground soil into the waste soil receptacle.

6.7 Drying and Sieving Fine Fraction Soil

6.7.1 Selected archived bulk soil samples will be dried at a low temperature and sieved to isolate the naturally occurring fine fraction using a #60 mesh sieve.

6.7.2 Set the oven temperature to 45-48 C (not to exceed 50 C).

6.7.3 Pour approximately 8 ounces of soil onto a pre-labeled (3-XXXXX-RA) drying tray and spread in an even layer to promote even drying. Return the remaining soil to the archive.

6.7.4 Check the oven temperature to verify proper temperature has been reached. Place the drying trays containing the samples into the oven(s). Leave the samples in the oven until completely dry as defined by a stable sample weight. Establish the drying time initially by recording weights for samples with varying soil moisture: 1) before drying, 2) at estimated completion, and 3) following an additional 15 minute drying time to confirm stable weight. Confirm sample dryness for all samples by squeezing a portion of the sample between a gloved thumb and forefinger. Sample dryness is indicated by a lack of

cohesiveness in the soil. Document the sample drying time for each sample on the Sample Preparation Log.

6.7.5 When samples are dry, remove from the oven and place in the ventilation area. **Before placing samples at the ventilation area, verify that the blower is turned on.**

6.7.6 Pour the dried sample onto a #60 sieve attached to a catch pan. Shake the sieve to pass the sample through the sieve into the catch pan. Dispose of any sample that did not pass through the sieve into the waste soil receptacle. Place the sample in the catch pan into a pre-labeled (3-XXXXX-F) sample bag. Completely seal the bag then mix by turning the bag end over end slowly a minimum of ten times. Using a spatula, stir the soil thoroughly and then fill the pre-labeled (3-XXXXX-F) XRF cup with soil from the sample bag, filling cup ½ to ¾ full. Secure a piece of Mylar film over the top of the cup to seal.

6.8 Quality Control Sample Preparation Procedure

6.8.1 Sample preparation will be performed in an area separate from the XRF operations. The sample preparation technician who prepares sample batches containing blind quality control samples may not perform analysis on those samples. The XRF analyst will not observe the sample preparation and will not view the preparation logs in order to maintain sample anonymity to the analyst.

6.8.2 Prepare each of following quality control samples at rate of one per twenty field samples by filling two XRF cups with soil (following sample drying, sieving, mixing and grinding procedures):

- One laboratory duplicate, labeled 3-XXXXX-B(or -F)-DUP
- One blind field split, labeled with a unique sample ID from the labels designated for QC samples.

6.8.3 Prepare confirmation samples at a rate specified by the EPA Remedial Project Manager (initially one per three field samples) by transferring approximately 4 ounces from the

prepared field sample bag (following drying, bulk sieving, fine sieving where applicable, and mixing; grinding of confirmation samples is not necessary) into a second bag and labeling the confirmation sample with the identical sample identification (i.e., 3-XXXXX-B or 3-XXXXX-F). The confirmation sample will be submitted under chain of custody to an off-site laboratory for analysis by Method 6010B (ICP) as described in the Chain of Custody and Sample Handling SOP (MK-VBI70-02).

6.8.4 Document the laboratory duplicate in the "Notes" column of the Field Sample Preparation Log. Document the blind field split Sample ID and original Sample ID on the QC Data Sheet for Blind Soil Field Splits.

6.8.5 Prepare blind standards as directed by the Field Quality Assurance Coordinator by filling a pre-labeled XRF cup with soil from the blind standard sample provided. If the standard is not received pre-dried, sieved and ground, the sample will be prepared in accordance with mixing, drying, sieving, and grinding procedures detailed above in Section 6.3, 6.4, 6.5, and 6.6. Label the cup with a unique sample ID from the list of sample labels designated for QC samples. Document the blind standard when prepared on the Performance Evaluation Standard (Blind Standard) QC Data Sheet.

6.8.6 Place 18 XRF cups for a single sample run into a staging container for transfer to the XRF Analyst (the analyst will complete the run with addition of a standard reference material and instrument blank).

6.9 Investigation Derived Waste Management

6.9.1 Remove the sample receptacle from under the ventilation hood and dispose of its contents into the waste soil drum when full and at the end of each day.

6.9.2 Place all non-dedicated sample drying trays, sieves, catch pans, spatulas, and spoons used during sample preparation in the receptacles for equipment decontamination.

7.0 ATTACHMENTS

Field Sample Preparation Logbook Sheet

QC Data Sheet, Blind Soil Field Splits

QC Data Sheet, Blind Performance Evaluation Samples

TECHNICAL STANDARD OPERATING PROCEDURE
SAMPLE PREPARATION

ATTACHMENTS

FIELD SAMPLE PREPARATION LOGBOOK SHEET

QC DATA SHEET, BLIND SOIL FIELD SPLITS

QC DATA SHEET, BLIND PERFORMANCE EVALUATION SAMPLES

VB170 Field Sample Preparation Logbook Sheet

Sample ID	Prep Batch Number	Confirmation Sample	Drying						Sieving			Notes
			Date/Time Drying Begun	Initial Weight	Date/Time Drying Estimated to be Complete	Weight	Date/Time Drying Complete	Final Weight	Date Sieved	Particle Size Fraction		
										Bulk (<2mm)	Fine (<250 μm)	

VBI70 Field Sample Preparation Logbook Sheet

Sample ID	Prep Batch Number	Drying		Sieving			Confir-mation Sample (Y/N)	Notes
		Date/Time Drying Begun	Date/Time Drying Complete	Date Sieved	Particle Size Fraction			
					Bulk (<2mm)	Fine (<250μm)		

VBI70 QC Data Sheet
Blind Field Split Samples

Date	Sample ID	Sample Class	Original Sample	Prepared By	Notes
		BD			
		BD			
		BD			
		BD			
		BD			
		BD			
		BD			
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VBI70 QC Data Sheet
Blind Standard

Date	Sample ID	Sample Class	Lot Number	Analysis Type		Prepared By
				XRF	Confirmation	
		PE				
		PE				
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		PE				
		PE				
		PE				
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		PE				
		PE				
		PE				
		PE				

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ATTACHMENT B

DATA VALIDATION CHECKLISTS

Vasquez Boulevard and I-70 Site
Environmental Samples - Data Validation Checklist

MFG Project No.
Sampling Dates:
Sample Type:
Property ID:

Laboratory:
Lab. Project No.:
Reviewer:

	Yes	No	NA
Data Completeness			
Is the chain-of-custody form complete and correct?			
Were all requested analyses performed?			
Were additional analyses requested and performed?			
Were any sample names changed or incorrect?			

Samples affected *Qualification action*

Holding Times			
Were samples properly preserved? (NA if no preservation required)			
Were holding times met for analysis and reanalysis?			

Samples affected *Qualification action*

Instrument Calibration (ICV and CCV)			
Are initial and continuous calibration verifications (ICV and CCV) within limits (90 - 110%)?			
Recalculate one percent recovery [%R = found/true)*100]. Lab calculation correct?			

Samples affected *Qualification action*

Calibration Control Blanks (ICB and CCB)			
Were initial control blank (ICB) and continuing calibration blank (CCB) analyzed after ICV and CCV?			
Are ICB and CCB within limits?			

Samples affected *Qualification action*

Matrix Spikes/Matrix Spike Duplicates

Were field ¨ or lab ¨ spike samples analyzed?

Were percent recoveries (50 to 150%) and relative percent differences (±35%) within limits? (see attached for calculation)

Samples affected *Qualification action*

Method Verification

Are laboratory control sample (LCS) recoveries (80 to 120%) and relative percent difference (±35%) results within limits?

Are preparation blank results within limits?

Samples affected *Qualification action*

Compound Identification and Quantitation

Were any samples diluted?

Were project-specified reporting limits met?

Were laboratory supplied data qualifiers present where needed?

Samples affected *Qualification action*

Equipment Blank

Were analytes detected in the equipment blank?

List analytes and concentrations:

Samples affected *Qualification action*

Field Duplicates

Was a field duplicate sample collected?

What is the relative percent difference in results (each parameter)? (see attached for calculation)

Samples affected *Qualification action*

Comments:

Calculation results (RPDs, % recovery, etc.):

Signature (data validator):_____
Date:_____

Guidelines:

1) USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, February 1994.
2) MFG, Inc., 2002, Community Health Program Pilot Study Work Plan

Calibration Control Blanks:
Sample results >MDL but <5 times the amount in any blank should be U qualified.

Data Qualifier Definitions:
U: parameter analyzed but not detected above the reported value (i.e., sample detection limit).
UJ: parameter analyzed but not detected above the method detection limit, and reported value is an estimated value which may be inaccurate or imprecise
J: estimated result value
R: result rejected for use (parameter may or may not be present)

Validation Flag Results

Sample ID/Lab Sample ID	Parameter	Result	Units	Flag

APPENDIX D

CDPHE AIR QUALITY CONTROL DIVISION REGULATION NO. 19

Regulation No. 19

Lead-Based Paint Abatement

Colorado Air Quality
Control Commission

Colorado Department
of Public Health
and Environment

Regulation No. 19
Lead-Based Paint Abatement

I. Scope and Applicability 1
II. Definitions 3
- II.A. Incorporated Materials 3
- II.B. Terms 3

III. Training and Certification Requirements 13
- III.A. Accreditation of Training Programs: Target Housing and Child-occupied Facilities 13
  - III.A.1. Scope 13
  - III.A.2. Application Process 13
  - III.A.3. Requirements for the Accreditation of Training Programs 15
  - III.A.4. Minimum Training Curriculum Requirements 18
  - III.A.5. Requirements for the Accreditation of Refresher Training Programs 21
  - III.A.6. Re-accreditation of Training Programs 23
  - III.A.7. Training Program Recordkeeping Requirements 24
- III.B. Certification of Individuals and Firms Engaged in Lead-based Paint Activities: Target Housing and Child-occupied Facilities 25
  - III.B.1. Certification of Individuals 25
  - III.B.2. Inspector, Risk Assessor or Supervisor 26
  - III.B.3. Abatement Worker and Project Designer 28
  - III.B.4. Certification Based on Prior Training 29
  - III.B.5. Re-certification 30
  - III.B.6. Certification of Firms 30

IV. Inspections, Lead-Hazard Screens, and Risk Assessments 33
- IV.A. Inspection 33
- IV.B. Lead Hazard Screen 34
- IV.C. Risk Assessment 35
- IV.D. Collection and Laboratory Analysis of Samples 38
- IV.E. Composite Dust Sampling 38
- IV.F. Recordkeeping 38
- IV.G. Alternative Procedures and Variances 38
- IV.H. Determinations 39

V. Abatement Requirements 41
- V.A. General Requirements 41
- V.B. Work Practice Restrictions and Prohibitions 42
- V.C. Interior Abatement Requirements (excluding window abatements) 43
- V.D. Exterior Abatement Requirements 46
  - V.D.1. Exterior Abatement Project Restrictions 46
  - V.D.2. Containment Requirements 46
- V.E. Window Abatement 49
- V.F. Soil Abatement 50
- V.G. Encapsulation and Enclosure Requirements 50
- V.H. Cleaning 51

V.I. Coating and Sealing 52
V.J. Final Clearance 53
V.K. Waste Handling 56
V.L. Recordkeeping 57
V.M. Alternative Procedures and Variances 57
VI. Delegation to Local Health or Building Departments 59
VII. Statement of Basis, Specific Statutory Authority, and Purpose 61
VII.A. August 21, 1998 61
VII.B. Revisions to Regulation No. 19; December 19, 2002 66
Appendix A: Number of Units to be Tested in Pre-1978 Multifamily Developments 69

Adopted: August 21, 1998
Effective: October 29, 1998

Adopted: December 19, 2002
Effective: March 2, 2003

I. Scope and Applicability

I.A. This Regulation No. 19 contains procedures and requirements for the accreditation of lead-based paint activities training programs, procedures and requirements for the certification of individuals and firms engaged in lead-based paint activities, and work practice standards for performing such activities. This Regulation No. 19 also requires that, except as discussed below, all lead-based paint activities, as defined in this Regulation No. 19, be performed by certified individuals and firms.

I.B. This Regulation No. 19 applies to all individuals and firms who are engaged in lead-based paint activities as defined in Section II.B.47. of this Regulation No. 19, except persons who perform these activities within residential dwellings that they own, unless the residential dwelling is occupied by a person or persons other than the owner or the owner's immediate family while these activities are being performed, or unless a child residing in the building has been identified as having an elevated blood lead level.

I.C. This Regulation No. 19 applies to all lead-based paint activities that are performed in target housing and child-occupied facilities and to buildings that will be converted to target housing or child-occupied facilities.

I.D. This Regulation No. 19 applies to all projects designed to permanently eliminate lead-based paint hazards in target housing and child-occupied facilities. This Regulation No. 19 does not apply to renovation, remodeling, landscaping, or other activities when such activities are not intended nor designed to permanently eliminate lead-based paint hazards but instead are intended to repair, restore or remodel a given structure or dwelling.

I.E. Each department, agency, and instrumentality of the executive, legislative, and judicial branches of the Federal and State government having jurisdiction over any property or facility, or engaged in any activity resulting, or which may result, in a lead-based paint hazard, and each officer, agent, or employee thereof shall be subject to, and comply with, all State and local requirements, both substantive and procedural, including the requirements of this Regulation No. 19 regarding lead-based paint, lead-based paint activities, and lead-based paint hazards.

I.F. While this Regulation No. 19 establishes specific requirements for performing lead-based paint activities should they be undertaken, nothing in this Regulation No. 19 requires that the owner or occupant undertake any particular lead-based paint activity.

I.G. [Reserved]

II. Definitions

II.A. Incorporated Materials

Some documents may be noted in this Regulation No. 19 as being incorporated by reference. Materials incorporated by reference are those in existence as of the dates indicated and do not include later amendments. The material incorporated by reference is available for public inspection during regular business hours at the Office of the Commission, located at 4300 Cherry Creek Drive South, Denver, Colorado 80246, or may be examined at any state publications depository library. Parties wishing to inspect these materials should contact the Technical Secretary of the Commission, located at the Office of the Commission.

II.B. Terms

Any terms that are not defined below are given the same meaning as in the Air Quality Control Commission's Common Provisions Regulation.

II.B.1. Abatement means any measure or set of measures that will contain or permanently eliminate lead-based paint hazards, including:

II.B.1.a. the removal of lead-based paint and lead-contaminated dust;

II.B.1.b. the permanent containment of lead-based paint;

II.B.1.c. the encapsulation of lead-based paint;

II.B.1.d. the replacement or enclosure of lead-painted surfaces or fixtures;

II.B.1.e. the removal or covering of lead-contaminated soil; and

II.B.1.f. all preparation, cleanup, disposal, monitoring, and clearance testing activities associated with the measures described in this Section II.B.1., of this Regulation No. 19.

II.B.2. Accredited training program means a training program that has been accredited by the division pursuant to Section III. (Training and Certification Requirements) of this Regulation No. 19 to provide training for individuals engaged in lead-based paint activities.

II.B.3. Adequate quality control means a plan or design which ensures the authenticity, integrity, and accuracy of samples, including dust, soil, and paint chip or paint film samples. Adequate quality control also includes provisions for representative sampling.

II.B.4. Arithmetic mean means the algebraic sum of data values divided by the number of data values (e.g., the sum of the concentration of lead in several soil samples divided by the number of samples).

II.B.5. Certified firm means a company, partnership, corporation, sole proprietorship, association, or other business entity that performs lead-based paint activities to which the division has issued a certificate of approval pursuant to Section III. (Training and Certification Requirements) of this Regulation No. 19.

II.B.6. Certified inspector means an individual who has been trained by an accredited training program, as defined by this Regulation No. 19, and certified by the division pursuant to Section III. (Training and Certification Requirements) of this Regulation No. 19 to conduct inspections. A certified inspector also samples for the presence of lead in dust and soil for the purposes of abatement clearance testing.

II.B.7. Certified abatement worker means an individual who has been trained by an accredited training program, as defined by this Section II. (Definitions) of this Regulation No. 19, and certified by the division pursuant to Section III. (Training and Certification Requirements) of this Regulation No. 19 to perform abatement.

II.B.8. Certified project designer means an individual who has been trained by an accredited training program, as defined by this Section II. (Definitions) of this Regulation No. 19, and certified by the division pursuant to Section III. (Training and Certification Requirements) of this Regulation No. 19 to prepare abatement project designs, occupant protection plans, and abatement reports.

II.B.9. Certified risk assessor means an individual who has been trained by an accredited training program, as defined by this Section II. (Definitions) of this Regulation No. 19, and certified by the division pursuant to Section III. (Training and Certification Requirements) of this Regulation 19 to conduct risk assessments. A risk assessor also samples for the presence of lead in dust and soil for the purposes of abatement clearance testing.

II.B.10. Certified supervisor means an individual who has been trained by an accredited training program, as defined by this Section II. (Definitions) of this Regulation No. 19, and certified by the division pursuant to Section III. (Training and Certifications Requirements) of this Regulation No. 19 to supervise and conduct abatements, and to prepare occupant protection plans and abatement reports.

II.B.11. Chewable surface means an interior or exterior surface painted with lead-based paint that a young child can mouth or chew. A chewable surface is the same as an "accessible surface" as defined in 42 U.S.C. 4851b(2). Hard metal substrates and other materials that cannot be dented by the bite of a young child are not considered chewable.

II.B.12. Child-occupied facility

II.B.12.a. Child-occupied facility means a building or portion of a building that:

II.B.12.a.(i) was constructed prior to 1978;

II.B.12.a.(ii) is visited regularly by the same child who is under 7 years of age;

II.B.12.a.(iii) is visited by such child on two or more days within any week, consisting of the period from Sunday through the following Saturday, with each such visit totaling six or more hours; and

II.B.12.a.(iv) is visited by such child a total of at least sixty hours in one year.

II.B.12.b. "Child-Occupied Facility" includes, but is not limited to, any day-care center, preschool, or kindergarten classroom constructed prior to 1978.

II.B.13. Clearance levels are values that indicate the maximum amount of lead permitted in dust on a surface following completion of an abatement activity.

II.B.14. Commission means the Air Quality Control Commission as created by Section 25-7-104, C.R.S.

II.B.15. Common area means a portion of a building that is generally accessible to all occupants. Such an area may include, but is not limited to, hallways, stairways, laundry and recreational rooms, playgrounds, community centers, garages, and boundary fences.

II.B.16. Common area group means a group of common areas that are similar in design, construction, and function. Common area groups include, but are not limited to hallways, stairwells, and laundry rooms.

II.B.17. Component or building component means specific design or structural elements or fixtures of a building, residential dwelling, or child-occupied facility that are distinguished from each other by form, function, and location. These include, but are not limited to, interior components such as: ceilings, crown molding, walls, chair rails, doors, door trim, floors, fireplaces, radiators and other heating units, shelves, shelf supports, stair treads, stair risers, stair stringers, newel posts, railing caps, balustrades, windows and trim (including sashes, window heads, jambs, sills or stools and troughs), built in cabinets, columns, beams, bathroom vanities, counter tops, and air conditioners; and exterior components such as: painted roofing, chimneys, flashing, gutters and downspouts, ceilings, soffits, fascias, rake boards, corner boards, bulkheads, doors and door trim, fences, floors, joists, lattice work, railings and railing caps, siding, handrails, stair risers and treads, stair stringers, columns, balustrades, window sills or stools and troughs, casings, sashes and wells, and air conditioners.

II.B.18. Concentration means the relative content of a specific substance contained within a larger mass, such as the amount of lead (in micrograms per gram or parts per million by weight) in a sample of dust or soil.

II.B.19. Containment means a process to protect workers and the environment by controlling exposures to the lead-contaminated dust and debris created during an abatement.

II.B.20. Course agenda means an outline of the key topics to be covered during a training course, including the time allotted to teach each topic.

II.B.21. Course test means an evaluation of the overall effectiveness of the training which shall test the trainees' knowledge and retention of the topics covered during the course.

II.B.22. Course test blue print means written documentation identifying the proportion of course test questions devoted to each major topic in the course curriculum.

II.B.23. Deteriorated paint means any interior or exterior paint or other coating that is peeling, chipping, chalking or cracking, or any paint or coating located on an interior or exterior surface or fixture that is otherwise damaged or separated from the substrate.

II.B.24. Discipline means one of the specific types or categories of lead-based paint activities identified in this Regulation No. 19 for which individuals may receive training from accredited programs and become certified by the division. For example, “abatement worker“ is a discipline.

II.B.25. Distinct painting history means the application history, as indicated by its visual appearance or a record of application, over time, of paint or other surface coatings to a component or room.

II.B.26. Disturb means:

II.B.26.a. In the case of paint, any activity that causes cracking, flaking, chipping, peeling, or separation of the paint from the substrate of a building component. Activities that disturb paint include, but are not limited to, scraping, grinding, sanding, abrasive blasting, drilling, sawing, or the application of chemical strippers; encapsulation and enclosure systems that are applied to surfaces where the paint is not deteriorated typically does not disturb the paint.

II.B.26.b. In the case of dust or soil, any activity that causes the movement of dust or soil, such as, but not limited to, sweeping, vacuuming, digging and sifting.

II.B.27. Division means the Air Pollution Control Division in the Department of Public Health and Environment.

