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US Army Corps of Engineers®
Engineer Research and Development Center

Hazardous Asbestos and Lead Optimal (HALO) Management System

Demonstration of Lead Hazard Management Plan Generation

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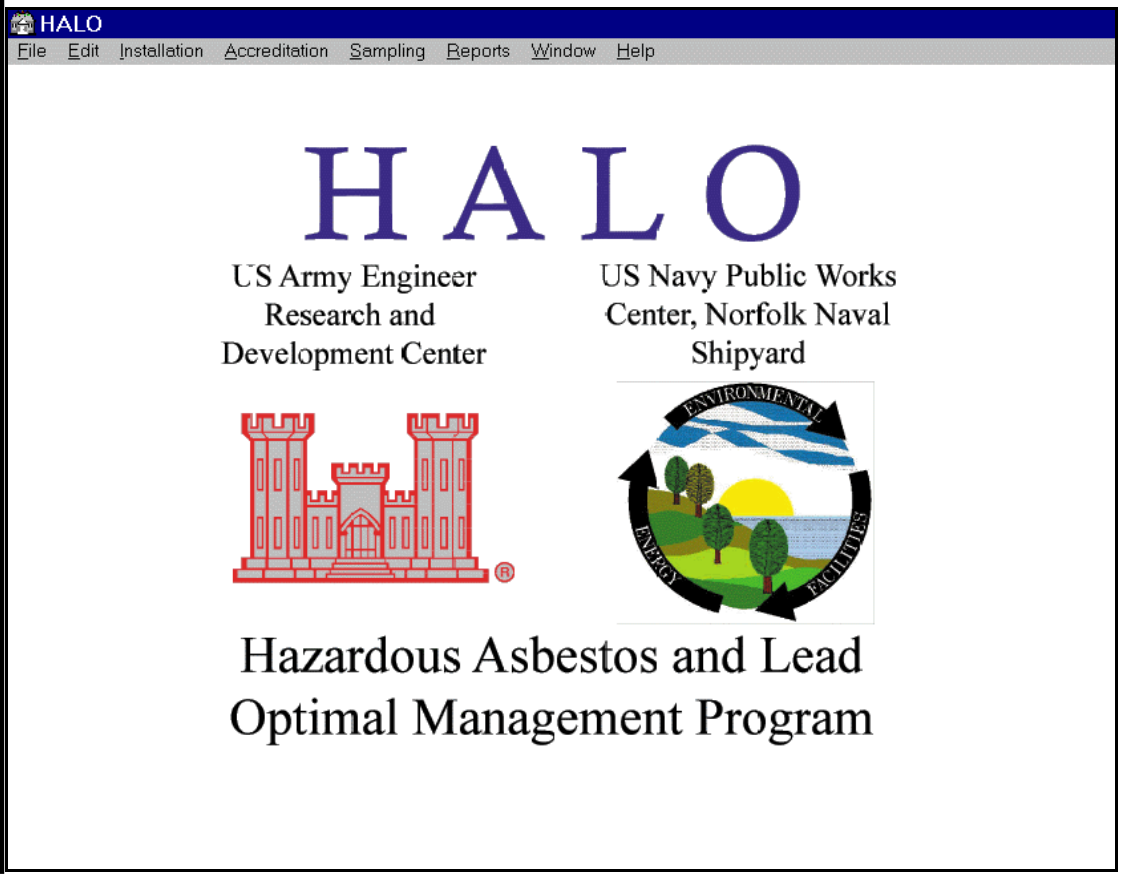

Construction Engineering Research Laboratory

Preface

This technology demonstration was conducted for Headquarters, Department of the Army under Program Element (PE) 063728A, "Environmental Technology Demonstration"; Project 002, "Environmental Compliance Technology"; Work Unit CF-M B101, "Cost Effective Technologies to Reduce, Characterize, Dispose, or Reuse Sources of Lead Hazards." Bryan Nix, ACS(IM)-FDF, was the technical monitor.

The work was performed by the Materials and Structures Branch (CF-M) of the Facilities Division (CF), Construction Engineering Research Laboratory (CERL). The Principal Investigator was Dr. Ashok Kumar. The technical editor was Linda L. Wheatley, Information Technology Laboratory – Champaign. Martin J. Savoie is Chief, CEERD-CF-M, and L. Michael Golish is Chief, CEERD-CF. The Technical Director of the Installation Operations Business Area is Gary W. Schanche (CV-T), and the Director of CERL is Dr. Alan W. Moore.

CERL is an element of the U.S. Army Engineer Research and Development Center (ERDC), U.S. Army Corps of Engineers. The ERDC Commander and Executive Director is COL John W. Morris III, EN, and the Director is Dr. James R. Houston.

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1 Introduction

Background

Before the dangers of lead and asbestos in the environment were fully understood, lead-based paints (LBPs) and asbestos were commonly used building materials. Now that the dangers are recognized, the Army finds itself with many structures containing lead and asbestos coatings or materials. Family housing, child development centers, and schools present a particular problem since young children are more sensitive to lead poisoning than adults. U.S. Environmental Protection Agency (EPA) and U.S. Department of Housing and Urban Development (HUD) rules require identification of lead hazards in paint, dust, and soil. When lead hazards are found, action must be taken to manage or remove them.

The *Residential Lead-Based Paint Hazard Reduction Act of 1992*, often referred to as Title X (read as Title Ten), requires disclosure of known lead hazards in housing built before 1978. Section 1017 of Title X required HUD to develop guidelines for lead hazard identification and control. HUD published *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing* (1995) to meet this requirement. The 1995 guidelines replaced the 1990 publication *Lead-Based Paint: Interim Guidelines for Hazard Identification and Abatement in Public and Indian Housing*.

The U.S. Army is required to follow these rules and guidelines and has issued Army Regulation (AR) 420-70, *Facilities Engineering, Building and Structures*. The AR requires the public works departments of each facility to comply with all Federal and state environmental regulations.

The former U.S. Army Center for Public Works published Public Works Technical Bulletin (PWTB) 420-70-2, *Installation Lead Hazard Management* to provide technical guidance to Army personnel who operate and maintain Army facilities. PWTB 420-70-2 assists in identifying and controlling hazards from lead-contaminated paint, dust, and soil, and from other sources in facilities constructed before 1978. It stresses a program of risk assessment, ongoing monitoring, interim controls, and abatement. The PWTB also contains guidelines for an installation-wide Lead Hazard Management Plan. The plan should contain all

the information about lead hazards and the proposed plans and methods of control and priorities for abatement of LBP.

Asbestos is a naturally occurring mineral mined from the earth. Commercial use of asbestos began in the early 1900s. It has been used in many building materials for its many beneficial characteristics such as resistance to heat, fire, and chemical corrosion. It is also a flexible, durable, and strong material. Asbestos has been used to reinforce many types of building materials such as plaster, dry wall, ceiling tiles, floor tiles, mastics, and many others. However, serious adverse health effects have been linked to exposure to this naturally occurring mineral. When asbestos fibers become airborne and are inhaled, there is an increased risk of asbestos-related diseases including asbestosis (scarring of the lungs), mesothelioma (cancer of the chest and abdominal lining), lung cancer, and cancer of the gastrointestinal tract.

To address the hazards of asbestos exposure, Congress enacted the *Asbestos Hazard Emergency Response Act* (AHERA) on 22 October 1986. AHERA mandated a regulatory program for addressing asbestos issues in public schools. On 28 November 1990, Congress passed the *Asbestos Schools Hazard Abatement Reauthorization Act* (ASHARA). This act amended AHERA by extending many of the training and accreditation requirements to persons performing asbestos work in public and commercial facilities. AR 420-70 also addresses the control and removal of asbestos in Army facilities. PWTB 420-70-8, *Installation Asbestos Management Program*, provides technical guidance to Army personnel in managing asbestos-containing materials. The PWTB also contains guidelines for manage-in-place plans, abatement, and an Asbestos Hazard Management Plan.

Separate from AHERA and ASHARA, the Occupational Safety and Health Administration (OSHA) mandates the control of employee exposure to airborne asbestos fibers and specifies training requirements for employees working with asbestos-containing materials or presumed asbestos-containing materials. For these reasons, managing asbestos and asbestos hazards is either directly or indirectly required.

Tracking the details of an effective lead and asbestos hazard management program can present a formidable task, even for a relatively small number of buildings. A computer database program is ideally suited to this task.

The Hazardous Asbestos and Lead Optimal (HALO) Management Program is derived from an old disk operating system (DOS)-based program written in DBase that the Navy developed for lead paint and asbestos data. The Army entered into an agreement to upgrade and modify the old program into a Microsoft®

(MS) Windows-based modern database program. The initial plans were to develop the system for lead paint surveys and risk assessments. The system would generate Lead Hazard Management Plans from the data as required by AR 420-70, *Buildings and Structures*, and in the format presented in PWTB 420-70-2. The program would also generate The Title X Lead Disclosure Form for tenants of Army housing. The data presented in this form would be taken from the program's data tables automatically so that any and all changes would be reflected every time the form was generated. This version of the HALO program (called PainterL) was written in MS FoxPro®, a relational database program. The program has subsequently been upgraded from this original version to include tables for asbestos surveys and software to generate reports from the data. It was made capable of generating the Asbestos Hazards Management Plan from the data included in the tables. The asbestos plan is also required by AR 420-70. The plan is designed to contain all the information that is required by PWTB 420-70-8. After this upgrade was complete, the program name was changed to the present HALO Management Program.

Several commercially available programs are designed to work with lead hazard data, derived mostly from paint inspection protocols. The HALO system is designed to assist Army personnel in performing lead and asbestos hazard inspections, tracking data, assessing risk, and selecting appropriate management actions. HALO uses regulation-based algorithms to assign risks so that the hazards found in family housing and other structures can be properly managed. The program serves to:

- Standardize the collection and analysis of risk assessment data
- Support the development of installation lead hazard and/or asbestos hazard management plans
- Support the implementation of interim and long-term lead hazard control strategies
- Provide guidance in managing lead and asbestos
- Generate standard and required reports, notifications, and other information.