II.B.28. Documented methodologies means division recognized methods or protocols used to sample for the presence of lead in paint, dust, and soil. Documented methodologies include the U.S. Department of Housing and Urban Development (HUD) Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing (June 1995); the EPA Guidance on Residential Lead-Based Paint, Lead Contaminated Dust, and lead-contaminated soil (Federal Register, Volume 60, No. 175, pp 47247-47257, Monday, September 11, 1995 "Guidance on Identification of Lead-Based Paint Hazard; Notice"); the EPA Residential Sampling for Lead: Protocols for Dust and Soil Sampling (EPA report number 747-R-95-001, March 1995); and other methods and guidelines determined by the division to be equivalent methods and guidelines.

II.B.29. Dripline means the area within 3 feet surrounding the perimeter of a building.

II.B.30. Elevated blood lead level (EBL) means an excessive absorption of lead that is a confirmed concentration of lead in whole blood of 20 μg/dl (micrograms of lead per deciliter of whole blood) for a single venous test or of 15-19 μg/dl in two consecutive tests taken 3 to 4 months apart.

II.B.31. Encapsulant means a substance that forms a barrier between lead-based paint and the environment using a liquid-applied coating (with or without reinforcement materials) or an adhesively bonded covering material.

II.B.32. Encapsulation means the application of an encapsulant.

II.B.33. Enclosure means the use of rigid, durable construction materials that are mechanically fastened to the substrate in order to act as a barrier between lead-based paint and the environment.

II.B.34. Exterior window sill means the portion of the horizontal window ledge that protrudes from the exterior of the room.

II.B.35. Friction surface means an interior or exterior surface that is subject to abrasion or friction, including, but not limited to, certain window, floor, and stair surfaces.

II.B.36. Guest instructor means an individual designated by the training program manager or principal instructor to provide instruction specific to the lecture, hands-on activities, or work practice components of a course.

II.B.37. Hands-on skills assessment means an evaluation which tests the trainees' ability to satisfactorily perform the work practices and procedures identified in Section III.A.4. (Minimum Training Curriculum Requirements) of this Regulation No. 19, as well as any other skill taught in a training course.

II.B.38. Hazardous waste means any waste as defined in 40 CFR Section 261.3.

II.B.39. HEPA means high efficiency particulate air. A HEPA filtration system is capable of trapping and retaining at least 99.97 percent of all monodispersed particles 0.3 microns in diameter or larger.

II.B.40. High-contact play area means any location on residential real property and on the property of a child-occupied facility or target housing where children under 7 years of age might commonly play. This term includes, but is not limited to, sandboxes, gardens, and swing sets.

II.B.41. [Reserved]

II.B.42. Impact surface means an interior or exterior surface that is subject to damage by repeated sudden force such as certain parts of door frames.

II.B.43. Inspection means a surface-by-surface investigation to determine the presence of lead-based paint and the provision of a report explaining the results of the investigation.

II.B.44. Interim controls means a set of measures designed to temporarily reduce human exposure or likely exposure to lead-based paint hazards, including specialized cleaning, repairs, maintenance, painting, temporary containment, ongoing monitoring of lead-based paint hazards or potential hazards, and the establishment and operation of management and resident education programs.

II.B.45. Interior window sill means the portion of the horizontal window ledge that protrudes into the interior of the room.

II.B.46. Lead-based paint means any paint containing more than six one-hundredths of one per cent by wet weight of lead metal, more than five-tenths of one percent by dry weight of lead metal, or more than one milligram per square centimeter of lead metal.

II.B.47. Lead-based paint activities means, in the case of target housing and child-occupied facilities, inspection, risk assessment, and abatement, as defined in this Section II. (Definitions) of this Regulation No. 19.

II.B.48. Lead-based paint hazard means any condition that causes exposure to lead from lead-contaminated dust, lead-contaminated soil, or lead-based paint. Lead-based paint hazard also means hazardous lead-based paint, dust-lead hazard or soil-lead hazard as identified below.

II.B.48.a. Paint-lead hazard. A paint-lead hazard is any of the following:

II.B.48.a.(i) Any lead-based paint on a friction surface that is subject to abrasion and where the lead dust levels on the nearest horizontal surface underneath the friction surface (e.g., window sill , or floor) are equal to or greater than the dust-lead hazard levels identified in this section.

II.B.48.a.(ii) Any damaged or otherwise deteriorated lead-based paint on an impact surface that is caused by impact from a related building component (such as a door knob that knocks into a wall or a door that knocks against its door frame).

II.B.48.a.(iii) Any chewable lead-based painted surface on which there is evidence of teeth marks.

II.B.48.a.(iv) Any other deteriorated lead-based paint in any residential building or child-occupied facility or on the exterior of any residential building or child-occupied facility.

II.B.48.b. Dust-lead hazard. A dust-lead hazard is surface dust in a residential dwelling or child-occupied facility that contains a mass-per-area concentration of lead equal

to or exceeding 40 $\mu g/ft^2$ on floors or 250 $\mu g/ft^2$ on interior window sills based on wipe samples.

II.B.48.c. Soil-lead hazard. A soil-lead hazard is bare soil on residential real property or on the property of a child-occupied facility that contains total lead equal to or exceeding 400 parts per million ($\mu g/g$) in a play area or average of 1,200 parts per million of bare soil in the rest of the yard based on soil samples.

II.B.49. Lead-contaminated dust means surface dust in residential dwellings or child-occupied facilities that contains an area or mass concentration of lead equal to or in excess of 40 $\mu g/ft^2$ on interior floors, 250 $\mu g/ft^2$ on interior window sills, 400 $\mu g/ft^2$ in window troughs, 500 $\mu g/ft^2$ on exterior window sills, and 800 $\mu g/ft^2$ on exterior surfaces (e.g. patios, porches, sidewalks).

II.B.50. Lead-contaminated soil means bare soil on residential real property and on the property of a child-occupied facility that contains lead equal to or in excess of 400 $\mu g/g$ in a play area or in excess of 1,200 $\mu g/g$ averaged in the rest of the yard (non-play areas).

II.B.51. Lead-contaminated waste means any waste generated as a result of lead-based paint activities or the deterioration of lead-based paint in a pre-1978 residential dwelling or child-occupied facility. This term includes, but is not limited to, lead-based paint chips, lead-contaminated dust, lead-contaminated soil, abatement control devices, disposable equipment and clothing, bags and other similar packaging contaminated with lead, waste water, architectural components, and chemical stripper sludge.

II.B.52. Lead-hazard screen means a limited risk assessment activity that involves limited paint and dust sampling as described in Section IV.B. (Lead Hazard Screen) of this Regulation No. 19.

II.B.53. Living area means any area of a residential dwelling used by one or more children under 7 years of age, including, but not limited to, living rooms, kitchen areas, dens, play rooms, and children's bedrooms.

II.B.54. Loading means the quantity of a specific substance present per unit of surface area, such as the amount of lead in micrograms contained in the dust collected from a certain surface area divided by the surface area in square feet or square meters.

II.B.55. Mid-yard means an area of a residential yard approximately midway between the dripline of a residential building and the nearest property boundary or between the driplines of a residential building and another building on the same property.

II.B.56. Multi-family dwelling means a structure that contains more than one separate residential dwelling unit, which is used or occupied, or intended to be used or occupied, in whole or in part, as the home or residence of one or more persons.

II.B.57. Paint means a liquid mixture, usually of a solid pigment in a liquid vehicle, used as a decorative or protective coating. This term includes, but is not limited to, primer, lacquer, polyurethane, and wood stain.

II.B.58. Paint in poor condition means more than two square feet of deteriorated paint per room or equivalent, twenty square feet of deteriorated paint on the exterior building, or ten percent of the total surface area of deteriorated paint on an interior or exterior type of component with a small surface area.

II.B.59. Permanently covered soil means soil which has been separated from human contact by the placement of a barrier consisting of solid, relatively impermeable materials, such as pavement or concrete. Grass, mulch, and other landscaping materials are not considered permanent covering.

II.B.60. Person means any individual, public or private corporation, partnership, association, firm, trust, estate, the United States or the state or any department, institution, or agency thereof, any municipal corporation, county, city and county, or other political subdivision of the state, or any other legal entity whatsoever which is recognized by law as the subject of rights and duties.

II.B.61. Play area means an area of frequent soil contact by children of less than 7 years of age as indicated by, but not limited to, such factors including the following; the presence of play equipment (e.g., sandboxes, swing sets and sliding boards), toys, or other children's possessions, observations of play patterns, or information provided by parents, residents, care givers, or property owners.

II.B.62. Principal instructor means the individual who has the primary responsibility for organizing and teaching a particular course.

II.B.63. Recognized laboratory means an environmental laboratory recognized by EPA pursuant to Toxic Substances Control Act Section 405(b) as being capable of performing an analysis for lead compounds in paint, soil, and dust.

II.B.64. Reduction means measures designed to reduce or eliminate human exposure to lead-based paint hazards through methods including interim controls and abatement.

II.B.65. Residential building means a building containing one or more residential dwellings.

II.B.66. Residential dwelling means (1) a detached single family dwelling unit, including attached structures such as porches and stoops; or (2) a single family dwelling unit in a structure that contains more than one separate residential dwelling unit, which is used or occupied, or intended to be used or occupied, in whole or in part, as the home or residence of one or more persons.

II.B.67. Risk assessment means (1) an on-site investigation to determine the existence, nature, severity, and location of lead-based paint hazards, and (2) the provision of a report by the individual or the firm conducting the risk assessment, explaining the results of the investigation and options for reducing lead-based paint hazards.

II.B.68. Room means a separate part of the inside of a building, such as a bedroom, living room, dining room, kitchen, bathroom, laundry room, or utility room. To be considered a separate room, the room must be separated from adjoining rooms by built-in walls or archways that extend at least 6 inches from an intersecting wall. Half walls or bookcases count as room separators if built-in. Moveable or collapsible partitions or partitions consisting solely of shelves or cabinets are not considered built-in walls. A screened in porch that is used as a living area is a room.

II.B.69. Soil sample means a sample collected in a representative location using ASTM E1727, "Standard Practice for Field Collection of Soil Samples for Lead Determination by Atomic Spectrometry Techniques," or equivalent method.

II.B.70. Target housing means housing constructed prior to 1978 other than any zero-bedroom dwelling or any housing for the elderly or a person with a disability; except that "target housing" includes housing for the elderly or a person with a disability if a child under 7 years of age resides or is expected to reside in the housing.

II.B.71. Training curriculum means an established set of course topics for instruction in an accredited training program for a particular discipline designed to provide specialized knowledge and skills.

II.B.72. Training hour means at least 50 minutes of actual learning, including, but not limited to, time devoted to lecture, learning activities, small group activities, demonstrations, evaluations, and/or hands-on experience.

II.B.73. Training manager means the individual responsible for administering a training program and monitoring the performance of principal instructors and guest instructor.

II.B.74. Visible emissions means any emissions which are visually detectable without the aid of instruments, coming from lead-based paint or lead-contaminated waste material.

II.B.75. Visual inspection for clearance testing means the visual examination of a residential dwelling or a child-occupied facility following an abatement to determine whether or not the abatement has been successfully completed.

II.B.76. Visual inspection for risk assessment means the visual examination of a residential dwelling or a child-occupied facility to determine the existence of deteriorated lead-based paint or other potential sources of lead-based paint hazards.

II.B.77. Weighted arithmetic mean means the arithmetic mean of sample results weighted by the number of subsamples in each sample. Its purpose is to give influence to a sample relative to the surface area it represents. A single surface sample is comprised of a single subsample. A composite sample may contain from two to four subsamples of the same area as each other and of each single surface sample in the composite. The weighted arithmetic mean is obtained by summing, for all samples, the product of the sample's result multiplied by the number of subsamples in the sample, and dividing the sum by the total number of subsamples contained in all samples. For example, the weighted arithmetic mean of a single surface sample containing 60

$\mu g/ft^2$, a composite sample (three subsamples) containing 100 $\mu g/ft^2$, and a composite sample (4 subsamples) containing 110 $\mu g/ft^2$ is 100 $\mu g/ft^2$. This result is based upon the equation (60+(3*100)+(4*110))/(1+3+4).

II.B.78. Window trough means, for a typical double-hung window, the portion of the exterior window sill between the interior window sill (or stool) and the frame of the storm window. If there is no storm window, the window trough is the area that receives both the upper and lower window sashes when they are both lowered. The window trough is sometimes referred to as the window well.

II.B.79. Wipe sample means a sample collected by wiping a representative surface of known area, as determined by ASTM E1728, "Standard Practice for Field Collection of Settled Dust Samples Using Wipe Sampling Methods for Lead Determination by Atomic Spectrometry Techniques, or equivalent method, with an acceptable wipe material as defined in ASTM E1792, "Standard Specification for Wipe Sampling Materials for Lead in Surface Dust."

II.B.80. Work area means an area covered or contained by polyethylene sheeting to prevent the spread of lead contamination; and an area within which concentrations of lead, exceed, or may exceed, clearance levels.

II.B.81. Working day means Monday through Friday and including holidays that fall on any of the days Monday through Friday.

III. Training and Certification Requirements

III.A. Accreditation of Training Programs: Target Housing and Child-occupied Facilities

III.A.1. Scope

III.A.1.a. A training program may seek accreditation to offer lead-based paint activities courses in any of the following disciplines: inspector, risk assessor, supervisor, project designer, and abatement worker. A training program may also seek accreditation to offer refresher courses for each of the above listed disciplines.

III.A.1.b. A training program shall not provide, offer, or claim to provide division-accredited lead-based paint activities courses without applying for and receiving accreditation from the division as required under Section III.A.2. (Application Process) of this Regulation No. 19 on or after the effective date of this Regulation No. 19.

III.A.2. Application Process

The following are procedures a training program shall follow to receive division accreditation to offer lead-based paint activities courses:

III.A.2.a. A training program seeking accreditation shall submit a written application to the division containing the following information:

III.A.2.a.(i) the training program's name, address, and telephone number;

III.A.2.a.(ii) a list of courses for which it is applying for accreditation; and

III.A.2.a.(iii) a statement signed by the training program manager certifying that the training program meets the requirements established in Section III.A.3. (Requirements for the Accreditation of Training Programs) of this Regulation No. 19. If a training program uses EPA-recommended model training materials, or training materials approved by a State or Indian Tribe that has been authorized by EPA under 40 C.F.R. Part 745, Subpart Q the training program manager shall include a statement certifying that, as well.

III.A.2.a.(iv) If a training program does not use EPA-recommended model training materials or training materials approved by an authorized State or Indian Tribe, its application for accreditation shall also include:

III.A.2.a.(iv)(a) a copy of the student and instructor manuals, or other materials to be used for each course; and

III.A.2.a.(iv)(b) a copy of the course agenda for each course.

III.A.2.a.(v) All training programs shall include in their application for accreditation the following:

III.A.2.a.(v)(a) a description of the facilities and equipment to be used for lecture and hands-on training;

III.A.2.a.(v)(b) a copy of the course test blue print for each course;

III.A.2.a.(v)(c) a description of the activities and procedures that will be used for conducting the assessment of hands-on skills for each course; and

III.A.2.a.(v)(d) a copy of the quality control plan as described in Section III.A.3.i. of this Regulation No. 19.

III.A.2.b. If a training program meets the requirements in Section III.A.3. (Requirements for the Accreditation of Training Programs) of this Regulation No. 19, then the division shall approve the application for accreditation no more than 180 days after receiving a complete application from the training program. In the case of approval, a certificate of accreditation shall be sent to the applicant. In the case of disapproval, a letter describing the reasons for disapproval shall be sent to the applicant. Prior to disapproval, the division may, at its discretion, work with the applicant to address inadequacies in the application for accreditation. The division may also request additional materials retained by the training program under Section III.A.7. (Training Program Recordkeeping Requirements) of this Regulation No. 19. If the division disapproves a training program's application, the program may reapply for accreditation at any time.

III.A.2.c. A training program may apply for accreditation to offer courses or refresher courses in as many disciplines as it chooses. A training program may seek accreditation for additional courses at any time as long as the program can demonstrate that it meets the requirements of this Section III. (Training and Certification Requirements) of this Regulation No. 19.

III.A.2.d. A training program which has received accreditation from US EPA or another state whose training and certification requirements are at least as stringent as Colorado's must first apply for and receive accreditation before conducting training in Colorado.

III.A.2.e. A training program must notify the division, on a form provided by the division, of scheduled courses at least 2 weeks prior to the offering of the course. The training program must receive written approval for each class from the division prior to conducting the training.

III.A.2.f. Fees for accreditation of training programs shall be as follows:

III.A.2.f.(i) Inspector (24-hour) course --$1,500;

III.A.2.f.(ii) Risk Assessor (16-hour) course -- $1,000;

III.A.2.f.(iii) Supervisor (32-hour) course -- $2,000;

III.A.2.f.(iv) Project Designer (8-hour) course -- $500;

III.A.2.f.(v) Abatement Worker (16-hour) course -- $1,000; and

III.A.2.f.(vi) All refresher training courses -- $500.

III.A.3. Requirements for the Accreditation of Training Programs

For a training program to obtain accreditation from the division to offer lead-based paint activities courses, the program shall meet the following requirements:

III.A.3.a. The training program shall employ a training manager who has:

III.A.3.a.(i) at least 2 years of experience, education, or training in teaching workers or adults; or

III.A.3.a.(ii) a bachelor's or graduate degree in building construction technology, engineering, industrial hygiene, safety, public health, education, business administration or program management or a related field; or

III.A.3.a.(iii) two years of experience in managing a training program specializing in environmental hazards; and

III.A.3.a.(iv) demonstrated experience, education, or training in the construction industry including: lead or asbestos abatement, painting, carpentry, renovation, remodeling, occupational safety and health, or industrial hygiene.

III.A.3.b. The training manager shall designate a qualified principal instructor for each course who has:

III.A.3.b.(i) demonstrated experience, education, or training in teaching workers or adults;

III.A.3.b.(ii) successfully completed at least 16 hours of any EPA-accredited or EPA-authorized State or Tribal-accredited lead-specific training; and

III.A.3.b.(iii) demonstrated experience, education, or training in lead or asbestos abatement, painting, carpentry, renovation, remodeling, occupational safety and health, or industrial hygiene.

III.A.3.c. The principal instructor shall be responsible for the organization of the course and oversight of the teaching of all course material. The training manager may designate guest instructors as needed to provide instruction specific to the lecture, hands-on activities, or work practice components of a course.

III.A.3.d. The following documents shall be recognized by the division as evidence that training managers and principal instructors have the education, work experience, training requirements or demonstrated experience, specifically listed in Sections III.A.3.a. and III.A.7. (Training Program Recordkeeping Requirements) of this Regulation No. 19. This documentation need not be submitted with the accreditation application, but, if not submitted, shall be retained by the training program as required by the recordkeeping requirements contained in Section III.A.7. (Training Program Recordkeeping Requirements) of this Regulation No. 19. Those documents include the following:

III.A.3.d.(i) official academic transcripts or diploma as evidence of meeting the education requirements;

III.A.3.d.(ii) résumés, letters of reference, or documentation of work experience, as evidence of meeting the work experience requirements; and

III.A.3.d.(iii) certificates from train-the-trainer courses and lead-specific training courses, as evidence of meeting the training requirements.

III.A.3.e. The training program shall ensure the availability of, and provide adequate facilities for, the delivery of the lecture, course test, hands-on training, and assessment activities. This includes providing training equipment that reflects current work practices and maintaining or updating the equipment and facilities as needed.

III.A.3.f. To become accredited in the following disciplines, the training program shall provide training courses that meet the following training hour requirements:

III.A.3.f.(i) The inspector course shall last a minimum of 24 training hours, with a minimum of 8 hours devoted to hands-on training activities. The minimum curriculum requirements for the inspector course are contained in Section III.A.4.a. (Inspector) of this Regulation No. 19.

III.A.3.f.(ii) The risk assessor course shall last a minimum of 16 training hours, with a minimum of 4 hours devoted to hands-on training activities. The minimum curriculum requirements for the risk assessor course are contained in Section III.A.4.b. (Risk Assessor) of this Regulation No. 19.

III.A.3.f.(iii) The supervisor course shall last a minimum of 32 training hours, with a minimum of 8 hours devoted to hands-on activities. The minimum curriculum requirements for the supervisor course are contained in Section III.A.4.c. (Supervisor) of this Regulation No. 19.

III.A.3.f.(iv) The project designer course shall last a minimum of 8 training hours. The minimum curriculum requirements for the project designer course are contained in Section III.A.4.d. (Project Designer) of this Regulation No. 19.

III.A.3.f.(v) The abatement worker course shall last a minimum of 16 training hours, with a minimum of 8 hours devoted to hands-on training activities. The minimum curriculum requirements for the abatement worker course are contained in Section III.A.4.e. (Abatement Worker) of this Regulation No. 19.

III.A.3.g. For each course offered, the training program shall conduct either a course test at the completion of the course, and if applicable, a hands-on skills assessment, or in the alternative, a proficiency test for that discipline. Each individual must successfully complete the hands-on skills assessment and receive a passing score on the course test to pass any course, or successfully complete a proficiency test.

III.A.3.g.(i) The training manager is responsible for maintaining the validity and integrity of the hands-on skills assessment or proficiency test to ensure that it accurately evaluates the trainees' performance of the work practices and procedures associated with the course topics contained in Section III.A.4. (Minimum Training Curriculum Requirements) of this Regulation No. 19.

III.A.3.g.(ii) The training manager is responsible for maintaining the validity and integrity of the course test to ensure that it accurately evaluates the trainees' knowledge and retention of the course topics.

III.A.3.g.(iii) The course test shall be developed in accordance with the test blueprint submitted with the training accreditation application.

III.A.3.h. The training program shall issue unique course completion certificates to each individual who passes the training course. The course completion certificate shall include:

III.A.3.h.(i) the name, a unique identification number, and address of the individual;

III.A.3.h.(ii) the name of the particular course that the individual completed;

III.A.3.h.(iii) dates of course completion/test passage; and

III.A.3.h.(iv) the name, address, and telephone number of the training program.

III.A.3.i. The training manager shall develop and implement a quality control plan. The plan shall be used to maintain and improve the quality of the training program over time. This plan shall contain at least the following elements:

III.A.3.i.(i) procedures for periodic revision of training materials and the course test to reflect innovations in the field; and

III.A.3.i.(ii) procedures for the training manager's annual review of principal instructor competency.

III.A.3.j. The training program shall offer courses which teach the work practice standards for conducting lead-based paint activities contained in this Section III. (Training and Certification Requirements) of this Regulation No. 19, and other standards developed by EPA pursuant to Title IV of TSCA. These standards shall be taught in the appropriate courses to provide trainees with the knowledge needed to perform the lead-based paint activities they are responsible for conducting.

III.A.3.k. The training manager shall be responsible for ensuring that the training program complies at all times with all of the requirements in this Section III. (Training and Certification Requirements) of this Regulation No. 19.

III.A.3.l. The training manager shall allow the division, at no cost to the division, to audit the training program to verify the contents of the application for accreditation as described in Section III.A.2. (Application Process) of this Regulation No. 19.

III.A.4. Minimum Training Curriculum Requirements

To become accredited to offer lead-based paint courses instruction in the specific disciplines listed below, training programs must ensure that their courses of study include, at a minimum, the following course topics. Requirements ending in an asterisk (*) indicate areas that require hands-on activities as an integral component of the course.

III.A.4.a. Inspector

III.A.4.a.(i) Role and responsibilities of an inspector.

III.A.4.a.(ii) Background information on lead and its adverse health effects.

III.A.4.a.(iii) Background information on Federal, State, and local regulations and guidance that pertains to lead-based paint and lead-based paint activities.

III.A.4.a.(iv) Lead-based paint inspection methods, including selection of rooms and components for sampling or testing.*

III.A.4.a.(v) Paint, dust, and soil sampling methodologies.*

III.A.4.a.(vi) Clearance standards and testing, including random sampling.*

III.A.4.a.(vii) Preparation of the final inspection report.*

III.A.4.a.(viii) Recordkeeping.

III.A.4.b. Risk Assessor

III.A.4.b.(i) Role and responsibilities of a risk assessor.

III.A.4.b.(ii) Collection of background information to perform a risk assessment.

III.A.4.b.(iii) Sources of environmental lead contamination such as paint, surface dust and soil, water, air, packaging, and food.

III.A.4.b.(iv) Visual inspection for the purposes of identifying potential sources of lead-based paint hazards.*

III.A.4.b.(v) Lead hazard screen protocol.

III.A.4.b.(vi) Sampling for other sources of lead exposure.*

III.A.4.b.(vii) Interpretation of lead-based paint and other lead sampling results, including all applicable State or Federal guidance or regulations pertaining to lead-based paint hazards.*

III.A.4.b.(viii) Development of hazard control options, the role of interim controls, and operations and maintenance activities to reduce lead-based paint hazards.

III.A.4.b.(ix) Preparation of a final risk assessment report.

III.A.4.c. Supervisor

III.A.4.c.(i) Role and responsibilities of a supervisor.

III.A.4.c.(ii) Background information on lead and its adverse health effects.

III.A.4.c.(iii) Background information on Federal, State, and local regulations and guidance that pertain to lead-based paint abatement.

III.A.4.c.(iv) Liability and insurance issues relating to lead-based paint abatement.

III.A.4.c.(v) Risk assessment and inspection report interpretation.*

III.A.4.c.(vi) Development and implementation of an occupant protection plan and abatement report.

III.A.4.c.(vii) Lead-based paint hazard recognition and control.*

III.A.4.c.(viii) Lead-based paint abatement and lead-based paint hazard reduction methods, including restricted practices.*

III.A.4.c.(ix) Interior dust abatement/cleanup or lead-based paint hazard control and reduction methods.*

III.A.4.c.(x) Soil and exterior dust abatement or lead-based paint hazard control and reduction methods.*

III.A.4.c.(xi) Clearance standards and testing.

III.A.4.c.(xii) Cleanup and waste disposal.

III.A.4.c.(xiii) Recordkeeping.

III.A.4.d. Project Designer

III.A.4.d.(i) Role and responsibilities of a project designer.

III.A.4.d.(ii) Development and implementation of an occupant protection plan for large scale abatement projects.

III.A.4.d.(iii) Lead-based paint abatement and lead-based paint hazard reduction methods, including restricted practices for large-scale abatement projects.

III.A.4.d.(iv) Interior dust abatement/cleanup or lead hazard control and reduction methods for large-scale abatement projects.

III.A.4.d.(v) Clearance standards and testing for large scale abatement projects.

III.A.4.d.(vi) Integration of lead-based paint abatement methods with modernization and rehabilitation projects for large scale abatement projects.

III.A.4.e. Abatement Worker

III.A.4.e.(i) Role and responsibilities of an abatement worker.

III.A.4.e.(ii) Background information on lead and its adverse health effects.

III.A.4.e.(iii) Background information on Federal, State and local regulations and guidance that pertain to lead-based paint abatement.

III.A.4.e.(iv) Lead-based paint hazard recognition and control.*

III.A.4.e.(v) Lead-based paint abatement and lead-based paint hazard reduction methods, including restricted practices.*

III.A.4.e.(vi) Interior dust abatement methods/cleanup or lead-based paint hazard reduction.*

III.A.4.e.(vii) Soil and exterior dust abatement methods or lead-based paint hazard reduction.*

III.A.4.f. The training program shall allow the division, without any cost to the division, to audit the training program to evaluate the quality of the course as well as to verify the contents of the application for accreditation as described in Section III.A.2. (Application Process) of this Regulation No. 19.

III.A.5. Requirements for the Accreditation of Refresher Training Programs

A training program may seek accreditation to offer refresher training courses in any of the following disciplines: inspector, risk assessor, supervisor, project designer, and abatement worker. To obtain division accreditation to offer refresher training, a training program must meet the following minimum requirements:

III.A.5.a. Each refresher course shall review the curriculum topics of the full-length courses listed under Section III.A.4. (Minimum Training Curriculum Requirements) of this Regulation No. 19, as appropriate. In addition, to become accredited to offer refresher training courses, training programs shall ensure that their courses of study include, at a minimum, the following:

III.A.5.a.(i) An overview of current safety practices relating to lead-based paint activities in general, as well as specific information pertaining to the appropriate discipline.

III.A.5.a.(ii) Current laws and regulations relating to lead-based paint activities in general, as well as specific information pertaining to the appropriate discipline.

III.A.5.a.(iii) Current technologies relating to lead-based paint activities in general, as well as specific information pertaining to the appropriate discipline.

III.A.5.b. Each refresher course, except for the project designer course, shall last a minimum of 8 training hours. The project designer refresher course shall last a minimum of 4 training hours.

III.A.5.c. For each course offered, the training program shall conduct a hands-on assessment (if applicable), and at the completion of the course, a course test.

III.A.5.d. A training program may apply for accreditation of a refresher course concurrently with its application for accreditation of the corresponding training course as described in Section III.A.2. (Application Process) of this Regulation No. 19. If so, the division shall use the approval procedure described in Section III.A.2. (Application Process) of this Regulation No. 19. In addition, the minimum requirements contained in Sections III.A.3. (Requirements for the Accreditation of Training Programs) (except for the requirements in Section III.A.3.f.), and III.A.5.a., III.A.5.b., and III.A.5.c. of this Regulation No. 19 shall also apply.

III.A.5.e. A training program seeking accreditation to offer refresher training courses only shall submit a written application to the division containing the following information:

III.A.5.e.(i) The refresher training program's name, address, and telephone number.

III.A.5.e.(ii) A list of courses for which it is applying for accreditation.

III.A.5.e.(iii) A statement signed by the training program manager certifying that the refresher training program meets the minimum requirements established in Section III.A.3. (Requirements for the Accreditation of Training Programs) of this Regulation No. 19, except for the requirements in Section III.A.3.f. of this Regulation No. 19. If a training program uses US EPA-developed model training materials, or training materials approved by a State or Indian Tribe that has been authorized by US EPA under 40 C.F.R., Section 745.324 to develop its refresher training course materials, the training manager shall include a statement certifying that, as well.

III.A.5.e.(iv) If the refresher training course materials are not based on US EPA-developed model training materials or training materials approved by an authorized State or Indian Tribe, the training program's application for accreditation shall include:

III.A.5.e.(iv)(a) a copy of the student and instructor manuals to be used for each course; and

III.A.5.e.(iv)(b) a copy of the course agenda for each course.

III.A.5.e.(v) All refresher training programs shall include in their application for accreditation the following:

III.A.5.e.(v)(a) a description of the facilities and equipment to be used for lecture and hands-on training;

III.A.5.e.(v)(b) a copy of the course test blue print for each course;

III.A.5.e.(v)(c) a description of the activities and procedures that will be used for conducting the assessment of hands-on skills for each course (if applicable); and

III.A.5.e.(v)(d) a copy of the quality control plan as described in Section III.A.3.i. of this Regulation No. 19.

III.A.5.e.(vi) The requirements in Sections III.A.3.a. through III.A.3.e., and III.A.3.g. through III.A.3.l. of this Regulation No. 19 apply to refresher training providers.

III.A.5.e.(vii) If a refresher training program meets the requirements listed in this Section III.A.5. (Requirements for the Accreditation of Training Programs) of this Regulation No. 19, then the division shall approve the application for accreditation no more than 180 days after receiving a complete application from the refresher training program. In the case of approval, a certificate of accreditation shall be sent to the applicant. In the case of disapproval, a letter describing the reasons for disapproval shall be sent to the applicant. Prior to disapproval, the division may, at

its discretion, work with the applicant to address inadequacies in the application for accreditation. The division may also request additional materials retained by the refresher training program under Section III.A.7. (Training Program Recordkeeping Requirements) of this Regulation No. 19. If a refresher training program's application is disapproved, the program may reapply for accreditation at any time.

III.A.6. Re-accreditation of Training Programs

III.A.6.a. Unless re-accredited, a training program's accreditation (including refresher training accreditation) shall expire 4 years after the date of issuance. If a training program meets the requirements of this section, the training program shall be re-accredited.

III.A.6.b. A training program seeking re-accreditation shall submit an application to the division no later than 180 days before its accreditation expires. If a training program does not submit its application for re-accreditation by that date, the division cannot guarantee that the program will be re-accredited before the end of the accreditation period.

III.A.6.c. The training program's application for re-accreditation shall contain:

III.A.6.c.(i) The training program's name, address, and telephone number.

III.A.6.c.(ii) A list of courses for which it is applying for re-accreditation.

III.A.6.c.(iii) A description of any changes to the training facility, equipment or course materials since its last application was approved that adversely affects the students ability to learn.

III.A.6.c.(iv) A statement signed by the program manager stating:

III.A.6.c.(iv)(a) That the training program complies at all times with all requirements in Sections III.A.3. (Requirements for the Accreditation of Training Programs) and III.A.5. (Requirements for the Accreditation of Refresher Training Programs) of this Regulation No. 19, as applicable; and

III.A.6.c.(iv)(b) The recordkeeping and reporting requirements of Section III.A.7. (Training Program Recordkeeping Requirements) of this Regulation No. 19 shall be followed.

III.A.6.d. The training program shall allow the division, at no cost to the division, to audit the training program to verify the contents of the application for re-accreditation as described in Section III.A.6.c. of this Regulation No. 19.

III.A.6.e. Fees for re-accreditation of training programs shall be as follows:

III.A.6.e.(i) Inspector (24-hour) course --$1,500;

III.A.6.e.(ii) Risk Assessor (16-hour) course -- $1,000;

III.A.6.e.(iii) Supervisor (32-hour) course -- $2,000;

III.A.6.e.(iv) Project Designer (8-hour) course -- $500;

III.A.6.e.(v) Abatement Worker (16-hour) course -- $1,000; and

III.A.6.e.(vi) Any refresher training course -- $500.

III.A.7. Training Program Recordkeeping Requirements

III.A.7.a. Accredited training programs shall maintain, and make available to the division, upon request, the following records:

III.A.7.a.(i) all documents specified in Section III.A.3.d. of this Regulation No. 19 that demonstrate the qualifications listed in Sections III.A.3.a. and III.A.3.b. of this Regulation No. 19 of the training manager and principal instructors;

III.A.7.a.(ii) current curriculum/course materials and documents reflecting any changes made to these materials;

III.A.7.a.(iii) the course test blue print; and

III.A.7.a.(iv) information regarding how the hands-on assessment is conducted including, but not limited to:

III.A.7.a.(iv)(a) who conducts the assessment;

III.A.7.a.(iv)(b) how the skills are graded;

III.A.7.a.(iv)(c) what facilities are used; and

III.A.7.a.(iv)(d) the pass/fail rate.

III.A.7.a.(v) the quality control plan as described in Section III.A.3.i. of this Regulation No. 19;

III.A.7.a.(vi) results of the students' hands-on skills assessments and course tests, and a record of each student's course completion certificate; and

III.A.7.a.(vii) any other material not listed above in Sections III.A.7.a.(i) through III.A.7.a.(vi) of this Regulation No. 19 that was submitted to the division as part of the program's application for accreditation.

III.A.7.b. The training program shall retain these records at the address specified on the training program accreditation application (or as modified in accordance with Section III.A.7.c. of this Regulation No. 19) for a minimum of 3 years and 6 months.

III.A.7.c. The training program shall notify the division in writing within 30 days of changing the address specified on its training program accreditation application or transferring the records from that address.

III.B. Certification of Individuals and Firms Engaged in Lead-based Paint Activities: Target Housing and Child-occupied Facilities

III.B.1. Certification of Individuals

III.B.1.a. Individuals seeking certification by the division to engage in lead-based paint activities must either:

III.B.1.a.(i) submit to the division an application demonstrating that they meet the requirements established in Sections III.B.2. (Inspector, Risk Assessor or Supervisor) or III.B.3. (Abatement Worker and Project Designer) of this Regulation No. 19 for the particular discipline for which certification is sought; or

III.B.1.a.(ii) submit to the division an application with a copy of a valid lead-based paint activities certification (or equivalent) from a State or Tribal program that has been authorized by EPA pursuant to 40 C.F.R., Part 745, Subpart Q.

III.B.1.b. Individuals seeking Colorado certification as an inspector, risk assessor or supervisor shall submit a fee to the division according to the following structure:

III.B.1.b.(i) Inspector -- $175 for the first year and $125 for each year thereafter;

III.B.1.b.(ii) Risk Assessor -- $175 for the first year and $125 for each year thereafter; and

III.B.1.b.(iii) Supervisor -- $175 for the first year and $125 for each year thereafter.

III.B.1.c. Individuals seeking Colorado certification as a worker or project designer shall submit a fee to the division according to the following structure:

III.B.1.c.(i) Worker -- $125 for each year of certification sought; and

III.B.1.c.(ii) Project Designer -- $125 for each year of certification sought.

III.B.1.d. Individuals may first apply to the division for certification to engage in lead-based paint activities pursuant to this section on or after the effective date of this Regulation No. 19.

III.B.1.e. Following the submission of an application demonstrating that all the requirements of this section have been met, the division shall certify an applicant as an inspector, risk assessor, supervisor, project designer, or abatement worker, as appropriate.

III.B.1.f. Upon receiving the division certification, individuals conducting lead-based paint activities shall comply with the work practice standards for performing the appropriate lead-based paint activities as established in Section V. (Abatement Requirements) of this Regulation No. 19.

III.B.2. Inspector, Risk Assessor or Supervisor

III.B.2.a. To become certified by the division as an inspector, risk assessor, or supervisor, pursuant to Section III.B.1.a.(i) of this Regulation No. 19, an individual must:

III.B.2.a.(i) Successfully complete an accredited course in the appropriate discipline and receive a course completion certificate from an accredited training program.

III.B.2.a.(ii) Pass the certification exam in the appropriate discipline offered by the division.

III.B.2.a.(iii) Meet or exceed the following experience and/or education requirements:

III.B.2.a.(iii)(a) Inspectors

III.B.2.a.(iii)(a)(i) no additional experience and/or education requirements.

III.B.2.a.(iii)(a)(ii) [Reserved]

III.B.2.a.(iii)(b) Risk Assessors

III.B.2.a.(iii)(b)(i) successful completion of an accredited training course for inspectors; and

III.B.2.a.(iii)(b)(ii) Bachelor's degree and 1 year of experience in a related field (e.g., lead, asbestos, environmental remediation work, or construction), or an Associates degree and 2 years experience in a related field (e.g., lead, asbestos, environmental remediation work, or construction); or

III.B.2.a.(iii)(b)(iii) certification as an industrial hygienist, professional engineer, registered architect and/or certification in a related engineering/health/environmental field (e.g., safety professional, environmental scientist); or

III.B.2.a.(iii)(b)(iv) a high school diploma (or equivalent), and at least 3 years of experience in a related field (e.g., lead, asbestos, environmental remediation work or construction).

III.B.2.a.(iii)(c) Supervisor

III.B.2.a.(iii)(c)(i) one year of experience as a certified lead-based paint abatement worker; or

III.B.2.a.(iii)(c)(ii) at least 2 years of experience in a related field (e.g., lead, asbestos, or environmental remediation work) or in the building trades.

III.B.2.b. The following documents shall be recognized by the division as evidence of meeting the requirements listed in Section III.B.2.b.(iii) of this Regulation No. 19:

III.B.2.b.(i) official academic transcripts or diploma, as evidence of meeting the education requirements;

III.B.2.b.(ii) resumes, letters of reference, or documentation of work experience, as evidence of meeting the work experience requirements; and

III.B.2.b.(iii) course completion certificates from lead-specific or other related training courses, issued by accredited training programs, as evidence of meeting the training requirements.

III.B.2.c. In order to take the certification examination for a particular discipline an individual must:

III.B.2.c.(i) successfully complete an accredited course in the appropriate discipline and receive a course completion certificate from an accredited training program; and

III.B.2.c.(ii) meet or exceed the education and/or experience requirements in Section III.B.2.a.(iii) of this Regulation No. 19.

III.B.2.d. After passing the appropriate certification exam and submitting an application demonstrating that he/she meets the appropriate training, education, and/or experience prerequisites described in Section III.B.2.a. of this Regulation No. 19, an individual shall be issued a certificate by the division. To maintain certification, an individual must be re-certified as described in Section III.B.5. (Re-certification) of this Regulation No. 19.

III.B.2.e. An individual may take the certification exam no more than three times within 6 months of receiving a course completion certificate.

III.B.2.f. If an individual does not pass the certification exam and receive a certificate within 6 months of receiving his/her course completion certificate, the individual must retake the appropriate course from an accredited training program before reapplying for certification from the division.

III.B.3. Abatement Worker and Project Designer

III.B.3.a. To become certified by the division as an abatement worker or project designer, pursuant to Section III.B.1.a. of this Regulation No. 19, an individual must:

III.B.3.a.(i) Successfully complete an accredited course in the appropriate discipline and receive a course completion certificate from an accredited training program.

III.B.3.a.(ii) Meet or exceed the following additional experience and/or education requirements.

III.B.3.a.(ii)(a) Abatement Workers

III.B.3.a.(ii)(a)(i) no additional experience and/or education requirements.

III.B.3.a.(ii)(a)(ii) [Reserved]

III.B.3.a.(ii)(b) Project Designers

III.B.3.a.(ii)(b)(i) successful completion of an accredited training course for supervisors; and

III.B.3.a.(ii)(b)(ii) Bachelor's degree in engineering, architecture, or a related profession, and 1 year of experience in building construction and design or a related field; or

III.B.3.a.(ii)(b)(iii) four years of experience in building construction and design or a related field.

III.B.3.b. The following documents shall be recognized by the division as evidence of meeting the requirements listed in this Section III.B.3. (Abatement Worker and Project Designer) of this Regulation No. 19:

III.B.3.b.(i) official academic transcripts or diploma, as evidence of meeting the education requirements;

III.B.3.b.(ii) resumes, letters of reference, or documentation of work experience, as evidence of meeting the work experience requirements; and

III.B.3.b.(iii) course completion certificates from lead-specific or other related training courses, issued by accredited training programs, as evidence of meeting the training requirements.

III.B.3.c. After successfully completing the appropriate training courses and meeting any other qualifications described in Section III.B.3.a. of this Regulation No. 19, an individual shall be issued a certificate from the division. To maintain certification, an individual must be re-certified as described in Section III.B.5. (Re-certification) of this Regulation No. 19.

III.B.4. Certification Based on Prior Training

III.B.4.a. Any individual who received training in a lead-based paint activity between October 1, 1990 and October 29, 1998 shall be eligible for certification by the division under the alternative procedures contained in this Section III.B.4.a. of this Regulation No. 19. Individuals who have received lead-based paint activities training at an EPA-authorized State or Tribal accredited training program shall also be eligible for certification by the division under the following alternative procedures:

III.B.4.a.(i) Applicants for certification as an inspector, risk assessor, or supervisor shall:

III.B.4.a.(i)(a) demonstrate that the applicant has successfully completed training or on-the-job training in the conduct of a lead-based paint activity;

III.B.4.a.(i)(b) demonstrate that the applicant meets or exceeds the education and/or experience requirements in Section III.B.2.a.(iii) of this Regulation No. 19;

III.B.4.a.(i)(c) successfully complete an accredited refresher training course for the appropriate discipline; and

III.B.4.a.(i)(d) pass a certification exam administered by the division for the appropriate discipline.