This demonstration included only the lead portion of the HALO program and used existing data generated from risk assessments completed for the Eighth U.S. Army, Korea Environmental Programs Office by the U.S. Army Center for Health Promotion and Preventive Medicine (CHPPM). Appendix A includes points of contact for the demonstration.

Official DoD Requirements

The U.S. Army Environmental Requirements and Technology Assessments (AERTA) requirements are stated in Compliance Category 8, Decontamination of Structural Facilities, Army-Wide Prioritized Requirement Statements: A(2.3.k), "Removal, Treatment, and Disposal Technologies for Lead-Based Paint (LBP) Contamination."

Three important federally driven programs related to this requirement are:

- Prevention of childhood lead poisoning
- Prevention of over-exposure of workers to lead
- Characterization and proper disposal of lead-contaminated debris.

LBP Control and Abatement

Routine maintenance, interim controls, or abatement of sources of LBP are inefficient and costly and can often result in exposure of children and workers to LBP as well as contamination of the environment through improper controls during abatement and disposal. The cost of managing or abating LBP sources is prohibitive, especially considering the large stock of older Army facilities, and often results in work not being affordable. For example, one of the commercial companies has applied LBP encapsulants to reduce the lead hazards to occupants, at a cost $8-$9 per square foot, for a total cost of $8.7 million. Lead-contaminated paint, dust, and soil are common in and around Army residential properties, child support facilities, and wooden structures constructed prior to 1978. In addition, numerous steel structures such as towers, tanks, bridges, piers, locks, and dams were constructed using LBP primers and coatings.

Surface area of steel structures at Army facilities is approximately 50 million square feet, with about 80 percent coated with red lead oxide primer. The Army also owns 800 million square feet of nonresidential buildings with an estimated 1 billion square feet of wall surfaces that contain LBP. In addition, the Army owns 95,400 family housing units in the United States and 26,200 units in foreign countries. The average age of these facilities is 36 years; therefore, 90,000 of these units, having a total area of about 1 billion square feet, predate 1978 and most likely contain some LBP.

The removal of LBP from steel structures and buildings is accomplished through a variety of methods. The two most common methods are chemical stripping and abrasive blasting. The waste generated from these operations is often hazardous due to the toxicity and leaching characteristics of lead. Currently used technologies result in emission of hazardous lead dust. Environmental contamination by fugitive dust emissions is regulated under the *Clean Air Act* (CAA) and *Clean*

Water Act (CWA) and their amendments, while the *Resource Conservation and Recovery Act* (RCRA) addresses the proper disposal of lead-bearing wastes. In addition, chemical strippers also introduce chemicals such as trichloroethylene, phenol, xylene, methylene chloride, and methyl ethyl ketone, which are considered hazardous wastes under RCRA.

The Army needs cost-effective technologies to control or abate sources of lead exposure and contamination as well as to safely remove, characterize, handle, store, transport, and dispose of LBP-contaminated debris. This need is highly important with building transfer under Base Realignment and Closure (BRAC) or when Army personnel move into new quarters (i.e., testing for LBP may be requested).

In addition, the Army needs a standard methodology for fast assessment techniques, a standard methodology for managing LBP in place, and environmentally safe and cost-effective removal and disposal techniques for LBP contamination. This is especially true for high volume/low toxicity debris, which fails the Toxicity Characteristic Leaching Procedure (TCLP) for lead.

This work also supports compliance with existing and proposed Federal environmental and housing regulations as well as Army safety and health regulations that are listed in the References. In addition, it also supports compliance with state and local requirements, which are often more stringent than Federal requirements.

How Requirements Were Addressed

This project addressed some of the DoD requirements by demonstrating a program that collects LBP data from risk assessments or paint surveys and generates the required Lead Hazard Management Plan and the Title X Lead Disclosure form for residential housing. The program is projected to reduce time and the amount of paperwork required for compliance with all the rules and to allow the user to produce the Army-required management plans for each installation. The plans can be inexpensively regenerated every time the data are updated.

Objective

The objective of this demonstration was to show the capabilities of a database system that would reduce the paperwork and storage requirements for survey reports and management plans required under Title X and mandated by AR 420-70. Data from a previous survey would be uploaded into the data tables, and the reports would be generated using this data.

Regulatory Issues

The *Residential Lead-Based Paint Hazard Reduction Act of 1992* (Title X) requires disclosure of known lead hazards in housing built before 1978. Section 1017 of Title X required HUD to develop guidelines for lead hazard identification and control. Their *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing* (1995) meet this requirement. The 1995 guidelines replaced the 1990 publication "Lead-Based Paint: Interim Guidelines for Hazard Identification and Abatement in Public and Indian Housing." Federal regulations imply that the facilities are the responsibility of the owner from cradle to grave. This includes any environmental hazards that were part of the building any time throughout its life.

In response to AR 420-70, *Buildings and Structures*, PWTB 420-70-2, *Installation Lead Hazard Management*, was published to provide technical guidance to Army personnel who operate and maintain Army facilities. PWTB 420-70-2 assists in identifying and controlling hazards from lead-contaminated paint, dust, and soil, and from other sources in facilities constructed before 1978. It also stresses a program of risk assessment, ongoing monitoring, interim controls, and abatement. Any management plans generated by the HALO program have to comply with the PWTB, and the disclosure form created from the database must comply with the Title X format.

Previous Testing of the Technology

The computer program was developed in stages and each stage was put through rigorous testing at the developer's site. As part of the development the program had data entered and reports written from the data multiple times to check the accuracy and consistency of the reports. The LBP portion of the program (at that time known as PAINTERL) was beta tested at Carlisle Barracks, PA. Data from the installation had been entered into the tables and reports generated by the environmental office of the Directorate of Public Works (DPW). The asbestos portion of the program was added, and the developer ran extensive tests on the data entry and report writing capability. The asbestos portion has been beta tested at DPW sites of the Eighth U. S. Army, Korea. Finally, when the data entry sheets were modified, the system was again extensively tested at the developer's site. Any and all software bugs that were located in the program during the testing were noted and subsequently repaired.

2 Technology Description

Description

The HALO Management Program is a relational database created with a series of linked tables that archive risk assessment data, paint surveys, asbestos surveys, training data, and worker exposures. The structure of the database contains tables for installation information, building information (including physical condition), soil lead samples, both composite and single lead dust samples, both composite and single paint chip samples, lead risk assessment factors, asbestos data, and the action levels for lead and asbestos (Figure 1). The data are entered into the system on several data pages. The reports are generated using templates and the data from the tables.

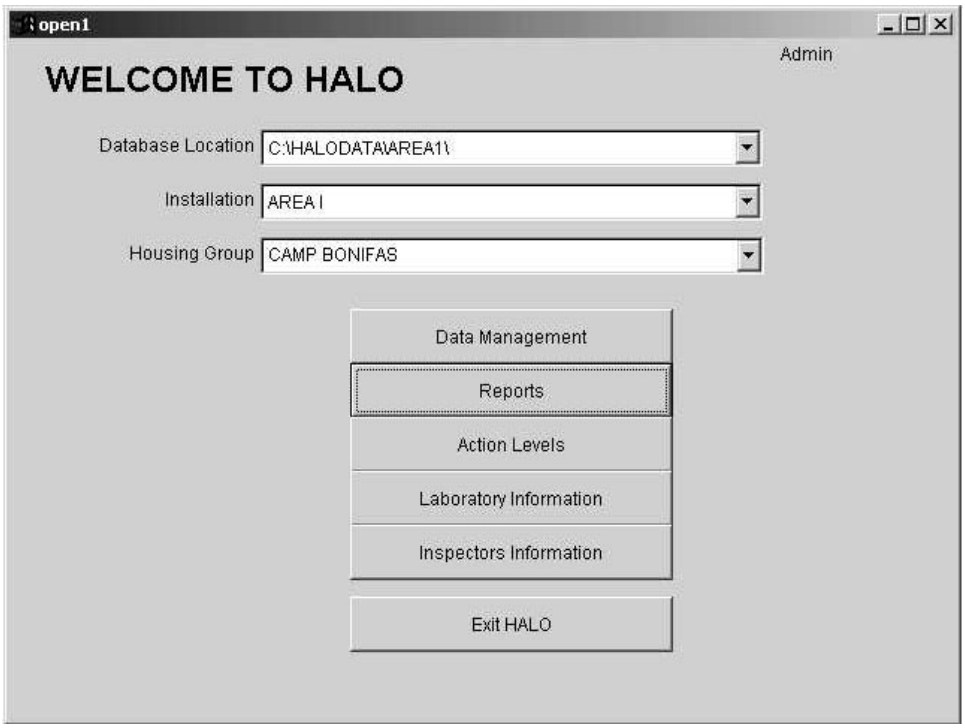

Figure 1. Welcome screen from the HALO program.

When decisions are to be made about the lead levels in various samples tested, the program uses the action level table to make the comparison. The HALO program comes preprogrammed with the EPA and HUD action levels. The levels can be changed if the local authority has more protective standards than required by Federal standards. When the reports are generated following the update, then the new action levels will be used for the decision process.

The HALO program uses the data stored in its tables to complete the reports. It can generate the Lead Hazard Management Plan, the Asbestos Hazard Management Plan, the Title X Disclosure Form for tenants, a priority ranking report for asbestos, and a building/floor plan report. It is also capable of printing out any of the data pages used throughout the program. The program allows the data tables to be remote from the desktop or laptop computer (such as on a local area network drive) and has two levels of access to the data tables. The first level allows the user to access the data and print reports. The next level of access allows the user to modify the tables by adding data from further surveys, training, and abatement activities. Figures 1 through 7 show several of the screens from the HALO Management Program. These screens are used to enter data into the tables. They have drop-down menus and popup description bars for many fields.