III.B.4.a.(ii) Applicants for certification as an abatement worker or project designer shall:

III.B.4.a.(ii)(a) demonstrate that the applicant has successfully completed training or on-the-job training in the conduct of a lead-based paint activity;

III.B.4.a.(ii)(b) demonstrate that the applicant meets the education and/or experience requirements in Section III.B.3.a. of this Regulation No. 19; and

III.B.4.a.(ii)(c) successfully complete an accredited refresher training course for the appropriate discipline.

III.B.5. Re-certification

III.B.5.a. To maintain certification in a particular discipline, a certified individual shall apply to and be re-certified by the division in that discipline by the division either:

III.B.5.a.(i) every 3 years if the individual completed a training course with a course test and hands-on assessment; or

III.B.5.a.(ii) every 5 years if the individual completed a training course with a proficiency test.

III.B.5.b. An individual shall be re-certified if the individual successfully completes the appropriate accredited refresher training course, submits a valid copy of the appropriate refresher course completion certificate to the division and submits a fee to the division according to the following structure:

III.B.5.b.(i) Inspector -- $125 for each year of certification sought;

III.B.5.b.(ii) Risk Assessor -- $125 for each year of certification sought;

III.B.5.b.(iii) Supervisor -- $125 for each year of certification sought;

III.B.5.b.(iv) Worker -- $125 for each year of certification sought; and

III.B.5.b.(v) Project Designer -- $125 for each year of certification sought.

III.B.6. Certification of Firms

III.B.6.a. All firms which perform or offer to perform any of the lead-based paint activities described in Section IV. (Inspections, Lead-Hazard Screens, and Risk Assessments) and/or Section V. (Abatement Requirements) of this Regulation No. 19 shall be certified by the division.

III.B.6.b. A firm seeking certification shall submit to the division a letter attesting that the firm shall only employ appropriately certified employees to conduct lead-based paint activities, and that the firm and its employees shall follow the work practice standards in Section IV. (Inspections, Lead-Hazard Screens, and Risk Assessments) and/or Section V. (Abatement Requirements) of this Regulation No. 19 for conducting lead-based paint activities.

III.B.6.b.(i) Firms seeking Colorado certification as a lead-based paint abatement contractor and/or inspection, lead-hazard screen, and risk assessment firm shall submit, along with their application, a fee to the division according to the following structure:

III.B.6.b.(i)(a) one-year certification for abatement firms -- $450;

III.B.6.b.(i)(b) one-year certification for inspection, lead hazard screen and risk assessment firms -- $350.

III.B.6.c. From the date of receiving the firm's letter requesting certification, the division shall have 90 days to approve or disapprove the firm's request for certification. Within that time, the division shall respond with either a certificate of approval or a letter describing the reasons for a disapproval.

III.B.6.d. The firm shall maintain all records pursuant to the requirements in Section IV. (Inspections, Lead-hazard Screens, and Risk Assessments) and/or Section V. (Abatement Requirements) of this Regulation No. 19.

III.B.6.e. Firms may first apply to the division for certification to engage in lead-based paint activities pursuant to this section on or after the effective date of this Regulation No. 19.

III.B.6.f. Firms shall be responsible for ensuring that anyone engaging in lead-based paint activities for their firm are properly trained and certified by the division pursuant to the requirements of this Regulation No. 19.

III.B.6.g. Firms shall be responsible for ensuring that anyone engaging in lead-based paint activities for their firm have a valid training certificate or Colorado certification photo identification card on the worksite at all times.

IV. Inspections, Lead-Hazard Screens, and Risk Assessments

When performing any lead-based paint activity involving an inspection, lead-hazard screen or risk assessment of a pre-1978 residential dwelling or child-occupied facility, a certified individual must perform that activity in compliance with the appropriate requirements below.

IV.A. Inspection

IV.A.1. An inspection shall be conducted only by a person certified by the division pursuant to this Regulation No. 19 as an inspector or risk assessor and, if conducted, must be conducted according to the procedures in Section IV.A. (Inspection) of this Regulation No. 19.

IV.A.2. When conducting an inspection, the following locations shall be selected according to documented methodologies and tested for the presence of lead-based paint:

IV.A.2.a. In the portion of a pre-1978 residential dwelling and child-occupied facility being inspected, each component with a distinct painting history and each exterior component with a distinct painting history shall be tested for lead-based paint, except those components that the inspector or risk assessor determines to have been replaced after 1978, or to not contain lead-based paint; and

IV.A.2.b. In the portion of a pre-1978 multi-family dwelling or child-occupied facility being inspected, each component with a distinct painting history in every common area shall be tested for lead-based paint, except those components that the inspector or risk assessor determines to have been replaced after 1978, or to not contain lead-based paint.

IV.A.3. Paint shall be sampled in the following manner:

IV.A.3.a. the analysis of paint to determine the presence of lead shall be conducted using documented methodologies which incorporate adequate quality control procedures; and/or

IV.A.3.b. all collected paint chip samples shall be analyzed according to Section IV.D. (Collection and Laboratory Analysis of Samples) of this Regulation No. 19, to determine if they contain detectable levels of lead that can be quantified numerically.

IV.A.4. The certified inspector or risk assessor shall prepare an inspection report which shall include the following information:

IV.A.4.a. date of each inspection;

IV.A.4.b. address of building;

IV.A.4.c. date of construction;

IV.A.4.d. apartment numbers (if applicable);

IV.A.4.e. name, address, and telephone number of the owner or owners of each pre-1978 residential dwelling or child-occupied facility;

IV.A.4.f. name, signature, and certification number of each certified inspector and/or risk assessor conducting testing;

IV.A.4.g. name, address, and telephone number of the certified firm employing each inspector and/or risk assessor, if applicable;

IV.A.4.h. each testing method and device and/or sampling procedure employed for paint analysis, including quality control data and, if used, the serial number of any x-ray fluorescence (XRF) device;

IV.A.4.i. specific locations of each painted component tested for the presence of lead-based paint; and

IV.A.4.j. the results of the inspection expressed in terms appropriate to the sampling method used.

IV.B. Lead Hazard Screen

IV.B.1. A lead hazard screen shall be conducted only by a person certified by the division as a risk assessor and, if conducted, must be conducted according to the procedures in this Section IV.B. (Lead Hazard Screen) of this Regulation No. 19.

IV.B.2. If conducted, a lead hazard screen shall be conducted as follows:

IV.B.2.a. Background information regarding the physical characteristics of the pre-1978 residential dwelling or child-occupied facility and occupant use patterns that may cause lead-based paint exposure to one or more children under 7 years of age shall be collected.

IV.B.2.b. A visual inspection of the pre-1978 residential dwelling or child-occupied facility shall be conducted to:

IV.B.2.b.(i) determine if any deteriorated paint is present, and

IV.B.2.b.(ii) locate at least two dust sampling locations.

IV.B.2.c. If deteriorated paint is present, each surface with deteriorated paint, which is determined, using documented methodologies, to be in poor condition and to have a distinct painting history, shall be tested for the presence of lead.

IV.B.2.d. In residential dwellings two composite dust samples shall be collected, one from the floors and the other from the windows, in rooms, hallways or stairwells

where one or more children, under 7 years of age, are most likely to come in contact with dust.

IV.B.2.e. In pre-1978 multi-family dwellings and child-occupied facilities, in addition to the floor and window samples required in Section IV.B.2.d. of this Regulation No. 19, the risk assessor shall also collect composite dust samples from common areas where one or more children, under 7 years of age, are most likely to come into contact with dust.

IV.B.3. Dust samples shall be collected and analyzed in the following manner.

IV.B.3.a. all dust samples shall be taken using documented methodologies that incorporate adequate quality control procedures; and

IV.B.3.b. all collected dust samples shall be analyzed according to Section IV.D. (Collection and Laboratory Analysis of Samples) of this Regulation No. 19, to determine if they contain detectable levels of lead that can be quantified numerically.

IV.B.4. Paint shall be sampled in the following manner:

IV.B.4.a. the analysis of paint to determine the presence of lead shall be conducted using documented methodologies which incorporate adequate quality control procedures; and/or

IV.B.4.b. all collected paint chip samples shall be analyzed according to Section IV.D (Collection and Laboratory Analysis of Samples) of this Regulation No. 19, to determine if they contain detectable levels of lead that can be quantified numerically.

IV.B.5. The risk assessor shall prepare a lead hazard screen report, which shall include the following information:

IV.B.5.a. The information required in a risk assessment report as specified in Section IV.C. (Risk Assessment) of this Regulation No. 19, including Sections IV.C.10.a. through IV.C.10.n. of this Regulation No. 19, and excluding Sections IV.C.10.o. through IV.C.10.r. of this Regulation No. 19. Additionally, any background information collected pursuant to Section IV.B.2.a. of this Regulation No. 19, shall be included in the risk assessment report.

IV.B.5.b. Recommendations, if warranted, for a follow-up risk assessment, and as appropriate, any further actions.

IV.C. Risk Assessment

IV.C.1. A risk assessment shall be conducted only by a person certified by the division as a risk assessor and, if conducted, must be conducted according to the procedures in this Section IV.C. (Risk Assessment) of this Regulation No. 19.

IV.C.2. A visual inspection for risk assessment of the pre-1978 residential dwelling or child-occupied facility shall be undertaken to locate the existence of deteriorated paint, assess the extent and causes of the deterioration, and other potential lead-based paint hazards.

IV.C.3. Background information regarding the physical characteristics of the pre-1978 residential dwelling, or child-occupied facility and occupant use patterns that may cause lead-based paint exposure to one or more children under 7 years of age shall be collected.

IV.C.4. The following surfaces which are determined, using documented methodologies, to have a distinct painting history, shall be tested for lead;

IV.C.4.a. Each friction surface or impact surface with visibly deteriorated paint; and

IV.C.4.b. All other surfaces with visibly deteriorated paint.

IV.C.5. In pre-1978 residential dwellings, dust samples (either composite or single-surface samples) from the interior window sills and floor shall be collected in all living areas where one or more children, under 7 years of age, are most likely to come into contact with dust.

IV.C.6. For pre-1978 multi-family dwellings and child-occupied facilities, the samples required in Section IV.C.4. of this Regulation No. 19, shall be taken. In addition, interior window sill and floor dust samples (either composite or single-surface samples) shall be collected in the following locations:

IV.C.6.a. common areas adjacent to the sampled pre-1978 residential dwelling or child-occupied facility; and

IV.C.6.b. other common areas in the building where the risk assessor determines that one or more children, under 7 years of age, are likely to come into contact with dust.

IV.C.7. For child-occupied facilities, interior window sill and floor dust samples (either composite or single-surface samples) shall be collected in each room, hallway or stairwell utilized by one or more children, under 7 years of age, and in other common areas in the child-occupied facility where the risk assessor determines one or more children, under 7 years of age, are likely to come into contact with dust.

IV.C.8. Soil samples shall be collected and analyzed for lead concentrations in the following locations:

IV.C.8.a. exterior play areas where bare soil is present; and

IV.C.8.b. The rest of the yard (i.e., non-play areas) where bare soil is present.

IV.C.8.c. Any paint, dust, or soil sampling or testing shall be conducted using documented methodologies that incorporate adequate quality control procedures.

IV.C.9. Any collected paint chip, dust, or soil samples shall be analyzed according to Section IV.D. (Collection and Laboratory Analysis of Samples) of this Regulation No. 19, to determine if they contain detectable levels of lead that can be quantified numerically.

IV.C.10. The certified risk assessor shall prepare a risk assessment report which shall include the following information:

IV.C.10.a. date of assessment;

IV.C.10.b. address of each building;

IV.C.10.c. date of construction of buildings;

IV.C.10.d. apartment number (if applicable);

IV.C.10.e. name, address, and telephone number of each owner of each building;

IV.C.10.f. name, signature, and certification of the certified risk assessor conducting the assessment;

IV.C.10.g. name, address, and telephone number of the certified firm employing each certified risk assessor if applicable;

IV.C.10.h. name, address, and telephone number of each recognized laboratory conducting analysis of collected samples;

IV.C.10.i. results of the visual inspection;

IV.C.10.j. testing method and sampling procedure for paint analysis employed;

IV.C.10.k. specific locations of each painted component tested for the presence of lead;

IV.C.10.l. all data collected from on-site testing, including quality control data and, if used, the serial number of any XRF device;

IV.C.10.m. all results of laboratory analysis on collected paint, soil, and dust samples;

IV.C.10.n. any other sampling results;

IV.C.10.o. any background information collected pursuant to Section IV.C.3. of this Regulation No. 19;

IV.C.10.p. to the extent that they are used as part of the lead-based paint hazard determination, the results of any previous inspections or analyses for the

presence of lead-based paint, or other assessments of lead-based paint-related hazards;

IV.C.10.q. a description of the location, type, and severity of identified lead-based paint hazards and any other potential lead hazards; and

IV.C.10.r. a description of interim controls and/or abatement options for each identified lead-based paint hazard and a suggested prioritization for addressing each hazard; if the use of an encapsulant or enclosure is recommended, the report shall recommend a maintenance and monitoring schedule for the encapsulant or enclosure.

IV.D. Collection and Laboratory Analysis of Samples

Any paint chip, dust, or soil samples collected as required by the work practice standards contained in this Section IV. (Inspections, Lead Hazard Screens, and Risk Assessments) of this Regulation No. 19 shall be:

IV.D.1. collected by persons certified by the division pursuant to this Regulation No. 19 as an inspector or risk assessor; and

IV.D.2. analyzed by a recognized laboratory.

IV.E. Composite Dust Sampling

Composite dust sampling may only be conducted in the situations specified in Sections IV.B. (Lead Hazard Screen) and IV.C. (Risk Assessment) of this Regulation No. 19. If such sampling is conducted, the following conditions shall apply:

IV.E.1. composite dust samples shall consist of at least two subsamples;

IV.E.2. every component that is being tested shall be included in the sampling; and

IV.E.3. composite dust samples shall not consist of subsamples from more than one type of component.

IV.F. Recordkeeping

All reports or plans required in this Section shall be maintained by the certified firm or individual who prepared the report for no fewer than 3 years. The certified firm or individual also shall provide copies of these reports to the building owner who contracted for its services.

IV.G. Alternative Procedures and Variances

The division may, at its discretion, grant a variance from the requirements in this Section IV. (Inspections, Lead Hazard Screens, and Risk Assessments) of this Regulation No. 19, allowing use of an alternative procedure for the inspection, risk assessment, and lead

hazard screen provided that the person requesting the variance submit an alternative procedure in writing to the division and demonstrates to the satisfaction of the division that compliance with this Regulation No. 19 is not practical or that the proposed alternative procedures provides equivalent means for determining the presence of lead and lead-based paint hazards.

IV.H. Determinations

IV.H.1. Lead-based paint is present:

IV.H.1.a. On any surface that is tested and found to contain lead equal to or in excess of 1.0 milligrams per square centimeter or equal to or in excess of 0.5% by weight; and

IV.H.1.b. On any surface like a surface tested in the same room equivalent that has a similar painting history and that is found to be lead-based paint.

IV.H.2. A paint-lead hazard is present:

IV.H.2.a. On any friction surface that is subject to abrasion and where the lead dust levels on the nearest horizontal surface underneath the friction surface (e.g., the window sill or floor) are equal to or greater than the dust hazard levels identified in this Regulation No. 19.

IV.H.2.b. On any chewable lead-based paint surface on which there is evidence of teeth marks;

IV.H.2.c. Where there is any damaged or otherwise deteriorated lead-based paint on an impact surface that is cause by impact from a related component (such as a door knob that knocks into a wall or a door that knocks against its door frame: and

IV.H.2.d. If there is any other deteriorated lead-based paint in any residential building or child-occupied facility or on the exterior of any residential building or child-occupied facility.

IV.H.3. A dust-lead hazard is present in a residential dwelling or child occupied facility:

IV.H.3.a. In a residential dwelling on the floors and interior window sills when the weighted arithmetic mean lead loading for all single surface or composite samples of floors and interior window sills are equal to or greater than 40 $\mu g/ft^2$ for floors and 250 $\mu g/ft^2$ for interior window sills, respectively:

IV.H.3.b. On floors or interior window sills in an unsampled residential dwelling in a multi-family dwelling, if a dust-lead hazard is present on floors or interior window sills, respectively, in at least one sampled residential unit on the property; and

IV.H.3.c. On floors or interior window sills in an unsampled common area in a multi-family dwelling, if a dust-lead hazard is present on floors or interior window sills, respectively, in at least one sampled common area group on the property.

IV.H.4. A soil-lead hazard is present:

IV.H.4.a. In a play area when the soil-lead concentration from a composite area sample of bare soil is equal to or greater than 400 parts per million: or

IV.H.4.b. In the rest of the yard when the arithmetic mean lead concentration from a composite sample (or arithmetic mean of composite samples) of bare soil from the rest of the yard (i.e., non-play areas) for each residential building on a property is equal to or greater than 1,200 parts per million.

V. Abatement Requirements

V.A. General Requirements

V.A.1. Except for those persons and activities exempted in Section I. (Scope and Applicability) of this Regulation No. 19, persons performing lead-based paint abatement in or to a pre-1978 residential dwelling or child-occupied facility shall comply with all the requirements of Section III. (Training and Certification Requirements) and this Section V. (Abatement Requirements) of this Regulation No. 19, if either one of the following conditions apply:

V.A.1.a. two or more square feet of lead-based paint or lead contaminated dust is being abated per room or equivalent

V.A.1.b. twenty or more square feet of lead-based paint, lead contaminated dust, or lead contaminated soil is being abated from or on the exterior building

V.A.2. An abatement shall be conducted only by an individual certified by the division, and if conducted, shall be conducted according to the procedures in this Section V. (Abatement Requirements) of this Regulation No. 19.

V.A.3. A certified supervisor is required for each abatement project and shall be onsite during all work site preparation and during the post-abatement cleanup of work areas.

V.A.4. The certified supervisor and the certified firm employing that supervisor shall ensure that all abatement activities are conducted according to the requirements of this Section V. (Abatement Requirements) of this Regulation No. 19, and all other Federal, State and local requirements.

V.A.5. Notification

V.A.5.a. Notification of the commencement of lead-based paint abatement in or to a pre-1978 residential dwelling or child-occupied facility shall be provided on a division-approved form and postmarked or hand-delivered to the division, the local county health department and the local building department a minimum of 10 working days prior to the commencement of abatement activities.

V.A.5.b. The 10 working day notification may be waived by the division if one or more of the following conditions exist:

V.A.5.b.(i) a child with an elevated blood lead level resides within the pre-1978 residential dwelling or child-occupied facility or regularly visits the child-occupied facility where the abatement will occur; or

V.A.5.b.(ii) the division determines that an imminent danger to health exists; or

V.A.5.b.(iii) the division determines that an unavoidable hardship would result.

V.A.5.c. The applicable notification fee given below shall accompany the notification form for the notice to be accepted by the division.

VALUATION OF WORK	NOTIFICATION FEE
$2,000 or less	$110
$2,001 - $50,000	$100 base plus $8.00 per $1,000 in valuation or fraction thereof of total valuation
$50,001 - $100,000	$150 base plus $7.00 per $1,000 in valuation or fraction thereof of total valuation
$100,001 - $500,000	$250 base plus $6.00 per $1,000 in valuation or fraction thereof of total valuation
Over $500,000	$750 base plus $5.00 per $1,000 in valuation or fraction thereof of total valuation

V.A.6. Occupant Protection Plan

A written occupant protection plan shall be developed for all abatement projects and shall be prepared according to the following procedures:

V.A.6.a. The occupant protection plan shall be unique to each pre-1978 residential dwelling or child-occupied facility and be developed prior to the abatement. The occupant protection plan shall describe the measures and management procedures that will be taken during the abatement to protect the building occupants from exposure to any lead-based paint hazards. At a minimum, the plan shall include the applicable occupant protection measures contained in Sections V.B. (Work Practice Restrictions and Prohibitions) through V.K. (Waste Handling) of this Regulation No. 19. In addition, the plan shall specifically address whether occupant relocation during abatement activities is necessary.

V.A.6.b. A certified supervisor or project designer shall prepare the occupant protection plan.

V.A.7. The integrity of all containment systems shall be maintained during abatement to prevent the potential spread of any lead contamination outside the work area. Should a breach occur, the areas contaminated with lead shall be cleaned in accordance with the applicable requirements in Section V.H (Cleaning) of this Regulation No. 19, and cleared in accordance with the applicable requirements in Section V.J (Final Clearance) of this Regulation No. 19.

V.B. Work Practice Restrictions and Prohibitions

The work practices listed below shall be restricted as follows during an abatement.

V.B.1. Open-flame burning or torching of lead-based paint is prohibited.

V.B.2. Machine sanding or grinding or abrasive blasting or sandblasting or drilling or cutting of lead-based paint is prohibited unless used with High Efficiency Particulate Air (HEPA) exhaust control which continually captures all particulate from the surface being abated.