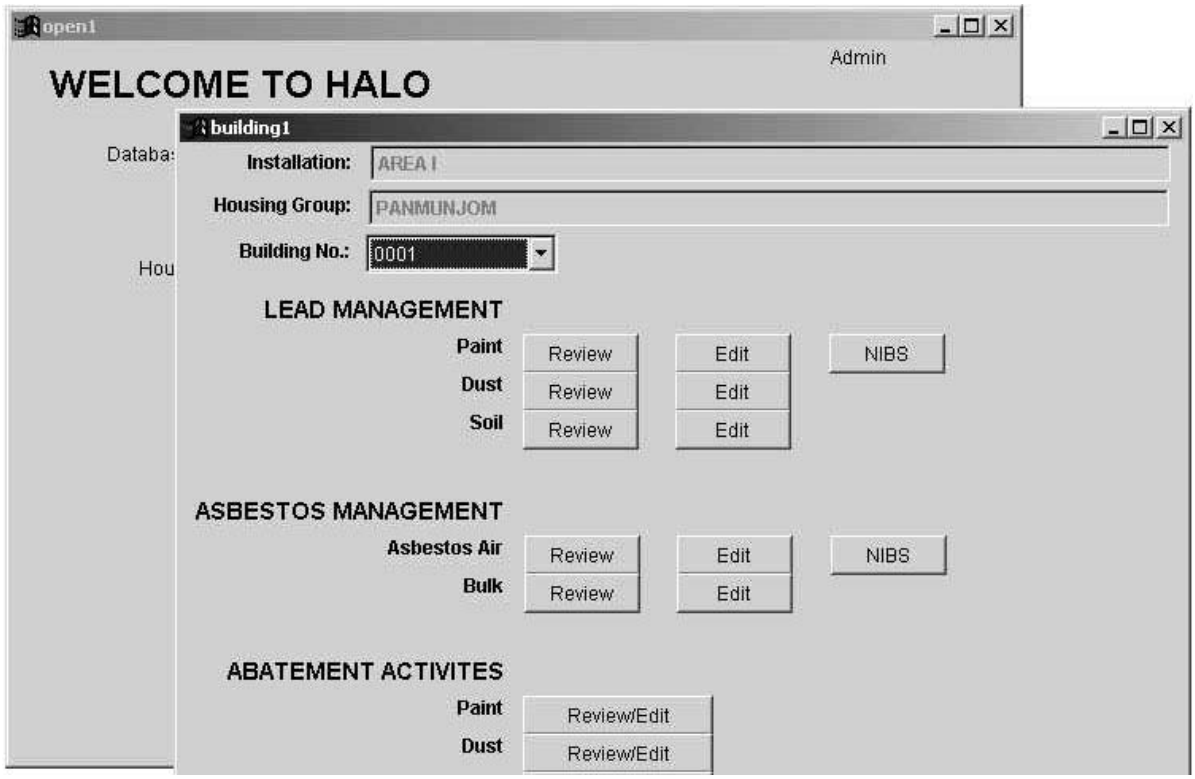

Figure 2. Data Management page from the HALO program.

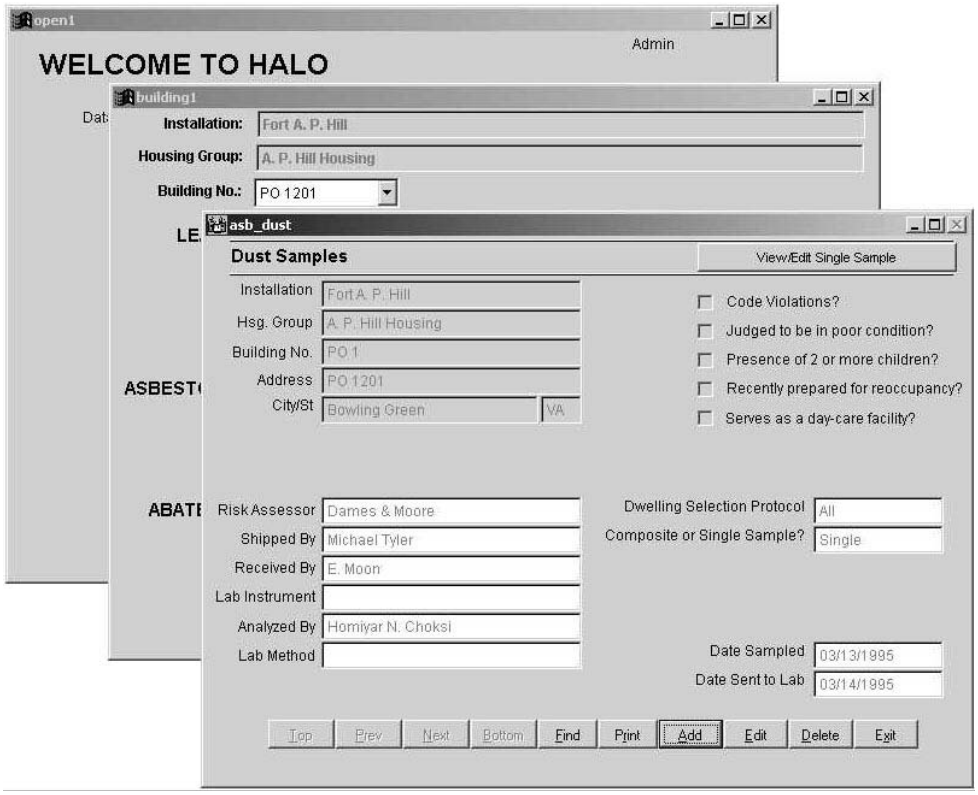

Figure 3. Dust Data entry sheet from the HALO program.

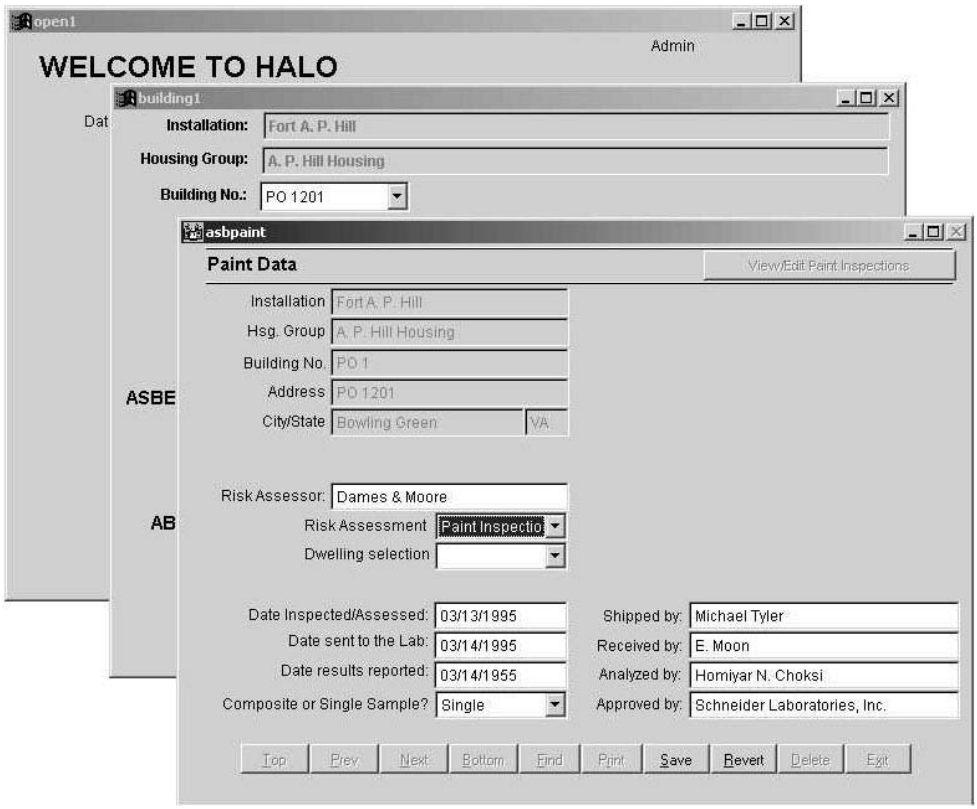

Figure 4. Paint Data entry sheet from the HALO program.

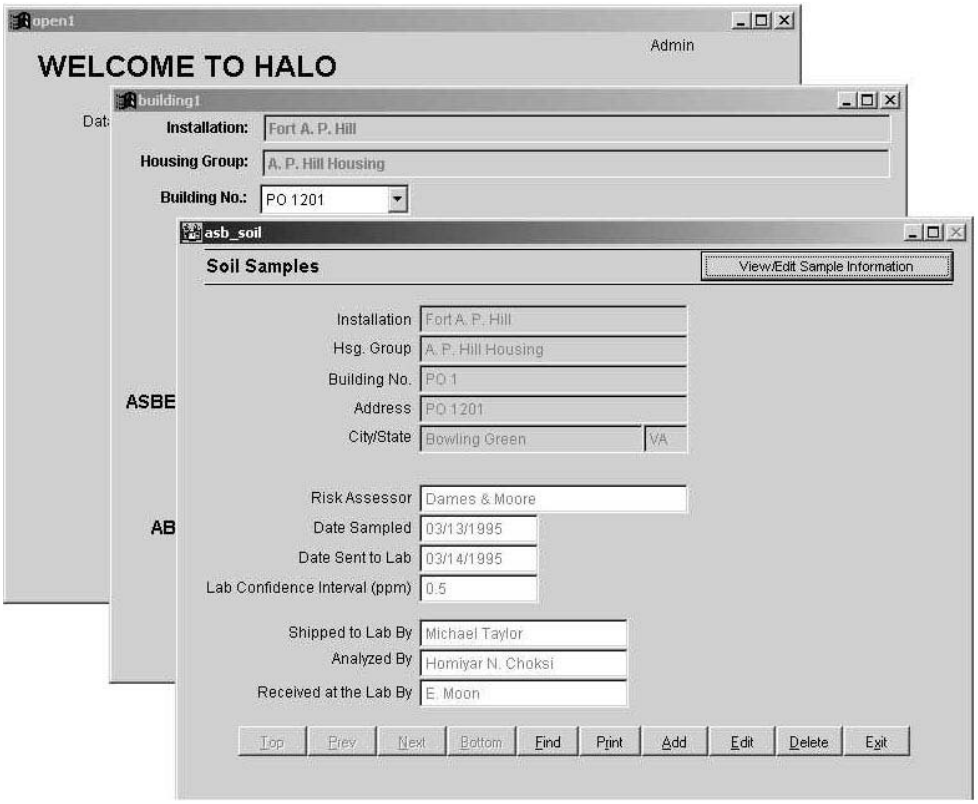

Figure 5. Soil Data entry sheet from the HALO program.

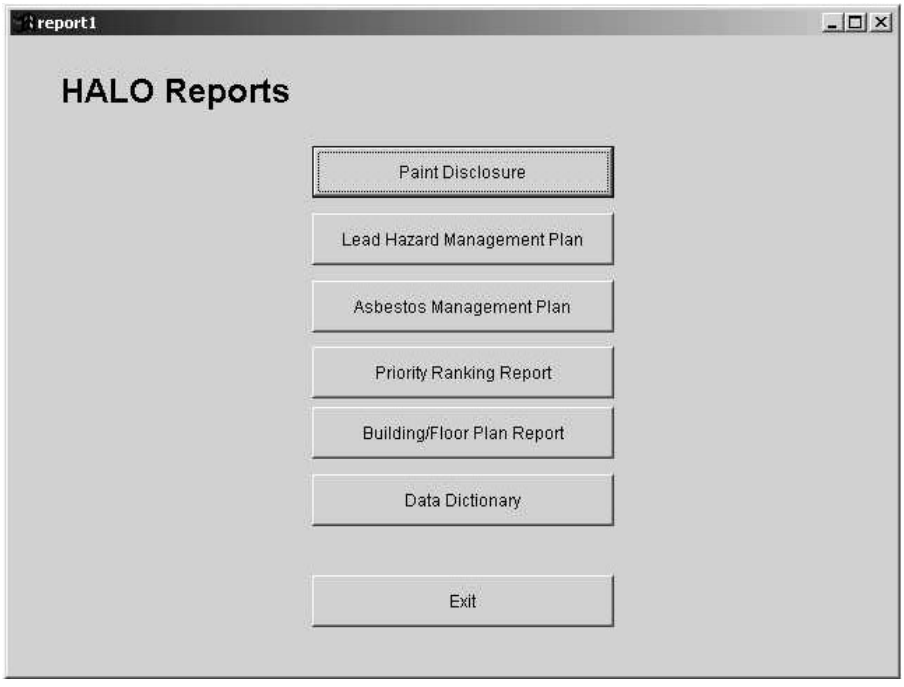

Figure 6. The Reports page from the HALO program.

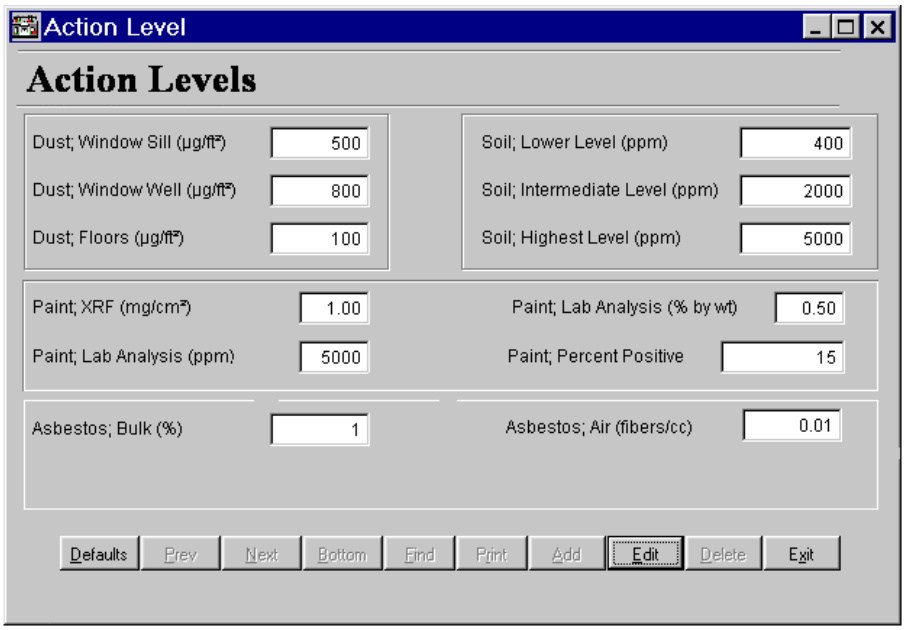

Figure 7. Action Level page from the HALO program.

The program runs under the MS Windows 95®, 98®, ME®, NT®, or 2000® operating systems. The hardware requirements are similar to those that are needed to run the operating system. Requirements include a Pentium-class processor, 16 megabytes (MB) of random access memory (RAM) and 10 MB of hard disk space for the program and unpopulated data tables. Additional hard disk space will be required as the data tables are populated with data. A mouse is required since some user actions do not have keyboard equivalents. The program will run on portable computers as well as on desktop computers.

Due to the large amount of information on the form screens, the display mode must be set to a minimum resolution of 800 x 600 pixels. The 640 x 480 pixels screen resolution will not show the entire entry form. The program is also expecting a 256-color mode for the display, although the program will function in 16-color mode with degraded appearance. Most modern desktops and portables have the 256-color mode available. The asbestos and lead guidance documents generated by the program use MS Word® version 7 or better commands to format the output.

A printer is required because some reports are sent directly to the printer after on-screen preview. The printer can be either an inkjet or LaserJet style and is not limited to specific models.

Strengths, Advantages, and Weaknesses

The HALO Management Program uses relational database tables to store all the necessary information and MS FoxPro® to link and relate them as necessary. MS FoxPro® has a powerful data engine and the tools necessary to calculate the algorithms required to generate the two management plans.

While the program was originally designed for lead risk assessment data (the Army-recommended process), paint inspection information can be stored and analyzed as well. Later upgrades to the program included asbestos data tables. The program presents on-screen forms for entry of hazard information to generate a comprehensive database. Then, using regulation-based algorithms, the data are used to generate the appropriate hazard management plan. For example, HALO can output a building-specific Title X "Disclosure of Information" document with all the lead hazards found and any remedial actions taken. Asbestos documents provided in HALO offer guidance for managing asbestos and asbestos hazards.

The data tables could be stored on a drive on the local area network. These tables could be viewed by anyone with access to the network drives but only changed by someone with administrative access. In this configuration, the environmental office would be responsible for maintaining the data tables, the management chain could do their own queries, and the housing office could generate the required Title X forms from the data.

A weakness of the program is the number of data entry tables required to accommodate all the data required to process the algorithms for the lead and asbestos evaluations. A modification of the data entry forms reduced the number of sheets and reorganized them into a more user-friendly format. Currently there is no search mechanism to allow general searches of the database. There are only specific preprogrammed searches. A very usable upgrade would be to incorporate a universal search capability.

Factors Influencing Cost and Performance

Using current practices as the basis of comparison, the generation of the data, the compilation of the results, and the generation of the Hazard Management Plan take considerable time. It is proposed that the use of the HALO Management Program will only affect the compilation of the data and generation of the Plan portions of the process. Since the data are already in electronic format, the data entry portion of the process will take considerably less time than if the data

were entered manually. A simple FoxPro® program can be used to quickly and easily append the data to the data tables. This would be true for any installation already having data in electronic form that begins using the HALO Management Program. The compilation of the data for the Lead Hazard Management Plan and the actual writing of the plan would take many man-hours to complete, and there is always the possibility of errors in the data and the inadvertent omission of some pertinent data.

Data entry is the time consuming part of any data management program. Contractors who collect the data through risk assessments and inspections have to accumulate the data in some format that can be put into the HALO format, which could then be appended to the existing database. Management plans could be generated from the new data only or from the whole database at any time it is needed. When the plan is generated, it will include all the current data. Plan generation will take considerably less time with HALO than the manual method. Routine questions about the status of a building can readily be answered by querying the database for the address, compared to the manual method of searching three-ring binders of information from the whole installation.

3 Site/Facility Description

Background

The Eighth U.S. Army has been headquartered in Korea since the cease-fire agreement of the Korean conflict. The peninsula has been divided into four logistical regions for public works and command concerns. Area I is the northern section along the demilitarized zone (DMZ) from coast to coast. Area II is Seoul and surrounding environs. Area III is west and south of Seoul. Area IV is the remainder of the peninsula. The Army has family housing in all but Area I. There are approximately 88 installations throughout the peninsula, from fuel depots to the garrison headquarters. All buildings occupied by the U.S. Army have been constructed since the early 1950s and, although an extensive building program is underway, there are still many earlier buildings remaining. Since South Korea has not banned LBP, there is LBP in most facilities at the Army's installations.

Site/Facility Characteristics

No LBP risk assessments or surveys had been done in Korea until the late 1990s, when the survey was conducted by U.S. Army CHPPM. The data were collected and entered into an MS Excel® spreadsheet. The survey was confined to family housing units at Yongsan Garrison (Area II), Camp Humphreys (Area III), and Camps Walker, George, and Hialeah (Area IV). Family housing comprises single-family dwellings, duplexes, quad-plexes, and high-rise apartment buildings. Survey samples were taken from all types of buildings and from the soil around the buildings.