V.B.3. Dry scraping of lead-based paint is permitted only in conjunction with heat guns or around electrical outlets.

V.B.4. Operating a heat gun on lead-based paint is permitted only at temperatures below 1100 degrees Fahrenheit.

V.B.5. Uncontained hydroblasting or high-pressure water washing is prohibited unless the point of operation is completely self-contained within a local shroud and the water is captured within the shroud.

V.B.6. Chemical stripping methods shall only be used to remove lead-based paint from highly decorative or ornate components or surfaces that are otherwise difficult to abate by any other method.

V.B.7. Dry, hand sanding is prohibited.

V.C. Interior Abatement Requirements (excluding window abatements)

V.C.1. The following containment system shall be used for all interior abatement projects except window abatements:

V.C.1.a. A containment level I-1, I-2 or I-3, as described in this Section V.C. (Interior Abatement Requirements) of this Regulation No. 19, shall be used in those work areas if the amount of lead-based paint or lead-contaminated dust that will be disturbed per room, hallway, or stairwell is less than 2 square feet.

V.C.1.b. A containment level I-2 or I-3, as described in this Section V.C. (Interior Abatement Requirements) of this Regulation No. 19, shall be used in those work areas if the amount of lead-based paint or lead-contaminated dust that will be disturbed per room, hallway, or stairwell is 2 or more square feet.

V.C.1.c. Regardless of the requirements in Sections V.C.1.a. and b. of this Regulation No. 19, an interior containment level I-3, as described in Section V.C.4. of this Regulation No. 19, shall be used to contain the work area if either one of the following conditions apply:

V.C.1.c.(i) if any amount of floor surface that is painted with lead-based paint, or was at one time painted with lead-based paint, is machine sanded; or

V.C.1.c.(ii) if any amount of lead-based paint is abated by abrasive blasting.

V.C.2. Interior containment level I-1 shall consist of the following elements:

V.C.2.a. Warning Signs. At a minimum, warning signs shall be posted at all entryways to the work area. The warning signs shall, in a language understandable by all occupants, state the following warning:

WARNING LEAD ABATEMENT WORK AREA HAZARDOUS LEAD DUST POISON DO NOT ENTER

V.C.2.b. Warning Barriers. A physical barrier (furniture, wood planking) shall be placed around the work area perimeter so as to prevent inadvertent access by children.

V.C.2.c. Ventilation System Shutdown. Vents that are within 5 feet from the surface being abated must be sealed with 6-mil thickness polyethylene sheeting to prevent contaminated air from leaving the work area.

V.C.2.d. Protection of Objects. Furniture and other objects within 5 feet in all directions of the surface to be abated shall be moved outside the room, hallway, or stairwell. Objects or furniture that cannot be moved shall be sealed with a minimum of one layer of 6-mil polyethylene sheeting.

V.C.2.e. Floor Protection. At a minimum, one layer of 6-mil thickness polyethylene sheeting or greater shall be sealed to the floor at least 5 feet beyond the perimeter of the surface being abated in all directions, so as to prevent contamination of the floor. Floors shall be pre-cleaned of debris as required in Section V.H.1. (Precleaning) of this Regulation No. 19 prior to sealing polyethylene sheeting on the floor.

V.C.2.f. Cleanup. All surfaces and floors extending 5 feet in all directions from the abated surface, and all adjacent areas used as a pathway to the work area, shall be cleaned by HEPA vacuuming, wet washing, and HEPA vacuuming, and as required in Section V.H. (Cleaning) of this Regulation No. 19.

V.C.3. Interior containment level I-2 shall consist of the following elements:

V.C.3.a. Warning Signs. At a minimum, warning signs shall be posted at all entryways to the work area. The warning signs shall, in a language understandable by all occupants, at least state the following warning:

WARNING LEAD ABATEMENT WORK AREA HAZARDOUS LEAD DUST POISON DO NOT ENTER

V.C.3.b. Ventilation System Shutdown. The ventilation system supplying air to the work area shall be turned off or otherwise prevented from supplying air to the work area until clearance has been achieved. All registers, vents and openings in the work area shall be sealed with 6-mil thickness polyethylene sheeting.

V.C.3.c. Barriers. All openings to the work area shall be sealed off from the rest of the building with a minimum of 1 layer of 6-mil thickness polyethylene sheeting to prevent air flow out of the work area.

V.C.3.d. Work Area Egress. Entry into and egress out of the work area shall be through an airlock that, at a minimum, shall consist of a single chamber with self-closing triple flaps or "Z-flaps" on either side of the chamber. Disposable clothing and footwear shall be worn by all persons entering the containment area. Disposable clothing and footwear used inside the containment shall be deposited in this airlock chamber prior to personnel exiting containment.

V.C.3.e. Protection of Objects. Furniture and other objects shall be moved outside the room, hallway, or stairwell. Objects or furniture that cannot be moved shall be sealed with a minimum of one layer of 6-mil polyethylene sheeting.

V.C.3.f. Floor Protection. The entire floor within the work area shall be sealed with a minimum of 2 layers of 6-mil thickness polyethylene sheeting. The polyethylene sheeting shall be installed such that removal of the top most layer of polyethylene sheeting will not cause the underlying polyethylene sheeting to lose its seal. Floors shall be pre-cleaned of debris as required in Section V.H.1. (Precleaning) of this Regulation No. 19 prior to sealing polyethylene sheeting on the floor.

V.C.3.g. Cleanup. All surfaces in the work area and all adjacent areas used as a pathway to the work area shall be cleaned by HEPA vacuuming, wet washing, and HEPA vacuuming, and as required in Section V.H. (Cleaning) of this Regulation No. 19. Polyethylene sheeting shall be removed in accordance with Section V.H.4. (Polyethylene Sheeting Removal Procedures) of this Regulation No. 19.

V.C.4. Interior containment level I-3 shall consist of the following elements:

V.C.4.a. Containment. At a minimum, all the level I-2 containment requirements as described in Section V.C.3. of this Regulation No. 19.

V.C.4.b. Work Area Egress. Entry into and egress out of the work area shall be through a 3-stage decontamination unit with a shower equipped with hot and cold water that is adjustable inside the shower unit. Each airlock in the decontamination unit shall be constructed with self-closing triple flaps or "Z-flaps" separating each individual chamber. Persons entering the abatement work area prior to final clearance shall don disposable clothing and footwear. Prior to exiting the containment, personnel shall dispose of the suits in the chamber adjacent to the work area and shower.

V.C.4.c. Negative Pressure/Airflow. The containment shall have a negative pressure differential of at least -0.02 inches water column between the work area and the clean area inside the pre-1978 residential dwelling or child-occupied facility. The pressure differential shall be continuously recorded with a recording manometer. The air within the work area shall be exchanged at a minimum rate of 10 times per hour and exhausted to the exterior of the building. Air flow shall always be from the outside of containment to within, as verified by smoke testing. Smoke tubes shall be on site at all times during abatement.

V.D. Exterior Abatement Requirements

V.D.1. Exterior Abatement Project Restrictions

All exterior abatement projects subject to this Regulation No. 19, except for abatement work areas sufficiently contained with an exterior containment level of X-2 or X-3, shall comply with the following restrictions.

V.D.1.a. Exterior abatement, except for cleanup to prevent the spread of lead contamination, shall not proceed if the local wind gusts are, or are expected to be, greater than 20 miles per hour.

V.D.1.b. Exterior abatement shall stop and cleanup shall occur before rain begins.

V.D.2. Containment Requirements

V.D.2.a. The following containment system shall be used for all exterior abatement projects except window and soil abatements:

V.D.2.a.(i) An exterior containment level X-1, X-2, or X-3, as described in this Section V.D.2. (Containment Requirements) of this Regulation No. 19, shall be used if the amount of lead-based paint that will be disturbed is less than 20 square feet.

V.D.2.a.(ii) An exterior containment level X-2 or X-3, as described in this Section V.D.2. (Containment Requirements) of this Regulation No. 19, shall be used if the amount of lead-based paint that will be disturbed is 20 or more square feet.

V.D.2.a.(iii) Regardless of the requirements in Sections V.D.2.a.(i) and (ii) of this Regulation No. 19, an exterior containment level X-3 as described in Section V.D.2.d. of this Regulation No. 19 shall be used if either one of the following conditions apply:

V.D.2.a.(iii)(a) any amount of floor surface (e.g. patio, step, deck) that is painted with lead-based paint, or was at one time painted with lead-based paint, is power sanded; or

V.D.2.a.(iii)(b) any amount of lead-based paint is abated by abrasive blasting.

V.D.2.b. Exterior containment level X-1 shall consist of the following elements:

V.D.2.b.(i) Warning Signs. Post warning signs on the building and at a 20-foot perimeter around the building (or less if distance to the next building or sidewalk is less than 20 feet). The warning signs shall, in a language understandable by all occupants, state the following warning:

WARNING LEAD ABATEMENT WORK AREA HAZARDOUS LEAD DUST POISON DO NOT ENTER

V.D.2.b.(ii) Warning Barriers. Erect temporary fencing or barrier tape at a 20-foot perimeter around working surfaces (or less if distance to the next building or sidewalk is less than 20 feet). If an entryway to the building is within 10 feet of the working surfaces, an alternate entryway shall be provided. At least one lead-safe entryway shall be made available to occupants at all times, unless the occupants have been relocated until final clearance has been achieved.

V.D.2.b.(iii) Barriers. All windows within 20 feet of the working surfaces shall be closed or sealed, including windows in adjacent structures.

V.D.2.b.(iv) Protection of Objects. All movable objects shall be removed to a minimum of 20 feet away from abatement surfaces in all directions. Objects that cannot be removed shall be sealed with a minimum of 1 layer of 6-mil thickness polyethylene sheeting.

V.D.2.b.(v) Ground Protection. At a minimum, the ground, including decks, driveways, and porches, extending 10 feet beyond the perimeter of the abatement surfaces in all directions shall be covered with one layer of 6-mil thickness polyethylene sheeting. The edges of the polyethylene sheeting shall be sealed to the building such that no gaps between the polyethylene sheeting and the building exist. The edges of the polyethylene sheeting shall be raised to create a basin to contain contaminated runoff. The polyethylene sheeting shall be weighted down or otherwise secured to prevent movement. The ground shall be pre-cleaned of visible debris as required in Section V.H.1. (Precleaning) of this Regulation No. 19 prior to sealing it with polyethylene sheeting.

V.D.2.b.(vi) Cleanup. All debris and ground polyethylene sheeting must be removed from the work area before leaving the site each night. Polyethylene sheeting shall be cleaned and removed in accordance with Section V.H.4. (Polyethylene Sheeting Removal Procedures) of this Regulation

No. 19. Paint chips in the soil shall be HEPA vacuumed and properly disposed.

V.D.2.c. Exterior containment level X-2 shall consist of the following elements:

V.D.2.c.(i) Warning Signs. Post visible warning signs on the building and on the outside of the containment barriers. The warning signs shall, in a language understandable by all occupants, state the following warning:

WARNING LEAD ABATEMENT WORK AREA HAZARDOUS LEAD DUST POISON DO NOT ENTER

V.D.2.c.(ii) Barriers. All openings to the work area shall be sealed off with a minimum of 1 layer of 6-mil thickness polyethylene sheeting to prevent air flow out of the work area.

V.D.2.c.(iii) Work Area Egress. Entry into and egress out of the work area shall be through an airlock that, at a minimum, shall consist of a single chamber with self-closing triple flaps or "Z-flaps" on either side of the chamber. Disposable clothing and footwear shall be worn by all persons entering the containment area. Disposable clothing and footwear used inside the containment shall be deposited in this airlock chamber prior to personnel exiting containment.

V.D.2.c.(iv) Protection of Objects. All movable objects shall be removed from the work area. Objects that cannot be removed shall be sealed with a minimum of 1 layer of 6-mil thickness polyethylene sheeting.

V.D.2.c.(v) Ground Protection. At a minimum, the ground, including decks, driveways and porches, within the work area shall be covered with two layers of 6-mil thickness polyethylene sheeting. The edges of the polyethylene sheeting shall be sealed to the building such that no gaps between the polyethylene sheeting and the building exist. The edges of the polyethylene sheeting shall be raised to create a basin to contain contaminated runoff. The polyethylene sheeting shall be weighted down or otherwise secured to prevent movement. The ground shall be pre-cleaned of visible debris as required in Section V.H.1. (Precleaning) of this Regulation No. 19 prior to sealing it with polyethylene sheeting.

V.D.2.c.(vi) Cleanup. Polyethylene barriers shall be cleaned and removed in accordance with Section V.H.4. (Polyethylene Sheeting Removal Procedures) of this Regulation No. 19. All surfaces and floors within the containment and all adjacent areas used as a pathway to the work

area, shall be cleaned by HEPA vacuuming, wet washing, and HEPA vacuuming, and as required in Section V.H. (Cleaning) of this Regulation No. 19. Paint chips in the soil shall be HEPA vacuumed and properly disposed.

V.D.2.d. Exterior containment level X-3 shall consist of the following elements:

V.D.2.d.(i) Containment. At a minimum, all the exterior level X-2 containment requirements as described in Section V.D.2.c. of this Regulation No. 19.

V.D.2.d.(ii) Work Area Egress. Entry into and egress out of the work area shall be through a 3-stage decontamination unit with a shower equipped with hot and cold water that is adjustable inside the shower. Each airlock in the decontamination unit shall be constructed with self-closing triple flaps or "Z-flaps" separating each individual chamber. Persons entering the abatement work area prior to final clearance shall don disposable clothing and footwear. Prior to exiting the containment, personnel shall dispose of the suits in the chamber adjacent to the work area and shower.

V.D.2.d.(iii) Negative Pressure/Airflow. The containment shall have a negative pressure differential of at least -0.02 inches water column between the work area and the clean area. The pressure differential shall be continuously recorded with a recording manometer. The air within the work area shall be exchanged at a minimum rate of 10 times per hour. Air flow shall always be from the outside of containment to within, as verified by smoke testing. Smoke tubes shall be on site at all times during abatement.

V.E. Window Abatement

V.E.1. When abating windows from the exterior of a pre-1978 residential dwelling or child-occupied facility, the person performing the abatement shall comply with the following requirements:

V.E.1.a. Comply with the restrictions in Section V.D.1. (Exterior Abatement Project Restrictions) of this Regulation No. 19.

V.E.1.b. At a minimum, seal two layers of 6-mil thickness polyethylene sheeting to the inside wall covering the window so as to prevent dust from migrating inside the building during abatement; and

V.E.1.c. At a minimum, comply with all the exterior containment level X-1, level X-2 or level X-3 requirements described in Section V.D.2. (Containment Requirements) of this Regulation No. 19.

V.E.2. When abating windows from the interior of a pre-1978 residential dwelling or child-occupied facility, the person performing the abatement shall comply with the following requirements:

V.E.2.a. at a minimum, secure two layers of 6-mil thickness polyethylene sheeting to the exterior wall so as to prevent dust from migrating outside the building during abatement; and

V.E.2.b. comply with all interior containment level I-2 or level I-3 requirements as described in Section V.C. (Interior Abatement Requirements) of this Regulation No. 19.

V.E.3. If containment is breached, then surfaces on both sides of the window shall be cleaned in accordance with the applicable requirements in Section V.H. (Cleaning) of this Regulation No. 19, and cleared in accordance with the applicable requirements in Section V.J. (Final Clearance) of this Regulation No. 19.

V.F. Soil Abatement

V.F.1. If conducted, or required pursuant to Section V.J.1.g.(ii) of this Regulation No. 19, soil abatement shall be conducted in one of the following ways:

V.F.1.a. If soil is removed the person performing the removal shall:

V.F.1.a.(i) comply with the exterior abatement project restrictions as described in Section V.D.1. (Exterior Abatement Project Restrictions) of this Regulation No. 19 and the exterior containment level X-1, level X-2, or level X-3 requirements, as described in Section V.D. (Exterior Abatement Requirements) of this Regulation No. 19; and

V.F.1.a.(ii) replace the lead-contaminated soil with soil as close to local background as practical, but no greater than 400 μg/g of lead.

V.F.1.a.(iii) The soil that is removed shall not be used as top soil at another residential property or child-occupied facility.

V.F.1.b. If soil is not removed, the lead-contaminated soil shall be permanently covered, as defined in Section II.B.59. of this Regulation No. 19.

V.F.2. The abatement, handling, transportation, and disposal of lead-contaminated soil shall be performed in a manner that prevents the spread of lead contamination to areas outside the abatement work area and the approved landfill.

V.G. Encapsulation and Enclosure Requirements

V.G.1. Encapsulation and enclosure systems shall be dust tight for a design life of at least 20 years. Encapsulation and enclosure systems shall not be used on unsound substrates that cannot be stabilized or repaired to support the enclosure or encapsulation systems for at least 20 years.

V.G.2. Encapsulation and enclosure systems shall be sealed in accordance with Section V.I.2. (Sealing Replacement Components, Enclosure and Encapsulation) of this Regulation No. 19.

V.G.3. To prevent a breach of an enclosure, the surface behind the enclosure shall be permanently labeled every 2 feet with the following warning, "Danger: Lead-Based Paint." A durable drawing of the property floor plan identifying the enclosed areas shall be mounted in a visible location within the structure (e.g. utility room, furnace area, garage).

V.G.4. Only those encapsulants explicitly recognized by the division shall be used for abatement projects subject to this Regulation No. 19.

V.H. Cleaning

V.H.1. Precleaning. Visible paint chips and lead-contaminated dust shall be removed from the work area prior to laying polyethylene sheeting on the floor but after all other containment barriers have been erected.

V.H.2. Daily Cleaning. All horizontal surfaces in the work area shall be cleaned of visible dust and debris prior to ceasing work for the day.

V.H.3. Carpet, Upholstery and Forced Air Duct Cleaning

V.H.3.a. Carpet and Rugs. All carpets or rugs that are contaminated with lead-contaminated dust that will be cleaned, and all carpet in the work area that will not be disposed of as lead-contaminated waste, shall be cleaned as set forth below:

V.H.3.a.(i) HEPA vacuums shall be used to vacuum all rugs and carpets. A HEPA vacuum equipped with a beater bar or agitator attachment on the vacuum head to dislodge embedded dust shall be used when vacuuming the pile side of carpets.

V.H.3.a.(ii) For wall to wall carpeting, the carpet shall be vacuumed for not less than 4 minutes per 10 square feet of carpeting, divided into two time segments of at least 2 minutes for each 10 square feet. The two time vacuuming segments shall be performed in perpendicular directions.

V.H.3.a.(iii) For area rugs, the top and bottom of the carpet shall be vacuumed for not less than 1 minute for every 10 square feet per side. After the initial vacuuming of the carpet, the floor below the area rug shall be vacuumed at normal speed. Following the vacuuming of the floor, the pile side of the rug shall again be vacuumed at a rate not less than 2 minutes per 10 square feet of rug.

V.H.3.a.(iv) When carpet or rugs are removed from the work area for off-site cleaning or disposal, the carpet or rugs shall be misted, carefully rolled

and sealed with 6-mil thickness polyethylene sheeting to prevent the release of dust.

V.H.3.b. Upholstery. All upholstery that is contaminated with lead-contaminated dust that will be cleaned, and all upholstered surfaces in the work area that are not disposed of as lead-contaminated waste, shall be HEPA vacuumed with a minimum of three passes over each surface at a total rate of 2 minutes per 10 square feet.

V.H.3.c. Forced Air Ducts. Air vent registers within the work area shall be HEPA vacuumed and wet cleaned. Horizontal surfaces in the duct work that can be reached with a vacuum attachment shall be cleaned of visible dust and debris. The division recommends that air filters on heating units and air conditioners be replaced at the same time as dust removal.

V.H.4. Polyethylene Sheeting Removal Procedures. Prior to final cleaning, protective polyethylene sheeting coverings shall be cleaned of visible debris by HEPA vacuuming and/or wet wiped so that they are visibly clean prior to removal. Multiple layers of polyethylene sheeting shall be removed one layer at a time and only after each individual layer has been wet wiped clean of visible debris.

V.H.5. Final Cleaning. No sooner than 1 hour after the completion of removal, encapsulation, or enclosure activities have ceased, and prior to final clearance, all surfaces in the work area shall be cleaned by HEPA vacuuming, followed by wet cleaning, followed by a second HEPA vacuuming. In addition, persons performing the cleaning shall comply with the following requirements:

V.H.5.a. HEPA vacuuming shall take place only after the surfaces in the work area being vacuumed are dry.

V.H.5.b. Wet cleaning shall use clean water mixed with a cleaning agent. The proportion of cleaning agent to water shall be in accordance with the manufacturer's specifications. At a minimum, the cleaning mixture shall be changed after its use in each room, hallway, or stairwell to avoid recontaminating an area by cleaning it with dirty water.

V.I. Coating and Sealing

V.I.1. Coating

V.I.1.a. All abated surfaces in the work area shall be sealed with polyurethane or deck enamel, painted, or similarly coated so that the surfaces are easily cleanable by occupants. The coating may be applied prior to conducting final clearance wipe sampling.

V.I.1.b. A visual inspection to ensure that lead-based paint hazards in the work area are eliminated shall be conducted prior to the coating of surfaces as required in

Section V.I.1.a. of this Regulation No. 19. The visual inspection shall be performed only by a certified inspector or risk assessor.