Figure 8. Headquarters, U.S. Forces Korea at Yongsan Garrison.

4 Demonstration Approach

Performance Objective

The objective of this demonstration of the HALO Management Program was to show the capability of the HALO program, the input of data, and the generation of reports based on that data. The standard data entry procedures for the program were not tested, as all data for this demonstration was in electronic format.

Physical Setup and Operation

The data were produced by a lead paint risk assessment conducted on U.S. Army family housing units in three of the logistical Areas in South Korea. The data were entered on an MS Excel® spreadsheet and forwarded to the Engineer Research and Development Center's Construction Engineering Research Laboratory (ERDC/CERL) for use in the demonstration. The spreadsheet contained all the pertinent data for the program. The data were converted to a DBF file, which was appended to the HALO data tables using a conversion program written specifically for the data set. The data tables were verified and the program was run. Various tests of the program were run to check out the report generation capability, including the Title X Disclosure Form and the Lead Hazard Management Plan.

Table 1. Principle equipment used.

Equipment	Type or Model	Purpose
Desk top computer	Gateway E-4200	Run program and upload data
Printer	HP LaserJet 5	Print reports

Sampling Procedures

The data were uploaded into the HALO data tables, and it was confirmed that they were usable by the program. The data in the tables were quality checked for accuracy and completeness after the upload procedure. Several of the Title X disclosure forms were run and compared with the data contained in both the tables and the original Excel® spreadsheet. The Lead Hazard Management Plan was then run and its data checked for completeness and accuracy in the printed report.

Analytical Procedures

No analytical procedures were required for this demonstration. However, the data generated by the risk assessment was from lead analysis of dust from windowsills and floors, from paint chips, and from soil samples around the buildings. The risk assessments were completed in accordance with standard protocols as defined by EPA and HUD. The chemical analysis of the samples was done in accordance with the American Society for Testing and Materials (ASTM) specifications. The dust samples were tested according to ASTM E1644, *Standard Practice for Hot Plate Digestion of Dust Wipe Samples for the Determination of Lead*, and ASTM E1613, *Standard Test Method for Determination of Lead by Inductively Coupled Plasma Atomic Emission Spectroscopy, Flame Atomic Absorption Spectroscopy, or Graphite Furnace Atomic Absorption Spectroscopy Techniques*. The paint samples were tested according to ASTM E1645, *Standard Practice for Preparation of Dried Paint Samples by Hotplate or Microwave Digestion for Subsequent Lead Analysis* and ASTM E1613. The soil samples were tested according to ASTM E1726, *Standard Practice for Preparation of Soil Samples by Hotplate Digestion for Subsequent Lead Analysis* and ASTM E1613. All procedures were performed by a certified laboratory.

5 Performance Assessment

Performance Data

The performance of the program was determined by the accuracy of the data contained in the management plans and Title X disclosure forms. The data contained in these documents were checked against each data table generated. Since there were three data sets for the three logistical areas of the Republic of Korea, disclosure forms and management plans were generated for each (Areas II, III, and IV). Appendix B contains a copy of one of the Title X disclosure forms that was generated for Area III. Appendix C contains the Lead Hazard Management Plan for Area III.

Data Assessment

The data were provided by U.S. Army CHPPM from their survey and risk assessment of Areas II, III, and IV. The accuracy of the original data as received was assumed. The data were uploaded into HALO and checked against the original Excel® spreadsheet. The data in the generated documents (Title X Disclosure Forms and the Management Plan) were compared to the original data as received. The HALO tables developed when the data were uploaded from the Excel® spreadsheet were correct and contained all the information from the spreadsheet.

Technology Comparison

The technology of this program was compared to other programs available when the program was first developed. The HALO program was designed to fit specific Army and Navy needs for data collection and assessment. The original Data Management Program (DATAMAN) was developed from the Navy program for storing lead and asbestos data. This program was created in the DOS environment and did not generate any reports that were considered critical to the Army.

Another program available at the time of the HALO program development was called pcV3, which was developed using the FoxPro® database program and was created to aid Facility, Asbestos Program Managers, Lead Program Managers, and System Managers of the Air Force track lead and asbestos data. The program is a "tool capable of quickly identifying potential lead-based paint and asbestos hazards relative to a particular site at a plant, within a building, and for a designated space and material" (*pcV3 User's Manual*, Golson Corp., Oakland, CA). The program was created primarily for asbestos hazard management and does not generate any forms required by law or regulation.

Other programs have been developed for individual installations. One was developed for Fort Lewis, WA by a consultant from Hart Crowser, Inc. This database system is based on MS Access and allows the managers to log data for facilities, asbestos, LBP, underground storage tanks, and other environmental information. The program is used to manage maintenance and repair activity, remodeling, or demolition projects. It allows creation of work orders whenever lead or asbestos is involved in the project. It does not, however, generate any of the documents required by law or regulation.

6 Cost Assessment

Cost Performance

The costs associated with using the HALO program, as with any database program, are for time required to enter data, which includes the original data and the follow-on surveys and assessments. Generating documents can be done at any time and will include any data that is already in the program. This demonstration included the conversion of electronic data from an MS Excel® spreadsheet to the data tables of HALO, the generation of Title X disclosure forms from the data, and the generation of the Lead Hazard Management Plan outlined in PWTB 420-70-2 for each of the three logistical regions (Areas II, III, and IV) in Korea. Table 2 summarizes the costs incurred for this demonstration.

Table 2. Costs to operate the HALO Management Program for this demonstration.

Startup		**O&M (Surface Preparation and Repainting)**		**Demobilization**	
Activity	**Cost ($)**	**Activity**	**Cost ($)**	**Activity**	**Cost ($)**
Prepare Data ($25/hr x 3)	75.00	Run Disclosure Forms ($25/hr x 0.1)	2.50	N/A	0
Append Data ($25/hr x 0.5)	12.50	Run Management Plan ($25/hr x 0.4)	10.00	N/A	0
Labor Subtotal	**87.50**		**12.50**		**0**
Consumable parts for equipment	0	Utilities	0	N/A	0
Materials Subtotal	**0**		**0**		**0**
Overhead	**42.85**		**6.15**	**N/A**	**0**
Total	**130.35**		**18.65**		**0**
Cost/Report					**149.00**

Cost Comparisons to Conventional and Other Technologies

As with any database program, the data entry and maintenance of the data can be very time consuming. If the data is in electronic form other than HALO, a short upload program can be written to append the data to the HALO tables. The data can be in .DBF or comma delimited format and easily appended. The data tables automatically set up the proper cross-reference protocols so that the tables are properly linked to access the new data.

If the data is in the HALO table format, then it can be automatically appended by a subroutine already built into the program. It will take the original tables and append the data, while doing a series of checks on the incoming data for consistency and accuracy.

If the data are in paper format, then a clerk will be required to enter the data using the data entry forms of the program. Once the clerk is accustomed to the program's table entry forms, the data can be quickly entered in the system. For other work, data entry took about 4 hours per 3-inch binder of printed reports.

The conventional method for generating the disclosure form is to look through volumes of data to locate the residence in question, then look through the lead paint risk assessment report for that building and copy the information about the presence of lead onto a form that the tenants sign. If it were done at all, it would take 1-2 hours to complete the form before the new tenants arrive to sign their lease. Using the HALO program it takes a matter of minutes to complete the same task and could be done immediately before the new tenants arrive. This would save a clerk (GS-05) conservatively 1 hour of work at a fully burdened cost of $40.96.

To generate the Lead Hazard Management Plan, an individual or group of individuals had to gather all the pertinent information and results from the assessments and surveys, compile the data into a usable form, analyze the data, generate a priority ranking for each building surveyed and assessed, and finally write the plan according to AR 420-70 as supplemented by PWTB 420-70-2. This process could take more than 3 weeks depending on the extent of the available data and the proximity of the storage area. Using the HALO program, the complete report could be compiled, printed, and bound in less than 30 minutes. Using the HALO Management Program would conservatively save 3 weeks work for an Environmental Specialist (GS-09), or approximately $8,400.

7 Approach to Regulatory Compliance and Acceptance

The Army requires that a lead hazard management plan be generated and used to address the presence of lead in Army housing. The HALO Management Program complies with AR 420-70 and the supplemental PWTB 420-70-2 by generating a lead hazard management plan that follows the prescribed format in the technical bulletin.

The Army, as a matter of policy, follows the requirements of Title X, *The Residential Lead-Based Paint Hazard Reduction Act of 1992*. As part of this Act, lead hazard disclosure forms are to be generated at the time a new tenant signs a lease for a residence. The form is to include any and all known lead hazards found in the residence. It is to be signed by both the leasing agent and the tenant. A copy is given to the tenant, and a copy is kept on file at the leasing agent's office. The HALO program generates the disclosure form from the data tables, filling in the information on lead hazards for the residence being leased.

The HALO Management Program fulfills these two requirements by quickly generating the management plans and disclosure forms with the data available in the database.

8 Technology Implementation

Department of Defense (DoD) Need

The DoD has housing at all its major installations, and they are all required to follow Title X. Each branch of the military has its own policy regarding the management of lead hazards in family housing, childcare facilities, and other child-occupied facilities. DoD Schools is required to manage its lead hazards also, but it falls under a different chain of command than the DoD Services.

The Army is changing the way it does the business of installation management by creating a centralized management structure for all its installations. All operations and maintenance (O&M) funding for the installation will be centrally managed and distributed. This is a major change from the traditional command structure for facilities. The installation commander is taken out of the loop and installation O&M resources will be prioritized and used on the installation at the direction of the future Installation Management Agency.

Transition to HALO

The implementation of the HALO Management Program will require several things to happen simultaneously. There must be a strong advocate for the program, the users must be convinced that it will help them do their job more efficiently, and there must be some funding to aid the user in implementing the program. Most installations have completed risk assessments of the Child Development Centers and schools. They have typically assessed about half of the housing units and none of the industrial and office buildings. The standing up of the Installation Management Agency could help in the acceptance and increased usage of the HALO Management Program throughout the Army by requiring that HALO or a similar program be used to accumulate and store data for LBP risk assessments. Money could also be prioritized to complete the Lead Hazard Management Plans required by AR 420-70. Although installation environmental offices are typically underfunded and understaffed, once the HALO program is installed and the data tables are updated, maintenance of the data will take very little time and reports can be generated in a fraction of the time that has traditionally been required.

9 Lessons Learned

With the installation of the HALO Management Program, several items need to be addressed. This is a new program, so there is a learning curve for the user. Although pains were taken to make the interface with the user as friendly as possible, it still takes time to get used to it. Within 1 hour, the operators have become comfortable with data entry.

Computers in Korea are generally of older vintage, and many do not have enough hard disk space to accommodate the program and data files. Others have old versions of CD-ROM drivers and cannot read the CDs created with the newer version of the drivers. Replacing the old computers with newer models as defined in the Description section of Chapter 2 will take care of this concern.

For most installations, there is no existing organization to the lead and asbestos data collected over the years, and this will have to be organized and the data entered into the HALO Management Program. This process can be done in-house or contracted out. Both of these processes are going to take financing of some kind. The problem with assigning it to in-house personnel is that it would have to be an "other duty as assigned" and therefore could take a long time to accomplish. The long wait for complete data in the HALO Management Program would reduce the usefulness of the program.

Maintaining the data in the HALO Management Program will require a person to periodically enter the data from new surveys and assessments. Depending on the amount of data accumulated, this task could be done once per week or once per month.

The placement of the data tables on a network server will reduce some of the hard-disk burden on the local desktop computer. It would also make the data available to a wider variety of people who need to have access (e.g., DPW managers and workers, and housing and environmental departments). The two-level security system built into the HALO Management Program would accommodate this need very easily. One level has read-only capability and could be used by managers who need to make reports or query the data for some data. The other level has read/write capability for those persons responsible for maintaining the database table with current and accurate information.

The HALO user's manual generally includes all the information about program operation (Averbuch, Long, and Kumar 2002). However, no on-line help is built into the program, which makes it a little less convenient to look up questions users may have about operations in the program.

Finally, the query capability of the current version of the HALO Management Program was observed to be somewhat limited. Only a few fields are available to be queried. The utility of the program would be greatly enhanced by developing a universal query capability for the program to enable allow users to query any number of items contained in the data tables.

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U.S. Army Environmental Requirements and Technology Assessments (AERTA), Compliance Category 8, Decontamination of Structural Facilities, Army-Wide Prioritized Requirement Statements: 2.3k, "Cost Effective Technologies to Remove, Characterize, and Dispose or Reuse Sources of Lead Hazards," Ranking 1, 2 November 2001.

Appendix A: Points of Contact

U.S. Army Engineer Research and Development Center Construction Engineering Research Laboratory Champaign, IL 61826	(217)373-7239 (217)373-6758 (217)373-7235
19th Theater Support Command Camp Henry, Korea	011-82-53-470-8739 011-82-53-470-8714
Assistant Chief of Staff for Installation Management Alexandria, VA 22315-3800	(703) 428-6176
Dewberry and Davis Fairfax, VA 22031	(703)849-0375
U.S. Army Center for Health Promotion and Preventive Medicine Aberdeen Proving Ground, MD 21010	(410)436-3118

Appendix B: Title X Disclosure Form

Disclosure of Information on Lead-Based Paint and/or Lead-Based Paint Hazards

Lead Warning Statement

Housing built before 1978 may contain lead-based paint. Lead from paint, paint chips, and dust can pose health hazards if not managed properly. Lead exposure is especially harmful to young children and pregnant women. Before renting pre-1978 housing, lessors must disclose the presence of known lead-based paint and/or lead-based paint hazards in the dwelling. Lessee must also receive a federally approved pamphlet on lead poisoning prevention.

Housing Address:

123 Henry

Lessor's Disclosure

(1) Presence of lead-based paint and/or lead-based paint hazards (check one below):

☒ Known lead-based paint or lead-based paint hazards are present in the housing (explain):
See Attached Report

☐ Lessor has no knowledge of lead-based paint and/or lead-based paint hazards in the housing.

(2) Records and reports available to the lessor (check one below):

☒ Lessor has provided the lessee with all available records and reports pertaining to lead-based paint and/or lead-based paint hazards in the housing (list documents below):
Lead Hazard Dislosure Report for 123 Henry

☐ Lessor has no reports or records pertaining to lead-based paint and/or lead-based paint hazards in the housing.

Lessee's Acknowledgment (initial each item)

_____ Lessee has received copies of all the information listed above.

_____ Lessee has received the pamphlet **Protect Your Family From Lead in Your Home.**

Agent's Acknowledgment (initial)

_____ Agent has informed the lessor of the lessor's obligations under 42 USC 4853 and is aware of his/her responsibility to ensure compliance.

Certification of Accuracy

The following parties have reviewed the information above and certify, to the best of heir knowledge, the information provided by the signatory is true and accurate.

Lessor	*Date*	*Lessor*	*Date*
Lessee	*Date*	*Lessee*	*Date*
Agent	*Date*	*Agent*	*Date*

Lead Hazard Dislosure Report for 123 Henry

Components in this housing unit were assessed for the presence of lead based paint and the information gathered during the assessment is shown below.
This housing unit was assessed for the presence of lead contaminated household dust. The information gathered in the assessment is shown below.
The exterior grounds of this housing unit were not assessed for the presence of lead contaminated soil however, similar grounds were assessed and lead contaminated soil was not found in the community.

Type of Hazard	Location	Room #	Component	Hazard?
Paint	bedroom	1	baseboard	Y
Abatement Method:				
Paint	bedroom	1	baseboard	Y
Abatement Method:				
Dust	bedroom	1	wood	U
Abatement Method:				
Dust		0	wood	U
Abatement Method:				

Lessor Signature_____Date:_____

Lessee Signature_____Date:_____

Appendix C: Lead Hazard Management Plan, Eighth U.S. Army, Korea, Area III, Camp Humphreys

LEAD HAZARD MANAGEMENT PLAN

Eighth US Army, Korea
Area III
Camp Humphreys

SPONSORED BY:
Department of the Army
Office of the Assistant Chief of Staff for Installation Management

IN COORDINATION WITH:
US Army Center for Health Promotion and Preventive Medicine
US Army Corps of Engineers Center for Public Works
US Army Corps of Engineers Construction Engineering Research Laboratories
Department of the Navy Publics Works Center
"March 1999"

NOTE: This document is a suggested lead hazard management plan that is based on information collected through performance of lead-based paint inspections and/or lead hazard risk assessments. The installation lead hazard management team must ultimately determine appropriate short and long term lead hazard control or abatement options based on available resources and command priorities.

CONTENTS

LEAD HAZARD MANAGEMENT TEAM

No contacts in HALO for this Post. /par

Team Leader, Ed DiCampli, (703)281-3599, 703 281-4545, ed.dicampli@rotor.com, Building 1, Room 15

Director of Public Relations, Jeff Lund, 703 281-4465

INSTALLATION DESCRIPTION

A summary of Camp Humphreys paint inspection and/or lead hazard risk assessment is below in Table 1. Provided in Appendix A are the floor plans and a list of surveyed housing units.

Table 1
"Camp Humphreys" Inspection Metrics

Housing Group	Number of Units Assessed by Protocol						Year(s) Constructed
	Paint Inspection	Risk Assessment					
		Paint	Dust	Bare Soil	EBL	Water	
Camp Humphreys	0	3	3	3	0	0	
Totals	0	3	3	3	0	0	

INTRODUCTION TO PAINT INSPECTION, RISK ASSESSMENT, AND EBL INVESTIGATION

Army policy is to provide safe and healthful living and working conditions for soldiers, their families, and civilians. The purpose of lead hazard management at Camp Humphreys is to determine if lead hazards exist in target housing and child-occupied facilities and to recommend methods to control or abate lead hazards or their sources. The Army has adopted the standard work practices contained in the Department of Housing and Urban Development (HUD) Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing (July 1995) and other national consensus standards.

HUD surveys indicate that lead in household dust is the major source of lead exposure for children. Lead in household dust is primarily the result of deteriorated lead-contaminated paint. Weathering and deterioration of exterior lead-contaminated paint contributes to lead in bare soil and contamination of household dust. HUD lead-contaminated household dust surveys confirm a relationship between the presence of deteriorated lead-based paint with lead in household dust and bare soil. The focus of this lead hazard management plan is lead-contaminated paint and associated hazards, however, other potential sources of lead exposure are also considered. Lead hazards in paint, dust, and bare soil can cause exposure of children and over exposure of workers to lead.

LEAD HAZARD EVALUATION OPTIONS

Risk assessment and paint inspection are strategies for identifying lead hazards in target housing and child-occupied facilities before these hazards actually cause lead poisoning in a child. Preventing lead hazards is cost effective for all property owners, especially in light of the substantial medical, legal, and relocation expenses associated with the care of a child with an elevated blood lead level. The following table is a comparison of risk assessments and paint inspections from the HUD Guidelines.