V.I.1.c. The installation of resilient coverings over an existing lead-based paint enclosure system are exempt from this Section V.I.1. (Coating) of this Regulation No. 19. Surfaces enclosed with resilient coverings such as vinyl, aluminum coil stock, or materials traditionally not repainted are exempt from this Section V.I.1. (Coating) of this Regulation No. 19.

V.I.2. Sealing Replacement Components, Enclosures and Encapsulation. All replacement components, encapsulation systems and enclosures shall be made dust-tight for at least 20 years. All crevices, holes, seams, edges, joints, and cracks shall be caulked. The underside of all components and enclosures shall be back-caulked to further prevent leaded dust and lead residues from escaping the abated surface.

V.J. Final Clearance

V.J.1. The following post-abatement clearance procedures shall be performed only by a certified inspector or risk assessor.

V.J.1.a. Visual inspection. Following an abatement, a visual inspection shall be performed to determine that all of the following conditions have been met prior to the continuation of the clearance procedures:

V.J.1.a.(i) Deteriorated painted surfaces and/or visible amounts of dust, debris or residue are not still present in the work area. If deteriorated painted surfaces or visible amounts of dust, debris or residue are present, these conditions must be eliminated prior to the continuation of the clearance procedures.

V.J.1.a.(ii) All surfaces in the work area are properly sealed and re-painted in accordance with Section V.I. (Coating and Sealing) of this Regulation No. 19, such that the surfaces are easily cleanable.

V.J.1.a.(iii) All enclosure and encapsulation systems are properly installed, caulked and are dust tight in accordance with Sections V.G. (Encapsulation and Enclosure Requirements), and V.I. (Coating and Sealing) of this Regulation No. 19.

V.J.1.a.(iv) All areas adjacent to the work area that were used as pathways to the work area are visibly free of lead-contaminated dust, debris or residue.

V.J.1.b. Following the visual inspection and any post-abatement cleanup required this Section V.J.1.a. (Visual Inspection) of this Regulation No. 19, clearance sampling for lead-contaminated dust and soil shall be conducted. Clearance sampling may be conducted by employing single-surface sampling or composite sampling techniques.

V.J.1.c. Dust and soil samples for clearance purposes shall be taken using documented methodologies that incorporate adequate quality control procedures.

V.J.1.d. Dust and soil samples for clearance purposes shall be taken a minimum of 1 hour after completion of final post-abatement cleanup activities.

V.J.1.e. The following post-abatement clearance activities shall be conducted as appropriate based upon the extent or manner of abatement activities conducted in or to the pre-1978 residential dwelling, or child-occupied facility:

V.J.1.e.(i) Clearance Sampling of Interior Abatement Projects

V.J.1.e.(i)(a) After conducting an abatement, at least one dust sample shall be taken from one interior window sill and from one window trough (if available) and at least one dust sample shall be taken from the floor of no less than four rooms, hallways or stairwells within the containment area. In addition, at least one dust sample shall be taken from the floor outside the containment area and within 10 feet of containment where potential contamination is likely. If there are less than four rooms, hallways or stairwells within the containment area, then all rooms, hallways or stairwells shall be sampled.

V.J.1.e.(ii) Clearance Sampling of Exterior Abatement Projects

V.J.1.e.(ii)(a) After conducting an exterior lead-based paint abatement, the following samples shall be collected:

V.J.1.e.(ii)(a)(i) At least two dust samples shall be collected from the work area if a paved surface or window are within the work area. At a minimum, one dust sample shall be taken from one window (if any) and one dust sample shall be collected from the floor of each patio, deck, driveway, or paved surface (if any) within the work area. Window samples shall be collected from the window sill or window trough, alternating between rooms.

V.J.1.e.(ii)(a)(ii) At least two composite soil samples shall be collected from the soil within the work area. At a minimum, one composite soil sample shall be collected from the soil along the building perimeter and one composite soil sample shall be collected from the child's principle play area (if any in the work area). Each composite soil sample shall consist of at least 5 and no more than 10 aliquots of soil from areas selected in accordance with documented methodologies.

V.J.1.e.(ii)(b) If the exterior abatement project involved only the covering or removing of bare soil then the collection of clearance soil samples

specified in this Section V.J.1.e.(ii)(a) of this Regulation No. 19 is not required. The visual inspection requirement specified in Section V.J.1.a. (Visual Inspection) of this Regulation No. 19, still applies to soil-only abatement projects.

V.J.1.f. The rooms, hallways or stairwells or exterior areas selected for sampling shall be selected according to documented methodologies.

V.J.1.g. The certified inspector or risk assessor shall compare the residual lead level (as determined by the laboratory analysis) from each dust and soil sample with applicable clearance levels for lead in dust and soil on floors, windows, and other surfaces.

V.J.1.g.(i) If the residual lead level in a single surface dust sample equals or exceeds 40 $\mu g/ft^2$ on interior floors, 250 $\mu g/ft^2$ on interior window sills, 400 $\mu g/ft^2$ on window troughs, 500 $\mu g/ft^2$ on exterior window sills, or 800 $\mu g/ft^2$ on exterior surfaces (e.g. patios, porches, sidewalks), or if the residual lead level in a composite dust sample equals or exceeds the applicable clearance level divided by half the number of subsamples in the composite sample, all the components represented by the failed sample shall be re-cleaned and re-tested until clearance levels are met.

V.J.1.g.(ii) If the residual lead levels in a soil sample exceed 400 $\mu g/g$ in a play area, or 1,200 $\mu g/g$ in the rest of the yard, the soil must be abated in accordance with Section V.F. (Soil Abatement) of this Regulation No. 19.

V.J.2. In a pre-1978 multi-family dwelling with similarly constructed and maintained pre-1978 residential dwellings, random sampling for the purposes of clearance may be conducted provided:

V.J.2.a. the certified individuals who abate or clean the pre-1978 residential dwellings do not know which residential dwellings will be selected for the random samples;

V.J.2.b. in accordance with Appendix A, a sufficient number of pre-1978 residential dwellings are selected for dust and soil sampling to provide a 95 percent level of confidence that no more than 5 percent or 50 of the residential dwellings (whichever is smaller) in the randomly sampled population exceed the appropriate clearance levels specified in Section V.J.1.g. of this Regulation No. 19; and

V.J.2.c. the randomly selected pre-1978 residential dwellings are sampled and evaluated for clearance according to the procedures found in Section V.J.1. of this Regulation No. 19.

V.J.3. An abatement report shall be prepared by a certified supervisor or project designer. The abatement report shall be completed within ninety days following the successful clearance of the project and include the following information:

V.J.3.a. start and completion dates of abatement;

V.J.3.b. the name and address of each certified firm conducting the abatement and the name of each supervisor assigned to the abatement project;

V.J.3.c. the occupant protection plan prepared pursuant to Section V.A.6. (Occupant Protection Plan) of this Regulation No. 19;

V.J.3.d. the name, address, and signature of each certified risk assessor or inspector conducting clearance sampling and the date of clearance testing;

V.J.3.e. the results of clearance testing and all soil analyses (if applicable) and the name of each recognized laboratory that conducted the analyses; and

V.J.3.f. a detailed written description of the abatement, including abatement methods used, locations of rooms and/or components where abatement occurred, reason for selecting particular abatement methods for each component, any suggested monitoring of encapsulants or enclosure, and any suggested post-abatement maintenance and cleaning methods.

V.J.4. Collection and laboratory analysis of samples. Any dust or soil samples collected pursuant to this Section V.J. (Final Clearance) of this Regulation No. 19 shall be:

V.J.4.a. collected by persons certified by the division as an inspector or risk assessor; and

V.J.4.b. analyzed by a recognized laboratory.

V.J.5. Composite dust sampling. Composite dust sampling may only be conducted in the situations specified in this Section V.J. (Final Clearance) of this Regulation No. 19. If such sampling is conducted, the following conditions shall apply:

V.J.5.a. composite dust samples shall consist of at least two subsamples, but no more than four subsamples;

V.J.5.b. every component that is being tested shall be included in the sampling; and

V.J.5.c. composite dust samples shall not consist of subsamples from more than one type of component.

V.K. Waste Handling

Each person handling any lead-contaminated waste shall comply with the following requirements:

V.K.1. wrap and seal lead-contaminated waste in at least 6-mil thick polyethylene sheeting prior to removing the waste from the containment or abatement work area;

V.K.2. store the waste in a covered container within a designated secure (locked) area, if not transported immediately off-site;

V.K.3. do not cut or break painted materials or perform any action that is likely to generate leaded dust;

V.K.4. comply with all local, State and Federal waste handling and disposal requirements; and

V.K.5. discharge no visible emissions during any handling of lead-contaminated waste outside the work area.

V.L. Recordkeeping

All reports or plans required in this Section V. (Abatement Requirements) of this Regulation No. 19, shall be maintained for no fewer than 3 years by the certified firm or individual who prepared the report. The certified firm or individual also shall provide copies of these reports to the building owner who contracted for its services.

V.M. Alternative Procedures and Variances

The division may, at its discretion, grant a variance from the requirements in this Section V. (Abatement Requirements) of this Regulation No. 19, allowing use of an alternative procedure for the clearance of abatement projects or the control of emissions from a lead abatement project provided that the person conducting the abatement submit an alternative procedure in writing to the division and demonstrates to the satisfaction of the division that compliance with this Regulation No. 19 is not practical or that the proposed alternative procedures provide equivalent control of lead.

VI. Delegation to Local Health or Building Departments

VI.A. Other than training and certification requirements specified in Section III. (Training and Certification Requirements) of this Regulation No. 19, the division may delegate, at its discretion, the implementation or enforcement of standards in this Regulation No. 19 to any local health or building department, if requested by such a local department.

VI.B. To receive delegation of a program for regulating lead-based paint activities pursuant to Section VI.A. of this Regulation No. 19, the local department must:

VI.B.1. adopt standards that are at least as stringent as the standards in this Regulation No. 19;

VI.B.2. demonstrate to the division that the local enforcement program is equivalent to the division's enforcement program; and

VI.B.3. demonstrate to the division that the appropriate infrastructure or government capacity exists to effectively carry out a local program.

VII. Statement of Basis, Specific Statutory Authority, and Purpose

VII.A. August 21, 1998

1. Background

This Statement of Basis, Specific Statutory Authority and Purpose complies with the requirements of the Colorado Administrative Procedures Act, section 24-4-103(4), C.R.S. and the Colorado Air Pollution Prevention and Control Act, sections 25-7-110 and 25-7-110.5, C.R.S.

2. Basis

U.S. Environmental Protection Agency ("US EPA") promulgated a regulation that allows states to promulgate US EPA-approved lead-based paint abatement programs and receive monies from US EPA to fund the initial development of state programs. (40 C.F.R. Part 745.) In 1997, the Colorado Legislature passed an act granting the Commission authority to promulgate a regulatory program for lead-based paint abatement. (SB 97-136, Prevention, Intervention, and Reduction of Lead Exposure.)

3. Authority

The authority for this regulation is contained in the Colorado Air Pollution Prevention and Control Act ("Colorado Act"), sections 25-7-1101 through 1107, which provides the Commission the authority to develop and adopt a lead-based paint abatement program.

4. Purpose

The Colorado Legislature has declared that exposure of children to lead represents a significant environmental health problem that is preventable by developing a regulatory program that leads to the creation of housing and facilities where no significant lead-based paint hazard is present. In addition, the Legislature declared that the achievement of uniformity in the regulation of lead abatement practices and uniformity in the qualifications for and certification of persons who perform such abatement is necessary statewide. The purpose of this regulation is to protect children from exposure to lead from lead-based paint by regulating how lead-based paint abatement is conducted in "target housing" and "child-occupied facilities". As a result, the scope of Regulation No. 19 is limited to homes constructed prior to 1978, child-occupied facilities, and only those projects where the intent is to abate lead-based paint hazards. Regulation No. 19 is intended to fulfill the requirements of the Lead-based Paint Hazard Reduction Act of 1992, pertaining to target housing and child-care facilities. The Commission finds that the work practice requirements contained in Regulation No. 19 are necessary for the protection of the public in targeted housing and child-care facilities.

5. Action Taken

The Commission concludes that adoption of this regulation is an appropriate step to begin to protect children from exposure to lead from lead-based paint as a result of lead-based paint abatement in "target housing" and "child-occupied facilities". At this time, the Commission adopts language substantially similar to the federal lead-based paint

abatement requirements. In the Commission's view, the requirements adopted will satisfy US EPA's requirements for a state lead-based paint abatement program.

a. Training and Certification

The Commission concludes that implementation of the training and certification provisions in this regulation will result in uniformity in the qualifications for and certification of persons who perform such abatement. The training and certification provisions will also aid in ensuring that trained and qualified individuals are available to advise consumers about lead hazards in general and about specific measures that may be needed to control such hazards. The training and certification requirements in the rule are identical to the training and certification requirements in the federal rule, except that the State rule: (1) establishes fees pursuant to section 25-7-1103, C.R.S.; (2) requires division approval of training courses; and (3) Does not include the provisions of the federal rule that allow accredited training courses to issue an interim certification valid for six months. Such interim certification is not necessary in the State program because, unlike the US EPA, the division is prepared to begin implementing the certification requirements immediately. Such variations from the federal rule are consistent with state statute, are administrative in nature, and do not constitute training and certification requirements that are more stringent than the federal requirements. Therefore, the training and certification provisions are not more stringent than the training and certification requirements established by the federal “Residential Lead-based Paint Hazard Reduction Act of 1992" and federal rules promulgated pursuant to that act or any training and certification requirements of any US EPA-approved state program that has been established under the Federal “Residential Lead-based Paint Hazard Reduction Act of 1992."

b. Performance Standards and Practices

Pursuant to section 25-7-1103(1)(b), C.R.S., the Commission adopts performance standards and practices for lead abatement. The Commission concludes that the performance standards and practices in Regulation 19 will result in uniformity in the regulation of lead abatement practices in the State of Colorado. These standards and practices require that abatement contractors employ consistent standards and procedures to remove, enclose, and encapsulate lead-based paint to remove lead hazards from target housing and child-occupied facilities. The standards and practices include US EPA's work practice standards and work practice measures that an abatement contractor must include in an occupant protection plan and comply with before, during, and after abatement. The work practice standards and measures were developed based upon US EPA's regulatory requirements and U.S. Department of Housing and Urban Development's ("HUD's") requirements.

The State rule includes work practices that are not required by the federal act, and that are, in some cases, otherwise more stringent than the federal requirements. The additional work practices in the State rule include the prohibition of uncontained hydroblasting and high-pressure washing, the prohibition of dry sanding, the restriction of chemical stripping, and the requirement that a supervisor be on-site at all times while abatement is occurring. Such requirements are not incorporated into

the State implementation plan and, therefore, are consistent with section 25-7-105.1, C.R.S.

In addition, the federal rule does not explicitly require the establishment of containment barriers; however, they do require an occupant protection plan that may require the use of containment barriers. The State rule expressly requires containment barriers.

US EPA requires a written occupant protection plan be developed for each residential dwelling or child-occupied facility prior to the abatement. (40 C.F.R. 745.227(e)(5).) The occupant protection plan "shall describe the measures and management procedures that will be taken during the abatement to protect the building occupants from exposure to any lead-based paint hazards." (40 C.F.R. 745.227(e)(5)(i).) US EPA does not provide the abatement contractor the minimum abatement work practice measures that will be required for the occupant protection plan. The Commission pursuant to its authority in section 25-7-1103(1)(b), C.R.S., adopts the work practice measures in Regulation No. 19 as the minimum work practice measures that must be included in an occupant protection plan and followed during abatement to ensure building occupants are protected from exposure to any lead-based paint hazards.

Certain standards and methodologies adopted by the Commission were developed by the HUD. The Commission adopts such standards and methodologies, because: 1) HUD has successfully implemented and enforced its lead-based paint abatement program and the associated guidelines and methodologies for the past eight years; 2) US EPA cites to HUD guidelines and methodologies in the Federal regulation (i.e., 40 C.F.R. section 745.227(a)(3)) as acceptable standards for Federal and state programs; 3) the HUD Guidelines are considered by industry as state-of-the-art; 4) several commenters in the workgroup stressed the importance of not reinventing the wheel and being consistent with HUD; and 5) the HUD Guideline incorporates the results of studies that indicate work practices and standards necessary to contain lead-based paint hazards and protect children's health.

The Commission adopts the requirement that a certified supervisor to be onsite during all work site preparation, abatement, and during post-abatement cleanup of the work areas, because such a practice is necessary to ensure workers properly conduct lead-based paint abatement. The Commission agrees that US EPA's requirement that a certified supervisor need only be reachable by telephone and is not required to be onsite is inadequate for the State of Colorado.

In addition, the State rule contains project notification requirements and establishes a project clearance level. The federal rule also requires notification but US EPA has not yet specified rules for such notification. US EPA may propose specific notification requirements before August 31, 1998. US EPA proposed a regulation for public comment identifying dangerous levels of lead in June of 1998. US EPA's proposal for soil hazard levels differs from HUD standard and the division's proposal

by not including a separate, more stringent, standard for high contact play areas. Although US EPA's regulation is not final, it's justification for a single soil level is persuasive and the Commission adopts that single soil level.

c. Procedures for Approval of Trained Persons
Regulation No. 19, as adopted, includes procedures for the approval of persons or companies who provide training or accreditation for workers, supervisors, inspectors, risk assessors, or project designers performing lead-based paint activities in target housing or child-occupied facilities pursuant to the Commission's authority in section 25-7-1103(1)(c), C.R.S.

d. Notification of Appropriate Persons
The Commission finds that the notification requirements in Regulation No. 19 are necessary and adequate to provide the Air Pollution Control Division ("Division") with notice of lead-based paint abatement projects occurring in the State of Colorado. The Division recommends that the Commission adopt a requirement that an abatement contractor notify the Division ten days prior to the commencement of lead-based paint abatement activities if the amount of lead-based paint, lead contaminated soil, or lead contaminated dust is greater than two square feet on interior surfaces or ten square feet on exterior surfaces. The Commission also adopts fee provisions intended to cover the cost of processing notifications. The Commission agrees with the division and includes such a requirement in the notification provisions of Regulation No. 19.

e. Fees for Certification of Persons
Regulation No. 19 includes requirements for fees for certification of persons conducting lead abatement services, for any necessary monitoring of such persons to ensure compliance with Regulation No. 19, and for approval of persons or companies involved in the training or accreditation of workers pursuant to the Commission's authority at section 25-7-1103(1)(e), C.R.S. The Commission concludes that the fee provisions in this Regulation No. 19 are adequate to fully fund the division's lead-based paint abatement program, if projected activity levels are accurate.

6. Definition of Child-Occupied Facilities
The rule incorporates the definition of the term "child-occupied facility" set out in section 25-7-1102(2)(a), C.R.S. Pursuant to the statutory definition, day-care centers, pre-schools and kindergarten classrooms constructed prior to 1978 are "child-occupied facilities" whether or not such facilities are visited by children for a total of at least six hours per visit. That is, the definitions set out in paragraphs (a) and (b) of sub-section (2) of section 25-7-1102, C.R.S., are independent definitions. Day-care centers, pre-schools and kindergarten classrooms are child-occupied facilities whether or not they meet the definition set out in section 25-7-1102(2)(a), C.R.S.

The foregoing interpretation of section 25-7-1102(2), C.R.S., is based on the plain language of the statute. Furthermore, such a reading furthers the legislative intent evident in section 25-7-1103(1), C.R.S., to establish a program that implements the requirements

of the federal program. The definition of "child-occupied facility" set out in section 25-7-1102(2)(a), C.R.S., differs from the federal definition expressed in 40 C.F.R. section 745.223. The difference between the two definitions concerns the length of time in which a child must visit a facility in order for the facility to be a "child-occupied facility." Pursuant to the federal definition, the critical time is defined as "combined weekly visits [of at least] six hours." The definition in section 25-7-1102(2)(a), C.R.S., requires each visit to total at least six hours. Many pre-schools and kindergarten classrooms operate more than six hours per week, but less than six hours per day. Such classrooms are included in the federal definition, but would not be included in the definition set out in section 25-7-1102(2)(a), C.R.S. Reading sections 25-7-1102(2)(a) and (2)(b), C.R.S., as independent definitions captures most, if not all, of the facilities that are included in the federal definition but excluded from the definition in section 25-7-1102(2)(a), C.R.S. Such a reading furthers the legislative intent to implement the federal program.

7. Findings Pursuant to Section 25-7-110.8, C.R.S.

The regulation promulgated by the Commission is based on reasonably available, validated, reviewed and sound scientific methodologies demonstrating that exposure to lead is hazardous to children under the age of seven, and that lead-based paint was commonly in use in residences and child-occupied facilities prior to 1978. Interested parties did not provide the Commission with any other validated, reviewed, and sound scientific methodologies or information.

The work practices in the regulation are designed to minimize airborne lead-contaminated dust during lead abatement projects. Therefore, such practices will result in a demonstrable reduction in air pollution associated with such projects. The remaining requirements of the regulation are administrative in nature and are not subject to the requirements of section 25-7-110.8(1)(b), C.R.S.

No one proposed an alternative that would comply with the state statutory requirements in a more cost-effective manner.

8. Delay of Effective Date of Regulation

The Commission delayed the effective date of this regulation for persons conducting abatement activities in dwellings that they own and occupy in order to provide homeowners time to be able to comply with this regulation.

9. Commission Directions to Staff

The Commission intends that the Department of Public Health and Environment's lead program, in September 1998, notify the primary care giver of known children with elevated blood lead levels of this regulation. The Commission intends that the division review the application of this regulation to renovation activities, and that it complete this review by December 31, 1998. The Commission intends that the division will maintain current lists of certified lead abatement contractors, supervisors and certification courses, and will make these lists available to the public.