Table 2
Comparison of Risk Assessment and Paint Inspection

Analysis, Content, or Use	Risk Assessment	Paint Inspection
Paint	Deteriorated paint only	Surface by surface
Dust	Yes	Optional
Soil	Yes *	Optional
Water	Optional	Optional
Air	No	No
Maintenance status	Optional	No
Management Plan	Optional	No
Status of any current child lead poisoning cases	If information is available	If information is available
Review of previous paint testing	Yes	Yes
Typical applications	1. Interim controls 2. Building nearing the end of expected life 3. Sale of property/turnover 4. Insurance (documentation of lead-safe status)	1. Abatement 2. Renovation work 3. Weatherization 4. Sale of property/turnover 5. Remodeling/ Repainting
Final report	Lead hazard control plan or certification of lead-based paint compliance	Lead concentrations for each surface tested

* If local experience indicates that soil lead levels are all very low, repeated soil sampling is not necessary.

Based on Table 5.2 of Department of Housing and Urban Development Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing (July 1995)

PAINT INSPECTIONS

Paint inspections follow statistical sampling procedures to determine the presence of lead-based paint on similar building components. Inspection results enable the management of all lead-based paint, since the exact locations of the lead-based paint have been identified. Lead-based paint inspections can be performed by either a certified inspector or a certified risk assessor.

All similar components are assumed to contain LBP if 15 percent or more of the tested components contain paint at or above the HUD standard. If paint inspection results determine that no component contains lead at or above the HUD standard, then all similar components are considered to be negative (not LBP). Note that lead-contaminated paint may still be present and that hazardous levels of lead-contaminated household dust and bare soil may be generated during abatement activities, renovation and remodeling, or other disturbances of painted surfaces.

RISK ASSESSMENTS

Risk assessments determine the presence or absence of lead hazards and suggest appropriate hazard control measures. They can be performed only by certified risk assessors.

In some cases, the risk assessor will provide recommendations beyond the basic lead hazard control options. For example, if lead-contaminated paint will remain in a dwelling after present hazards are corrected, the risk assessor will provide information on how to keep that paint in a non-hazardous condition.

Risk assessments do not simply identify lead-contaminated paint, but lead hazards. Risk assessments go beyond simply assessing the condition of paint, and take into account both resident and owner use patterns and management/maintenance practices that will affect that paint. Risk assessments also identify other potential sources of lead hazards, such as dust and bare soil. By considering all hazards and examining resident and owner practices, a risk assessor determines appropriate ways to control hazards and to modify management practices so that the chance of hazards recurring is reduced.

In dwellings in relatively good condition where the probability of finding lead hazards is low, a full risk assessment may be unnecessary. To avoid the costs of a full risk assessment, a lead hazard screen risk assessment may be conducted. A screen risk assessment employs more limited sampling and more sensitive hazard identification criteria. If a screen indicates that lead hazards may be present, then a full risk assessment performed. Because lead hazard screen risk assessments employ more stringent evaluation criteria to act as a negative screen, they are only cost effective for dwellings in good condition. Lead hazard screen risk assessments should not be used in buildings in poor conditions, since a full risk assessment will usually be needed. This is especially true of structures built before 1960.

The ultimate goal of any risk assessment is to use the data gathered from the questionnaires and interviews, the visual inspection, and the environmental sampling to determine whether any lead-based paint hazards are present. If lead hazards are found, the risk assessor will also identify acceptable options for controlling the hazards in each property. These options should allow the property owner to make an informed decision about what actions should be taken to protect the health of current and future occupants. The risk assessor's recommendation could include hazard control measures to correct current lead-based paint hazards and or new property management and maintenance policies designed to prevent hazards from occurring or recurring.

Table 3 shows lead hazard levels for risk assessments. Some state and local jurisdictions use different levels and/or standards for lead-contaminated dust. At least one state (Rhode Island) measures hazardous level of lead in dust in parts per million (known as concentration), instead of micrograms per square foot (known as loading). The risk assessor should be familiar with the local standard and how that standard is measured.

Table 3
HUD Action Levels for Lead-Based Paint Risk Assessments

Media	Level	
Deteriorated paint *(single-surface)* **Deteriorated paint** *(composite)*	5,000 µg/g or 1 mg/cm^2 5,000 µg/g or 1 mg/cm^2 Number of sub-samples	
Dust *(wipe sampling only) (includes both single-surface and composite)*	Risk assessment	Risk assessment screen *(dwellings in good condition only)*
Carpeted floors	100 µg/ft^2	500 µg/ft^2
Hard floors	100 µg/ft^2	50 µg/ft^2
Interior window sills	500 µg/ft^2	250 µg/ft^2
Window troughs	800 µg/ft^2	400 µg/ft^2
Bare soil *(Areas expected to be used by children, including: Residential backyards Day care and school yards Playgrounds Public Parks Other areas where children gather*	400-5,000 ppm	Interim Controls
	>5,000 ppm	Abatement of Soil
Bare soil *(Areas where contact by children is less likely or infrequent*	2,000-5,000 ppm	Interim Controls
	>5,000 ppm	Abatement of Soil

Based on Table 5.7 of Department of Housing and Urban Development Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing (July 1995)and Table 1 of Federal Register 11 Sept 95, page 47253

Lead hazards in deteriorated paint

Deteriorated paint is classified as in either fair or poor condition and is considered to be a lead hazard, even if it has lead below the HUD standard. For example, deteriorated paint with 4,000 µg/g is more hazardous than intact paint with 5,000 µg/g of lead. Any component that contains deteriorated lead-contaminated paint is a hazard and should be treated. Any component with deteriorated paint that is not tested and does not have a painting history similar to a tested component should be considered a lead hazard. Table 4 explains the categories of paint film quality.

Table 4
Categories of Paint Film Quality

Type of Building Component[1]	Total Area of Deteriorated Paint on Each Component		
	Intact	Fair[2]	Poor[3]
Exterior components with large surface areas.	Entire surface is intact.	Less than or equal to 10 square feet.	More than 10 square feet.
Interior components with large surface areas (*walls, ceilings, floors, doors*)	Entire surface is intact.	Less than or equal to 2 square feet.	More than 2 square feet.
Interior and exterior components with small surface areas (*window sills, baseboards, soffits, trim*).	Entire surface is intact.	Less than or equal to 10% of the total surface area of the component.	More than 10% of the total surface area of the component.

[1] Building component in this table 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 ft^2 of deteriorated paint is in fair condition, even if the other three walls in a room are intact).
[2] Surfaces in fair condition should be repaired and/or monitored, but are not considered to be lead-based paint hazards" as defined in Title X.
[3] Surfaces in poor condition are considered to be lead-based paint hazards as defined in Title X and should be addressed through abatement or interim controls.

Based on Table 5.3 of Department of Housing and Urban Development Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing (July 1995)

Paint film in intact condition: Unless testing determines otherwise, it is assumed that lead-contaminated paint is present on all surfaces. Implement interim control and worker monitoring and protection programs to monitor and maintain paint film condition.

Paint film in fair condition: Stabilize fair paint films and implement interim control program to monitor and maintain paint film condition.

Paint film in poor condition: Prevent exposure of occupants to lead hazards. Implement abatement actions, worker protection measure, and solid waste disposal procedures to remove and dispose of lead-contaminated paint film.

Lead hazards in household dust

Until EPA releases its health-based lead in dust standards, the HUD interim dust standards should be used to determine if hazardous lead dust levels are present. If lead dust samples exceed the levels listed in Table 3, a lead hazard exists.

Lead hazards in bare soil

EPA is developing new bare soil lead standards under Title X. Until these standards have been established, the lead hazard levels listed in Table 3 apply. The soil standard is lower in some state and local jurisdictions. Soil that is covered with grass or other covering does not need to be sampled or treated, although the covering must be maintained properly. Risk assessors may be asked to collect soil samples before exterior abatement or interim control work for clearance purposes to determine background levels. These samples may be archived and not analyzed at all unless soil samples exceed clearance standards after the hazard control work has been completed.

EBL INVESTIGATIONS

Although lead-contaminated paint, dust, and bare soil are the causes of most lead exposure in children, another lead source may be the principal cause for a specific instance of lead poisoning or contribute to the blood lead elevation. Risk assessment and paint inspection are meant for use in dwellings

regardless of a resident child's blood lead level ("primary prevention"). EBL investigations are intended for use as a part of "secondary prevention", which involves medical and environmental followup services for individual lead poisoned children.

Lead hazards are identified through the administration and evaluation of a questionnaire and through environmental sampling. The questionnaire should always be completed prior to sampling. In some cases, a clear lead source will emerge from the answers to the questionnaire. If this occurs, the investigation of exposure sources should still be thorough and complete. Environmental testing should be linked to the child's history and may include a prior residence or other areas frequented by the child.

The investigations of dwellings housing lead poisoned children differ from lead hazard risk assessments in the following ways:

- *An EBL investigation identifies a cause or causes for the lead poisoning of a child. A risk assessment identifies lead hazards in the dwelling, regardless of whether or not a child is poisoned.*

- *The EBL investigator conducts a comprehensive of all sources of lead in the child's environment (glazed pottery, traditional medicines or remedies, and other dwellings or areas frequented by the child), not just lead in paint, dust, and bare soil.*

- *EBL investigations include parents and local regulatory agencies in the decision making process.*

- *Deteriorated paint on furniture is tested in an EBL investigation.*

- *The range of dust sampling in a dwelling depends on the areas frequented by the child.*

- *Discrete samples of bare soil frequented by the child are taken for EBL investigations.*

If the child's home is identified as a probable source of lead exposure, appropriate environmental sampling should be conducted. This should include the following samples:

- *Laboratory paint-chip or X-ray fluorescence (XRF) analysis of all defective paint on the dwelling, furniture, play structures, or on nearby buildings frequented by the child.*

- *Laboratory paint-chip or X-ray fluorescence (XRF) analysis of all intact paint chewable, impact, and friction surfaces.*

- *Dust samples from areas frequented by the child, including play areas, porches, kitchens, bedrooms, and living and dining rooms. Bust samples may also be collected from automobiles, work shoes and laundry rooms (to assess the lead dust on work clothes brought into the dwelling) if occupational lead exposure is a possibility.*

- *Soil samples from play areas, areas near the foundation of the house, and areas from the yard. If the child spends significant time at a park or other public play area, samples should also be collected from these areas, unless the area has already been sampled.*

- *First-drawn and flushed water samples from the tap most commonly used for drinking water, infant formula, or food preparation.*

- *Glazed dinner ware or ceramic cookware containing lead.*

OTHER LEAD HAZARD INVESTIGATIONS

Paint, dust, and soil are the primary sources of lead poisoning in children. Other possible sources of lead poisoning can include drinking water, point sources (such as smelters or industrial dischargers), ceramics, lead brought home from a parent's workplace, home and folk remedies, cosmetics, and hobbies (such as casting lead sinkers or toy soldiers, making stained glass, loading ammunition, and soldering).