VII.B. Revisions to Regulation No. 19; December 19, 2002

1. Background

This Statement of Basis, Specific Statutory Authority and Purpose complies with the requirements of the Colorado Administrative Procedure Act Sections 24-4-103(4) and (12.5), C.R.S. for new and revised regulations.

2. Basis

Regulation No. 19 sets forth the Air Quality Control Commission's lead-based paint abatement program. Colorado's program is tailored after the Federal program. In January of 2001, the United States Environmental Protection Agency ("EPA") adopted revisions to the Federal program. EPA has given the state until June 7, 2003 to revise its regulation in order to make Colorado's program consistent with EPA's newly revised regulation. These revisions to Regulation No. 19 are intended to comply with this mandate. Additionally, obsolete provisions have been deleted and certain minor language changes have been made to help clarify the regulation. Finally, changes to the certification fee structure have been made to minimize the burden on the regulated community and encourage the type of growth necessary to serve the needs of the public while allowing the program to be fully funded from the collection of fees as required pursuant to § 25-7-1105, C.R.S.

3. Specific Statutory Authority

The specific statutory authority for these revisions is set forth in various sections of the Colorado Air Pollution Prevention and Control Act. Section, 25-7-105(1), C.R.S., gives the Air Quality Control Commission general authority to promulgate rules and regulations necessary for the proper implementation of the Air Pollution Prevention and Control Act ("Act"). Section 25-7-1103(1), C.R.S. gives the Commission specific authority to promulgate regulations necessary to establish and implement a state lead-based paint abatement program, including regulations regarding lead-based paint abatement performance standards and certification requirements. Finally, § 25-7-1105, C.R.S. allows the Commission to set fees that are sufficient to cover the costs of the program.

4. Purpose

The purpose of the revised regulation is to continue to protect children from lead exposure by establishing standards for lead-based paint abatement in "target housing" and "child occupied-facilities." The primary purpose of these revisions is to make the Colorado regulation consistent with the recently adopted Federal regulations governing lead-based paint abatement. To accomplish this, revisions have been made to Sections II. (Definitions), III. (Training and Certification Requirements) , IV. (Inspections, Lead Hazard Screens, and Risk Assessments) and V. (Abatement Requirements) of Regulation No. 19. Changes have also been made to the table in Appendix A, governing the number of sample that must be taken in clearing projects in multi-family dwellings constructed prior to 1978. The new table is consistent with the revised HUD Guidelines for Lead-Based Paint, and therefore serves to make Regulation No. 19 consistent with the federal program.

5. Action Taken

In addition to the changes necessary to make the State program consistent with Federal requirements, certain additional changes were made in order to clarify program requirements. For example, surplus language was removed from the provisions set forth in Section III.B.1.b., while the language in Section IV.B.1 was expanded to clarify that risk assessments are to be conducted in accordance with requirements of Section IV. (Inspections, Lead Hazard Screens, and Risk Assessments). These changes are not substantive and are not intended to change any program requirements.

A limited number of minor substantive changes were made to remove obsolete provisions, correct unintended consequences of the old regulatory language, and eliminate unnecessarily burdensome requirements. For example, the notification fee table set forth in Section V.A.5.c. sets forth the amount of fees that need to be paid based on the size of the project. Due to errors in the table, fees for larger projects could actually be less than fees for smaller projects. These errors have been corrected to create a graduated fee schedule. Section V.J.3. of the old regulation required that a supervisor or project designer prepare an abatement report, but failed to specify a time frame for completion of the report, thereby rendering enforcement of this requirement difficult. The revisions correct this oversight by providing a ninety-day time frame for report completion. Finally, section V.C.2.c. has been changed to eliminate the requirement that ventilation systems be shut down during level I-1 projects. This requirement was deemed unnecessary given the nature of such projects and the fact that vents must be adequately sealed prior to abatement.

Several changes were made with respect to certification requirements. EPA's regulations require that all abatement, inspection and risk assessment firms be certified. For some reason, the prior version of regulation No. 19 failed to require certification for inspection or risk assessment firms. The revisions correct this oversight. The revisions also set certification fees for risk assessment and inspection firms, as well as modify the fees for abatement firms. The fee levels were based on an analysis of the amount of money that needs to be collected through fees in order to cover the costs of the program as required pursuant to § 25-7-1105, C.R.S. Given the continued growth of the program, and the addition of certification fees for inspection and risk assessment firms, the fee levels for abatement firms were able to be substantially reduced. These new fees will apply to firms seeking certification after the effective date of these revisions. Firms certified prior to the effective date shall not be entitled to a refund of any previously paid fees.

6. Findings Pursuant to § 25-7-110.8, C.R.S.

These revisions are based on reasonably available, validated and reviewed, and sound scientific methodologies demonstrating that exposure to lead is hazardous to children under the age of seven, and that lead based-paint was commonly used in residences and child-occupied facilities prior to 1978. Interested parties did not provide the Commission with any other validated, reviewed and scientifically sound methodologies or information.

Based on the evidence presented on the record, the requirements of this revised regulation will reduce the amount of airborne lead-contaminated dust occurring during lead-based paint abatement projects, and therefore reduce the risks to human health and the environment thereby justifying the costs associated with this regulation.

The revisions represent the regulatory alternative presented to the Commission, which best balances cost-effectiveness, flexibility to the regulated community and maximization of air quality benefits.

APPENDIX A

Number of Units to be Tested in Pre-1978 Multifamily Developments
(Section V.J.2.b.)

Number of Similar Units, Similar Common Areas or Exterior Sites in a Building or Development	Pre-1960 or Unknown-age building or Development: Number to Test	1960-1977 Building or Development: Number to Test
1-9	All	All
10-13	All	10
14	All	11
15	All	12
16-17	All	13
18	All	14
19	All	15
20	All	16
21-26	20	16
27	21	17
28	22	18
29	23	18
30	23	19
31	24	19
32	25	19
33-34	26	19
35	27	19
36	28	19
37	29	19
38-39	30	20
40-48	31	21
49-50	31	22
51	32	22
52-53	33	22
54	34	22
55-56	35	22
57-58	36	22
59	37	23
60-69	38	23
70-73	38	24
74-75	39	24
76-77	40	24
78-79	41	24
80-88	42	24
89-95	42	25
96-97	43	25

Appendix A: (continued)

Number of Similar Units, Similar Common Areas or Exterior Sites in a Building or Development	Pre-1960 or Unknown-age building or Development: Number to Test	1960-1977 Building or Development: Number to Test
98-99	44	25
100-109	45	25
110-117	45	26
118-119	46	26
120-138	47	26
139-157	48	26
158-159	49	26
160-177	49	27
178-197	50	27
198-218	51	27
219-258	52	27
259-279	53	27
280-299	53	28
300-279	54	28
380499	55	28
500-776	56	28
777-939	57	28
970-1004	57	29
1005-1022	58	29
1023-1032	59	29
1033-1039	59	30
1500	87	44
2000	116	58
2500	145	73
3000	174	87
3500	203	102
4000	232	116

APPENDIX E

SAMPLE ANALYSES AND QUALITY ASSURANCE PLAN FOR URINARY ARSENIC AND BLOOD LEAD AMONG RESIDENTS OF VBI70 NEIGHBORHOODS

SAMPLE ANALYSIS AND QUALITY ASSURANCE PLAN

for

URINARY ARSENIC AND BLOOD LEAD AMONG RESIDENTS OF VBI70 NEIGHBORHOODS

March 2003

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APPROVAL PAGE

This Sampling Analysis and Quality Assurance Project Plan, written for the University of Colorado Health Science Center arsenic/lead exposure and biomonitoring study, has been prepared at the request of the U.S. Environmental Protection Agency, Region 8, by Syracuse Research Corporation and revised by MFG, Inc. for use by the Community Health Program proposed for the Vasquez Boulevard/Interstate 70 Superfund Site remedy. Study investigations and activities addressed in this Project Plan are approved without condition.

Bonnie Lavelle

Technical Approval
Bonnie Lavelle
USEPA Project Manager

3/25/03
Date

1.0 INTRODUCTION

USEPA Region 8 will be responsible for the chemical analysis of blood-lead and urinary-arsenic samples collected during the Community Health Program (CHP) component of the remedy for Vasquez Boulevard/Interstate 70 Superfund Site. This document details the sample handing, analysis, and quality assurance procedures that will be followed during this support activity.

2.0 ANALYSIS OF URINE

CHP staff will collect urine samples from participants. Each collection container will be labeled with a unique sample identification number using the following format:

CHP VBI70 Uxxxx

One copy of the label will be applied directly to the sample collection vessel. A second copy of the label will be applied to the survey form used to record the name and address of the sample donor. A third copy of the label will be used to label the sample tube shipped to the laboratory (see below).

2.1 Sample Holding and Preparation

a. Each urine sample will be held under refrigeration at approximately 4°C in its original collection container. Under these conditions, the holding time for un-preserved urine is 3 months. Samples should be maintained in a restricted access area at all times

b. Either daily or once per week (whichever is most convenient), all samples scheduled for analysis will be well mixed by swirling the urine container, and 3-4 mL will be removed by pipette and transferred to a 15-mL plastic screw-cap tube. This tube will be labeled with the same number as that given to the original parent sample (see above). After transfer of the aliquot, the cap of the tube will be screwed on tight to prevent leakage, and the tube will be placed in a test tube rack. This sub-sample will be submitted to the analytical laboratory for analysis. The remainder of the sample will be stored in a refrigerator until the sample has been successfully analyzed by the laboratory.

2.2 Sample Shipment to the Laboratory

Packaging

Samples will be packaged for shipment to the analytical laboratory in test tube racks. Each rack of tubes will be placed inside a large plastic bag to ensure that the tubes do not fall out of the rack and to help contain any spills or leaks. Sealed bags will be placed in a cooler and secured against excess movement by addition of plastic bubble wrap. Adsorbent material should be added around the bags in case of any spills or leaks. The cooler will be kept cool by inclusion of 3-4 frozen "blue ice" packages. Once filled, the cooler will be sealed with tape and a signed custody seal will be placed across the opening of the shipping container in order to ensure that no tampering occurs during the shipping process.

Shipping

Each cooler will be shipped to the laboratory performing the urine analysis by overnight transport. The laboratory shall be notified by phone to expect each shipment, and shipping should always occur so that someone is present at the laboratory to receive the shipment. Shipment on a Monday or Tuesday is generally preferred.

No special labeling is required for urine samples.

Chain of Custody

Each cooler shipped to the laboratory will be accompanied by a Chain of Custody (COC) form. These COC forms are to be prepared in triplicate on carbonless forms using the approach specified in SOP No. MFG-VBI70-07. Each COC form will identify the samples included in the sample delivery group (SDG) (i.e., in the cooler) and the required analyses. Each complete COC form will be reviewed for accuracy and clarity by CHP staff before shipment, and then signed. The pink (bottom) copy of the form will be kept by CHP as documentation of the date and contents of the shipment. The white (top) and yellow (middle) copies of the COC form will be sealed inside the shipping container but inside a plastic zip-lock bag to avoid damage from moisture.

When the cooler arrives at the laboratory, the laboratory sample custodian will document the date and time of receipt. The cooler will be opened and the contents inspected. The chain-of custody form will be reviewed, and any tubes that are missing, broken, or otherwise questionable or compromised will be noted on the COC form. The laboratory will notify EPA's CHP contractor

of any such problems immediately, and EPA's CHP Contractor will instruct the laboratory or arrange for replacement samples to be shipped, as needed. Once all samples have been reviewed and all issues have been resolved, the laboratory sample custodian will sign and date the COC form. Both remaining COC form copies (white and yellow) will be appropriately filed by the laboratory sample custodian.

2.3 Sample Analysis

2.3.1 Total Non-Dietary (Inorganic) Arsenic

All samples of urine will be analyzed for total non-dietary arsenic. This total includes both trivalent and pentavalent forms of inorganic arsenic (As+3, As+5), as well as the primary urinary metabolites of these forms (monomethyarsonate (MMA), and dimethylarsinate (DMA)). Complex organic arsenicals found in seafood (e.g., arsenobetaine) are not included in the total.

Details of the sample preparation and analysis are proprietary. In general, iodine is added to the sample and the target analytes are extracted into an organic phase under acidic conditions. A portion of this extract is analyzed for arsenic via ICP-MS. The detection limit is approximately 1.0 µg/L.

Each urine sample will also be analyzed for creatinine.

2.4 Quality Control

Quality Control (QC) consists of the collection of data that allow a quantitative evaluation of the accuracy and precision of the data collected during the project. QC samples that will be collected for urinary arsenic during this project include the following types of samples:

<u>Laboratory-Based QC Samples</u>

The analytical laboratory will collect several types of data that help assess the accuracy and precision of the sample preparation and analysis procedure. The analytical laboratory will use BioRad laboratory control samples (LCS). These samples are prepared from human urine and contain inorganic and organic forms of arsenic. Specifically, following each calibration of the instrument, the analytical laboratory will analyze one blank, one BioRad Level 1 (target = 56 µg/L, range 42 - 70µg/L), and one BioRad Level 2 (target = 137 µg/L, range 103-172 µg/L)

laboratory control sample. After every 10 analyses, the analytical laboratory will analyze one LCS, alternating between Level 1 and Level 2. Furthermore, one non-dietary LCS (certified for MMA, DMA, As+5) and one dietary LCS (certified for MMA, DMA, As+5, and arsenobetaine) will be analyzed once a week to ensure the inorganic arsenic is correctly extracted and no dietary arsenic is included in the analyses. If any of the LCS values are outside the specified acceptance criteria (2 standard deviations from the mean based on 20 measurements), all samples analyzed since the last successful LCS analysis will be re-analyzed.

Field-Based QC Samples

Field-based QC samples are samples that are prepared by the study team and are submitted to the analytical laboratory in a blind fashion. That is, the laboratory is not aware the sample is a QC sample, and should treat the sample in the same way as a field sample. Two types of blind field QC sample will be submitted in this program:

Field Splits

A field spilt sample is prepared by withdrawing a second 3-4 mL aliquot of a parent urine sample and submitting that to the laboratory under a different (and unique) sample number from the first aliquot. The results of field split sample analysis help evaluate analytical precision (reproducibility). Split samples will be prepared at a rate of approximately 5%, and submitted in random order.

PE Samples

Performance Evaluation (PE) samples are samples of urine that contain a known and certified level of a contaminant. SOP #2 (attached) describes the procedure for preparation of the PE samples. That procedure is summarized below.

The results of PE sample analysis help evaluate analytical accuracy. In brief, an independent laboratory prepares the "blank" PE samples by collecting urine from adult volunteers who have not ingested seafood for at least three days. Note that the concentration of total inorganic arsenic in this sample will not be zero and will be measured by the laboratory before use of the PE samples. Other PE samples are prepared by spiking this "blank" urine with known incremental concentrations (5 µg arsenic/L and 15 µg arsenic/L) of sodium arsenate (As+5), sodium arsenite (As+3), monomethylarsonate (MMA), or dimethylarsenate (DMA). One concentration (20 µg/L) of arsenobetaine will also be prepared. Thus, there are a total of 10 different PE samples for this

program (1 blank, 9 spikes). The laboratory preparing the PE samples then establishes nominal concentrations for each PE sample. Those concentrations will be reported to the CHP for use in evaluating accuracy of urinary-arsenic results.

As part of the first sample shipment, two samples of each of these 10 PE samples will be submitted in random order. For subsequent weekly shipments, one of each standard type will be submitted in random order.

In cases where fewer than 5 samples can be submitted to the laboratory during a single sample shipment, the few CHP urine samples may be run with other urine samples, and the results of the QA analyses performed with that sample delivery group, may be used to evaluate precision and accuracy of the CHP urine analyses.

QC Acceptance Criteria

The acceptance criterion for field split samples is a Relative Percent Difference (RPD) of no more than 30%.
For all PE samples analyzed for total inorganic arsenic, the acceptance criteria will be ± 20% of the nominal value established by the lab preparing the PE samples.

QC Assessment and Response Actions

Results for QC samples will be reviewed by EPA's CHP contractor promptly upon receipt from the laboratory. Any deviation of a QC sample from the acceptance criteria above will be evaluated and a corrective action selected. If deviations are minor (only slightly outside the acceptance bounds) and are not consistent over time or sample type, no action will be required. If deviations are consistent (occurring in two or more consecutive weeks) or if deviations are not trivial, EPA's CHP contractor will immediately contact the laboratory to discuss possible causes and appropriate laboratory corrective actions.

2.5 Reporting

During the time that samples are submitted by the CHP, the laboratory will provide periodic result reports to the CHP that include a summary of the results for each submitted/analyzed sample, including the total inorganic arsenic concentration (µg/L), urinary creatinine concentration (g/L), and total inorganic arsenic concentration normalized for creatinine (µg/g). Each report will also include a summary of the laboratory QC samples for each sample delivery

group. Reports will be provided at least every two weeks, so that the CHP can respond to families in a timely manner.

3.0 ANALYSIS OF BLOOD

3.1 Sample Collection

To collect a capillary blood sample, the tip of the participant's finger is carefully washed and dried, and the finger is pierced using a sterile lancet. Once a drop of blood has collected on the finger tip, the blood is drawn into a plastic capillary tube that is held in a microtainer. When the capillary is filled, the capillary is tipped upright, allowing the blood to drain into the microtainer. The capillary and the lancet are discarded as biomedical waste, and the microtainer is sealed with the attached cap.

Each microtainer will be assigned a unique sample identifier using the following format :

CHP VBI70 Bxxxx

One copy of the label is applied to the microtainer by wrapping it around the bottom portion of the microtainer. A second copy of the label is applied to the field survey form that records the name and address of the sample donor. A database will be used to record and correlate the sample identification number and the name and address of the sample donor.

All microtainers will be stored in bubble wrap envelopes (20-25 microtainers per envelope) and stored refrigerated at 4°C.

3.2 Sample Preparation

No sample preparation is necessary prior to sample shipment.

3.3 Sample Shipment to the Laboratory

Packaging

Samples will be shipped to the analytical laboratory in plastic bubble wrap envelopes. Each envelope will be sealed to ensure that the tubes do not fall out during shipment. Envelopes will be placed in a cooler and secured against excess movement by addition of extra plastic bubble wrap. The cooler will be kept cool by inclusion of 3-4 frozen "blue ice" packages. Once filled,

the cooler will be sealed with tape and a signed custody seal will be placed across the opening of the shipping container in order to ensure that no tampering occurs during the shipping process.

Shipping

Delivery of the samples from CHP to the laboratory performing the blood analysis will occur at least once per week during the time period that blood lead samples are being collected by the program. Transport will normally by courier sent from the laboratory. CHP staff will contact the laboratory when a shipment is ready, and arrange for the details of the shipment. In the event that this method is not available, a CHP staff member will contact the laboratory and transport the samples to the analytical facility at an agreed upon time.

Chain of Custody

Each cooler shipped to the laboratory will be accompanied by a Chain of Custody (COC) form. These COC forms are to be prepared in triplicate on carbonless forms using the approach specified in SOP No. MFG-VBI70-07. Each COC form will identify the samples included in the sample delivery group (SDG) (i.e., in the cooler) and the required analyses. Each complete COC form will be reviewed for accuracy and clarity by CHP staff before shipment, and then signed.

One copy of the form will be kept by CHP as documentation of the date and contents of the shipment. The other copies of the COC form will be sealed inside the shipping container but inside a plastic zip-lock bag to avoid damage from moisture.

When the cooler arrives at the laboratory, the laboratory sample custodian will document the date and time of receipt. The cooler will be opened and the contents inspected. The chain-of custody form will be reviewed, and any tubes that are missing, open, or otherwise questionable or compromised will be noted. The laboratory will notify the CHP of any such problems immediately.

3.4 Sample Analysis

Each blood sample will be analyzed for lead using the method of Miller (1987). See SOP # 01 (attached) for method details. In brief, the method uses graphite furnace atomic absorption spectrometry (GFAAS) to analyze blood samples for lead. In order to stabilize the blood, all blood samples will be combined with known volumes of Metexchange reagent. This method requires a minimum volume of 50 µL of blood, with 100 µL being desirable. The detection limit is 2.0 µg/dL.

3.5 Quality Assurance

Laboratory-Based QC Samples

Following each calibration, the laboratory will analyze one low (8.0 µg/dL), one medium (20.0 µg/dL), and one high (40.0 µg/dL) LCS. Upon a successful run, the laboratory will analyze one set of 10 field samples followed by two sets of 11 field samples. Following each series, the laboratory will analyze one medium and one high LCS. Once each series of samples have been analyzed with all LCS samples passing established acceptance criteria, the laboratory will re-calibrate the machine and repeat the steps above. The acceptance criterion is defined as an LCS that is within 2.0 µg/dL of the nominal concentration.

In the event that a QC sample result is outside the acceptance criteria, the laboratory will re-calibrate the machine and re-analyze the LCS. If the LCS fails twice, the laboratory will stop the machine and take appropriate measures to correct the problem.

Field-Based QC Samples

Field Duplicate

Field duplicate samples are collected at the same time as the primary sample. In this case, the field duplicate sample is a second sample of blood drawn from the same individual, by filling a second capillary tube immediately after filling the first tube. These samples will be collected opportunistically from those individuals with sufficient blood flow after a single finger prick. Each field duplicate sample is assigned a unique sample identifier that is not related to the sample identifier for the primary field sample. Field duplicate samples will be collected and submitted in random order at a frequency of about 5%, if possible.

PE Samples

PE samples for blood lead analysis will be provided by the Centers for Disease Control and Prevention. Consensus (nominal) concentrations of lead in these samples were determined by CDC using GFAAS or ICP-MS. A summary of these samples is listed below:

CDC Sample ID	Nominal Value (µg/dL)
194	0.4
1494	4.5
994	8.9
396	14.8

PE samples will be prepared for submittal to the laboratory by withdrawing 50-75 uL samples from the CDC stock samples using the sample capillary sampling device as is used to collect blood samples from program participants. Microtainers containing PE samples will be assigned random sample numbers and submitted blind to the laboratory along with the field samples. Each week, one sample of each PE sample above (i.e., a total of 4) will be submitted. In the first shipment of samples, two of each PE sample will be submitted.

QC Acceptance Criteria

Field Duplicates

The acceptance criterion for field split samples is a maximum difference of 2.0 µg/dL between the primary sample and the field duplicate sample.

PE Samples

In accord with recommendations from CDC, the acceptance criterion for all blood PE samples with nominal concentrations below 40 µg/dL is ± 4 µg/dL.

QC Assessment and Response Actions

Results for QC samples will be reviewed by the CHP contractor promptly upon receipt from the laboratory. Any deviation of a QC sample from the acceptance criteria above will be evaluated and a corrective action selected. If deviations are minor (only slightly outside the acceptance bounds) and are not consistent over time or sample type, no action will be required. If deviations are consistent (occurring in two or more consecutive weeks) or if deviations are not trivial, EPA's CHP contractor will immediately contact the laboratory to discuss possible causes and appropriate laboratory corrective actions.

3.6 Reporting

During the period when the CHP is submitting blood lead sampling, the laboratory will provide EPA's CHP contractor with periodic electronic reports of sample results and a hard copy machine printout of all QC results. Results may be delivered via email. Periodic reporting will be at least every two weeks so that the CHP can respond to families in a timely manner. However, any sample results above 10 µg/dL will either be phoned or faxed to the CHP immediately following sample analysis.

When a sample of blood from a program participant is reported to exceed a value of 10 µg/dL, the CHP will promptly report the sample number, name, and address to DDEH, and will seek to arrange for collection of a second (confirmation) sample from the individual. Whenever possible, this sample will be a venous sample collected in a vacutainer by a trained pediatric phlebotomist. This sample will be submitted to the blood lead laboratory with a unique identifier number for analysis for lead, as above. If the second sample confirms a blood lead level above 10 µg/dL, the CHP will provide the laboratory with the name and address of the donor, and in accord with Colorado State law (6 CCR-1009-7), the laboratory will report the value to the Colorado Department of Public Health and Environment (CDPHE) within 30 days.

5.0 FIELD AUDIT ACTIVITIES

As part of the overall Quality Assurance Plan for this project, EPA will provide random audits of field data and sample collection procedures by CHP staff. This will include ensuring that all surveys are administered properly and that responses are recorded correctly and with consistency between different teams, that biological samples are collected properly, and that biological sample identifier information is correct and complete. Audits will include observations of each different field team's activities, including initial visits and return visits for repeat sample collection. Audits will be concentrated in the beginning of the program, but will continue at random times throughout the program.

Any issues or problems observed by the field auditors will be reported to EPA and the CHP Program Administrator, both verbally and in written (memo) form, along with any suggestions for addressing those problems.

6.0 REFERENCES

Colorado Department of Public Health and Environment (CDPHE). 1999. Rules and regulations pertaining to the detection, monitoring, and investigation of environmental and chronic diseases. http://www.cdphe.state.co.us/op/regs/100907.pdf

Miller et al. 1987. Determination of lead in blood using electrothermal atomic absorption spectrometry, l'vov platform, and matrix modifier. Analyst 112:1701-1704

VBI70 SURVEY OF ARSENIC AND LEAD EXPOSURE AMONG RESIDENTS

Date: May 2002 (Rev. # 0) **SOP No. 01**

Title: Analysis of Blood Lead Samples by Graphite Furnace Atomic Absorption Spectrometry (GFAAS)

Total Pages 5

APPROVALS:

Syracuse Research Corp, Inc.
Author

Study Director Date

SYNOPSIS: This SOP describes the method to be used for collection of blood samples for lead analysis.

REVIEWS:

TEAM MEMBER	SIGNATURE/TITLE	DATE
US EPA Region 8		
Study QA Officer		
Syracuse Research Corp.		

BLOOD LEAD ANALYSIS USING GRAPHITE FURNACE ATOMIC ABSORPTION SPECTROMETRY

(Reference: Miller et al., Analyst, Vol. 112, 1701, 1987)

Graphite furnace atomic absorption spectrometry (GFAAS) is a method whereby specific wavelengths of light are passed through vaporized media (solid and aqueous) to ascertain the concentration of an element. GFAAS is dependant on two factors: the accurate measurement of the light intensity and the assumption that the light absorbed by the element is proportional to its concentration.

1.0 EQUIPMENT AND MATERIALS

- Perkin-Elmer model 5100 atomic absorption spectrometer and graphite furnace
- Model PRS-10 printer/sequencer
- Metexchange reagant
- 100 uL pipet and pipet tips
- 2-ml conical autosampler cups
- Vortex Mixer
- Whole blood lead standards

2.0 PREPARATION OF SAMPLES FOR ANALYSIS

Proper handling of blood samples and other biological fluids is essential not only for valid analytical assessments to be made, but also to ensure the health of technicians. As human blood is capable of transmitting disease, every sample will be handled as if potentially infectious. Technicians will be cautioned and instructed to maintain clean working areas, not to eat or drink in those areas, and to clean up any spills. They will also be required to wear lab coats and disposable gloves when handling these human blood samples.

Specimen quality, homogeneity, and proper handling are important factors in determining the accuracy of any of the tests. The presence of clots in the samples interfere in the methods to be performed (as they would in any hematological method) and produce inaccurate volume measurements when pipetting.
Therefore, the quality of the blood samples will be evaluated visually before any sample preparation is performed. Capillary tubes containing clots will not be analyzed. The bad samples will be recorded and subsequently stored. Any other peculiarities of a sample, such as lipemia,

hemolysis or any discoloration from normal, will be noted and recorded on the data form and analyzed at the discretion of the Lab Director (Donna Clark).

All sample preparations and analyses will be carried out under a temporary type hood to avoid air-borne contamination. Since thorough mixing and homogeneity of the sample is essential, whole blood samples will be always placed on an orbital mixer for approximately 30 minutes before any aliquot is removed. To maintain homogeneity, samples will be recapped and inverted before another portion of blood is to be removed.

The blood obtained by fingerstick, and contained in the lead-free microtainers will be dispensed into a known volumes of Metexchange reagent the same day the sample is received by the laboratory. The blood and reagent mixture is stable at room temperature for at least one year, which is more than sufficient to permit sample analysis.

3.0 PROCEDURE AND CALIBRATION

Anlysis of blood samples will occur using a Perkin-Elmer model 5100 GFAAS. Prior to analysis, the instrument parameters must be adjusted to the following:

Parameter	Parameter Specifications
Resonance radiation source	Hollow-cathode lamp
Lamp current	10 mA
Wavelength	283.3 nm, slit 0.7 (low)
Sample Volume	20 uL

Instrument calibration can be accomplished by analyzing a standard blood lead solution and performing a comparison to known values. To do this, Add 50 uL of whole blood to 200 uL of Metexchange reagent. After the Metexchange reagent has been combined with the blood, perform a series of 7 dilutions in 2 ml autosampler cups. Add 50, 100, 250, 500, 750, or 1000 ug/L of lead standards. Mix well and analyze. Create a calibration graph by plotting concentration vs. absorbance.

To begin the analyzing a blood sample, inject 20 uL of prepared sample material into the GFAAS. Once the sample is injected, the GFAAS will begin the analysis. The four principle analytical steps and their corresponding instrument control settings are listed below:

Step	**Temperature/° C**	**Ramp time/s**	**Hold time/s**	**Argon flow-rate/mL min^{-1}**
Dry	180	10	25	300
Char	750	5	25	300
Atomise	2400	1	4	20
Cool	20	1	4	200

Record the absorbance readings.

The instrument platform should be cleaned daily and not to exceed 300 analyses between cleanings.

4.0 CALCULATIONS

Blood lead concentrations are calculated by comparing the absorbance to the calibration graph. All results should be reported in ug/L or ug/g lead in whole blood.

5.0 REFERENCES

Miller et al. 1987. Determination of lead in blood using electrothermal atomic absorption spectrometry, l'vov platform, and matrix modifier. Analyst 112:1701-1704

VBI70 SURVEY OF ARSENIC AND LEAD EXPOSURE AMONG RESIDENTS

Date: September 1999 (Rev. # 0) **SOP No. 02**

Title: Preparation of Urine for Arsenic Performance Evaluation Samples

Total Pages 7

APPROVALS:

Ed Hinderberger L.E.T., Inc.

Author

Date

Study Director

SYNOPSIS: This SOP details the procedure for collecting and preparing urine samples for use in estimating arsenic bioavailability in test materials.

REVIEWS:

TEAM MEMBER	SIGNATURE/TITLE	DATE
US EPA Region 8		
Study QA Officer		
Syracuse Research Corporation		

1.0 PURPOSE

Bioavailability of arsenic will be evaluated for several test materials. Arsenic doses will be administered to juvenille swine on a predetermined schedule. Urine samples will be collected, digested, and analyzed for arsenic.

2.0 SCOPE

The procedures described in this SOP are for the preparation and analysis of arsenic by hydride generation. These methods were developed by the L.E.T laboratory in Columbia Missouri and are intended primarily for use in this study. They may not apply to other types of analyses.

3.0 SAMPLE PREPARATION

Transfer 25 ml. of urine to an acid cleaned 100 ml. beaker. Add 3.0 ml. of Methanol, 5 drops of anti-foam agent, 10.0 ml of 40% (W/V) Magnesium Nitrate Hexahydrate, and 10.0 ml of concentrated trace metal grade Nitric acid (HNO_3). Cover with a watch glass and place on a hot plate to reflux for 8-12 hours at 70 - 80 C. or overnight. Increase heat to 200 C and slide the watch glass back to allow faster evaporation. Heat to complete dryness (8 - 12 hours). Cover with watch glass and allow to cool. Transfer samples to cool muffle furnace and run following program. Ramp to 500 C at 1 degree/minute then hold at 500 C for 3 hours, turn off and allow to cool. Remove samples and add 5 ml. D.I. Water and 5 ml concentrated trace metal grade Hydrochloric acid (HCl). Allow to gently boil until the white residue is dissolved. After dissolving the residue cool and dilute with D.I. water to 50.0 ml. Transfer to clean labeled 2 oz. bottles.

When samples are ready for analysis they are diluted for Hydride Generation AA with a solution of 10% HCl, 10% KI, and 5% Ascorbic Acid. The samples are initially diluted l/10 or 1/5 in 1O.O ml. depending on the detection limit desired and capped. A 1/10 dilution should give a detection limit of 2 mg/L and a 1/5 should give a detection limit of 1 mg/L. Samples should set at least 30 minutes before analysis, but overnight is preferred.

4.0 APPARATUS AND MATERIALS

4.1 Equipment

The basic analysis equipment required are the Perkin-Elmer 3100 atomic absorption spectrometer (AAS), the Perkin-Elmer FIAS 200 flow injection system, the Perkin-Elmer

autosampler (AS-90), computer, monitor, and printer.

4.2 Standards, Reagents, and Miscellaneous

Other materials required are acid cleaned beakers for sample digestion, hotplate, fumehoods, Class A volumetric glassware and pipets for sample dilution and standards preparation, and the following reagents:

Trace Metal Grade Hydrochloric Acid – Fisher
Trace Metal Grade Nitric Acid – Fisher
Anti-Foam Reagent
Methanol ACS grade - Fisher
Electrolytic Sodium Hydroxide - Fisher
Potassium Iodide A.C.S. grade - Fisher
1000 PPM Arsenic standard - Fisher
Sodium Tetrahyridoborate 98% - Alfa
Ascorbic Acid - Recrystalized
Arsenic Calibration Check Standard - ERA

Purity of reagents is essential in this analysis. Contamination in samples and standards is often the limiting factor in low level analysis. High purity reagents must be used to avoid introducing contaminants during sample digestion. Calibration and check standards should not be used beyond the certified expiration date. Reagents must be either analytical reagent (AR) or ultrapure grade and should be chosen based on instrument response. Ideally, peak area absorbance should be near zero or small compared to the reporting limit. Calibration standards are prepared from the 1000 ppm arsenic standard.

6.0 ANALYTICAL PROCEDURES

6.1 Instrument Setup

Turn on the Perkin-Elmer 3100, FIAS 200, AS-9O, Computer, Monitor and Printer. Make sure the quartz cell is the one used for Arsenic, if not then change to the correct cell. Use the mouse whenever possible on the computer. When Dosshell comes on the screen, double click on Perkin-Elmer 3100. On the next screen double click on the aa inst.exe icon. On the next screen, when the icons for the 3100, FIAS 2OO and AS-90 are lit, click on the MHS-FIAS box, and then double click on the AUTO icon. Click on Element file, then double click on ASTST.MEL. When the four screens are completed, click on the FIAS control box and click on the Cell On/Off box to turn on the cell. The method will probably have less drift if the cell is allowed to heat overnight at 900 deg. C;

if there is a rush it can be used as soon as the temperature reaches 900.
After overnight warm up or while the cell is heating to 900 deg. C, prepare the standards in 10% HCl, 10% KI, 5% Ascorbic Acid. Prepare the following standards: 0.0, 0.2, 1.0, 5.0, 10.0, and 15.0 PPB. Prepare the ERA standard at about 5.0 mg/L for use as a calibration check standard. Turn on the EDL power supply and light the EDL Arsenic lamp and adjust the wattage to 8-10 watts. Place the Arsenic lamp in the instrument and adjust the wavelength to 193.7 with a 0.7 High Slit. After 10-15 minutes, move mouse arrow to windows and click on Align Lamps. Optimize the lamp energy using the wavelength knob and the two lamp position knobs. Click on AGE/AIC if the energy goes over 3/4 of the scale. Click on the upper left corner to close Align Lamps and move the mouse arrow to windows and click on Continuous Graphics. The absorbance reading will probably not be zero, so it will be necessary to autozero the reading. Using the three position knobs on the furnace head adjust the position to give the lowest reading. It may be necessary to autozero during the adjustments. When the best position has been found move the mouse pointer to the upper left corner and click to close the Continuous Graphics box.
Make sure that the reaction cell and reagent tubes are the correct ones for Arsenic. Change all the peristaltic tubing on the FIAS pumps. Prepare fresh 10% HC1 carrier and O.2% NaBH4 in 0.5% NaOH. Approximately 2 liters of HCL will be needed for each liter of NaBH4.

Move arrow to Windows and click on ID/Weight Parameter. Enter all data on the samples to be run(sample number autosampler position and dilution) Up to 98 samples can be run on one autosampler load. When all the sample information has been entered and checked, move the mouse arrow to File and click on Save As.... enter the name of the file(usually the number of the first sample to be analyzed minus the 9 exp. L95080001 would be entered as L5080001) this is necessary since the file name can only have 8 characters. Click on OK to save the file with that name and then move the mouse arrow to the upper left and click to exit ID/Wt Parameter.

6.2 Calibration

Click on AS-90 Control box and enter the name and the Data File: (usually the same as the first sample to be run that day the first number). Enter ASSTD as the ID/Wt File name (this file has the assignments for the calibration, standards check, known QC check and detection limit determination). Fill all the tubes and place in the positions required by the ASSTD ID/Wt File. Place the appropriate tubes in the l0% HCl and NaBH4 solutions. Click on the FIAS Control box and start pump 2. Move the clamps into position to start pumping the reagents. Turn on the Argon, after you are sure no liquid is going to go through the tube that goes to the Hydride cell, connect it to the cell. Click on Pump 1 and position its clamp to start pumping. Make sure that the rinse(zero standard) cup has the 10% HCl, 10% KI, and 5% Ascorbic Acid zero standard. Click on the AS-90 Control box and enter 8 in the Samples to Run: line and click on the box. Click on Run

Samples. The 5.00 PPB standard should be run 3 times and the absorbance values will be given in the lower left screen. If the last two values are within 5% of one another then the standardization can start. Click on Save Data On/Off and Printer On/Off(the boxes should be black if they are on) Click on Samples to Run ID/Wt box, and then on Run All. This should start the standardization. The standards run are S1 - 0.00, S2 - 5.00, and S3 - 15.00, this will calibrate from zero to 15.00 PPB. After the standardization the 5.00 standard in cup 8 will be run, if it is within 5% of 5.00 (4.75-5.25) the analysis will proceed. The next samples are a 10.00 standard and the known sample (ERA ~5.0 mg/L). If these are within the acceptable limits then the next ten samples will be the 0.2 PPB standard to determine the detection limit. Do a mean and standard deviation of the ten values (three times the standard deviation will be used as the detection limit). If the detection limit is not at least 0.1 PPB, then try to determine the problem and start the calibration over after solving the problem. The 5.00 PPb standard is run every ten samples and if it is not within the range 4.75 - 5.25 then the instrument will be restandardized and the 5.00 PPB standard rechecked, if it is still outside the range the analysis will stop.

6.2 Sample Analysis

After standardization, acceptance of the standard check samples, and detection limit, samples can then be analyzed. Move the mouse pointer to ID/Wt File: and enter the name of the file you want to run. Move the mouse arrow to reset sampler and click. Make sure that the Printer On/Off and Save Data On/Off are on. If it is necessary to turn data on again, make sure you append the data and do not write over the file. Place all the samples in the auto sampler in the positions matching the ID/Wt File:. Click on the box by ID/wt. to run the ID/wt file and then click

on Run Samples. An independent check standard (ERA ~5.0 mg/L) will be analyzed every 10 samples to verify instrument calibration (within 10% of accepted value). The instrument will check the 5.00 standard and if acceptable will then start the samples. The 5.0 standard is checked every 10 samples, and if it is not within the range 4.75 to 5.25 the instrument will be restandardized and if the 5.00 is still not in the range it will stop until the problem is resolved and restarted. Check the printer frequently to find any samples that are above 10.00 PPB, make the appropriate dilutions to be run after the other samples have been run.

7.0 DATA HANDLING

After all the samples and dilutions are run then the data can be reformatted. Move the mouse pointer to File and click on Exit to Benchtop. When in Benchtop, move the mouse pointer to Windows and click on Reformat Data, type the name of the data file and hit enter. Change the extension to AS, click on the box to it's left, then click on Header

Included. To go to the next page click, on Sample, then click on Sample Position, Dilution, Mean Conc (std units) and finally on Execute Reformat. The reformatted file is now saved. Exit by moving the mouse pointer to File and click on Exit to DOS. Click on OK when told that changes will be lost to reformat and OK when asked if OK to exit software. When back in Dosshell, double click on Command Prompt. When C:\DOS> is on the screen then type cd.. and enter. Then type aa_inst\aa_files\data and enter. Type print xxxxxxxx.as(your file name) and enter. Hit enter when asked for name of list device [PRN]. This should print out your reformatted data. Next place a 3.5" disc in the computer and type xcopy xxxxxxxx.as B:. This will transfer the file to disc for use in the calculations. The data are corrected for drift using quattro, then transferred to the main quattro file for final calculation. The formula is (corrected soln. conc. X dilution X final volume)/sample volume(ml.). the units are Ng/ml. or mg/L.

8.0 HEALTH AND SAFETY

Laboratory personnel should always follow established laboratory safety procedures. All digestions using perchloric acid should be performed in the perchloric acid fumehood.

9.0 QUALITY CONTROL

Quality control samples will be prepared at the following frequency:

Preparation Blank - 1/20 samples
Duplicate - 1/10 samples
Matrix Spike - 1/10 samples
NIST (#2670) Toxic Metals Freeze Dried Urine (Laboratory Control Standard) - 1/20 samples.

Contamination should be at a minimum in the blank samples and in no instance should it exceed the instrument detection limit. If contamination exceeds the instrument detection limit, the source of the contamination should be eliminated, the affected samples redigested and reanalyzed.

The difference between duplicate samples should not be greater than 1 mg/L if the values are <10 mg/L during the analysis run. At values ≥10 mg/L, the duplicate values should have a relative percent difference (RPD) of 20% or less.

The RPD is calculated using the following formula:

$$RPD = \frac{S - D}{\frac{S+D}{2}} \times 100$$

Where:

S = Original sample value.
D = Duplicate sample value.

Matrix spike recovery should be in the range 85-115% and the LCS recovery should be within the established control windows.

If duplicate precision, matrix spike, or LCS control limits are not met for a sample batch, potential problems should be investigated and solved. If sample preparation is found to be the problem, the affected samples should be redigested and reanalyzed. If the analytical instrumentation is the problem, the affected samples and QC should be reanalyzed once the problem is solved.

The calibration check standard (ERA ~5.0 mg/L) will be analyzed every ten samples. If this standard is not within $\pm$ 10% of the true value, the analysis will be stopped, any problems solved. The instrument will be recalibrated and all samples since the last good calibration check reanalyzed.

The data, calculations, quality control and reports are checked by the Quality Assurance Officer before a final report is released.