WORKER PROTECTION

Since worker exposure to lead during lead abatement work may be greater than the permissible exposure limit (PEL) set by the Occupational Safety and Health Administration (OSHA), develop a written compliance plan and designate a competent person to oversee in-house worker protection efforts. The permissible lead

exposure limit is 50 micrograms of lead per cubic meter ($\mu g/m^{3)}$ of air. The compliance plan shall be based on the following actions:

1. Conduct an exposure assessment for each job classification in each work area. Monitoring current work is the best means of conducting exposure assessments. Perform air sampling in one dwelling unit out of every 20 being treated, with an emphasis on sampling "worst case" dwellings. Alternatively, if working conditions are similar to previous jobs by the same employer, previously collected exposure data can be used to estimate worker exposures. Finally, objective data may be used to determine worker lead exposure in some cases. Exposures to airborne leaded dust greater than 30 $\mu g/m^3$ (8 hour time weighted average) trigger protective requirements that are enforced by OSHA.

2. If lead hazard control will include manual demolition, manual scraping, manual sanding, heat gun use, or use of power tools such as needle guns, then specific worker protection measures are required unit an initial exposure assessment is completed. If the initial exposure assessment indicates exposures are less than 30 $\mu g/m^3$, the requirements do not legally apply, although exposure to led should be kept as low as possible at all times.

3. Implement engineering, work practice, and administrative controls to bring worker exposure levels below the PEL. Examples of such controls include the use of wet abatement methods and the selection of other work methods that generate little dust.

4. Where needed, supplement the use of engineering and work practice controls with appropriate respirators and implement a respiratory protection program. Provide a respirator to any employee who request one, regardless of the degree of exposure. Most residential lead hazard control projects will involve the use of a half mask, air purifying respirator with high efficiency particulate air HEPA cartridges.

5. Arrange for a medical exam before work begins for each worker who will be required to wear a respirator. The exam will indicate whether the worker is physically capable of wearing a respirator safely. Conduct fit testing for all workers who will b required to wear respirators. Workers with beards, scars, or unusual facial shapes may not be able to wear certain kinds of fitted respirators.

6. Provide protective clothing and arrange for proper disposal or laundering of work clothing.

7. Provide handwashing facilities, preferably with showers.

8. Implement a medical surveillance program that includes blood lead monitoring under the supervision of a qualified physician pursuant to OSHA regulations. Initial blood testing for lead exposure is required by OSHA for workers performing certain tasks, such as manual scraping, and for any worker who may be exposed to greater than 30 $\mu g/m^3$ of lead on any day.

9. Ensure that workers are properly trained in the hazards of lead exposure, the location of lead containing materials, the use of job specific exposure control methods, the use of hygiene facilities, and the signs and symptoms of lead poisoning. OSHA and EPA require all lead hazard control workers to be trained, even if exposures are very low.

10. Post lead hazard warning signs around work areas. Also, post an emergency telephone number in case an on the job injury occurs.

11. Conduct work as specified.

12. Conduct worker decontamination before all breaks, before lunch, and at the end of the shift. Decontamination usually consists of:

    - *Cleaning all tools, end of the shift only.*
    - *HEPA vacuuming all protective clothing if visibly contaminated with paint chips or dust before entering the decontamination area*
    - *Entering the decontamination area, dirty side.*
    - *Removing protective clothing by rolling inward, removing work shoes and putting in plastic bag*
    - *Entering shower or washing facility.*
    - *Washing hands and then removing respirator.*
    - *Taking a shower using plenty of soap and water; washing hair, hands, underneath fingernails, and face especially well.*
    - *Entering the clean area and putting on street clothing and shoes.*

13. Maintain exposure assessment and medical surveillance records for 30 years. Notify workers within 5 days after receiving air sampling and blood lead level results.

INTERIM CONTROLS

Interim controls are intended to make dwellings lead-safe by temporarily controlling lead hazards, as opposed to abatement, which is intended to permanently control lead hazards. In Title X of the Housing and Community Development Act of 1992, interim controls are defined as "...a set of measures designed to reduce temporarily human exposure or likely exposure to [lead hazards], including specialized cleaning, repairs, maintenance, painting, temporary containment, ongoing monitoring of [lead hazards] or potential hazards and the establishment and operation of management and resident education programs." Interim control measures are fully effective only as long as they are carefully monitored, maintained, and periodically professionally reevaluated. If interim controls are properly conducted, they may be effective indefinitely. As long as surfaces are covered with lead-based paint, however, they constitute potential hazards. Interim lead hazard control measures include:

- *Repairing all rotted or defective substrates that could lead to rapid paint deterioration. (Repairing defective building systems that cause substrate damage may be a prerequisite for effective interim control.)*

- *Stabilize deteriorated fair condition painted surfaces (poor condition painted surfaces should be abated.*

- *Friction and impact surface treatment - treating floors and interior window sills and window troughs so that they are smooth and cleanable.*

- *Treating friction and impact surfaces, such as windows, doors, stair treads, and floors, when they are generating paint chips or excessive levels of lead in dust that cannot be controlled with ordinary cleaning.*

- *Treating protruding, accessible surfaces, such as interior window sills, where lead-contaminated paint may be present and there is either visual or reported evidence that children are mouthing or chewing these surfaces.*

- *Treating lead-contaminated bare soil or providing temporary barriers between children and soil.*

- *Educating occupants and maintenance workers on how to avoid lead exposure.*

- *Conducting reevaluations by certified individuals every 3 to 6 months to determine if the surface condition has changed, ongoing monitoring, and observation by occupants.*

Interim controls are more effective when most surfaces with lead-contaminated paint are intact and structurally sound and lead exposure comes primarily from deteriorating paint and excessive levels of lead in household dust and/or soil. Interim controls are also appropriate if the housing unit is slated for demolition or renovation within a few years. Federal, State, and local legislation or regulations may require that certain lead hazards be permanently abated rather than controlled on an interim basis.

If the housing unit has substantial structural defects or if interior or exterior walls or major components, such as windows and porches are seriously deteriorated or subject to excessive moisture, interim controls are unlikely to be effective. Paint cannot be stabilized effectively unless substrates are dry, structurally sound, and waterproof. Other interim control measures, such as window repair, would also not be effective if structural problems are likely to result in rapid treatment failure. Any structural problems should be repaired before interim controls can be implemented.

Operations And Maintenance Program

Develop an Operations and Maintenance (O&M) Program for all LBP components. Refer to HUD Guidelines for specific measures to take when establishing an O&M Program. Periodic O&M assessment and maintenance will reduce the hazard potential from LBP components over the long run versus performing abatement. Educate and disclose to occupants the location and presence of the LBP. Inform occupants to contact the O&M Manager upon any change in condition to LBP components. This type of reporting is to supplement O&M assessment, not replace it.

Lead-Contaminated Paint

The objective is to reduce human exposure or likely exposure to LBP hazards through proper paint film stabilization techniques. HUD specifically outlines how to successfully stabilize paint film. The steps from the Guidelines are listed below.

- *Eliminate any exterior leaks in the building envelope (e.g., roofing leaks, gutter or downspout problems, missing or damaged doors, roof flashing, missing opening trim, missing glass in windows, defective or missing caulk and glazing, loose fasteners).*

- *Eliminate any interior water leaks (e.g., plumbing leaks; clogged condense drip lines for air conditioners; missing water pans for hot water heaters; inadequately ventilated attic spaces; clogged bathtub drains; missing tile, grout, or caulking in bathtub drains; windows that won't close completely.*

- *Select and implement an appropriate Work site Preparation Level.*

- *For exterior work, collect soil samples before the work begins (unless soil sampling has already been completed for a risk assessment). These samples need not be analyzed unless clearance samples show soil lead are above applicable clearance standards.*

- *Repair all rotted structural, siding, or railing components; defective plaster; missing door hardware; loose siding or trim; and loose wallpaper.*

- *Prepare surface by wet scraping or wet sanding. Do not remove paint by burning or torching, power sanding without HEPA attachments, or abrasive blasting. Dry scraping and chemical strippers with methylene chloride are not recommended.*

- *Clean, degloss, neutralize, and rinse surfaces. Surfaces should be dry before priming or repainting.*

- *Select primer and topcoat by considering longevity, moisture resistance, and organic compound content with low volatility. Paint film stabilization involves the application of at least two coats (the primer and the topcoat). Use a primer/topcoat system from the same manufacturer to ensure compatibility.*

- *Apply all paints at appropriate thickness or according to manufacturer's directions. Apply paint only during proper temperature, wind, and humidity conditions. Allow sufficient time for each coat to dry fully.*

- *Conduct final cleanup according to Chapter 14 of HUD Guidelines.*

- *At the end of the lead hazard control project, have a certified inspector technician or risk assessor conduct a clearance examination and provide appropriate documentation or statements of lead-based paint compliance.*

- *Conduct reevaluations annually as indicated in the site-specific schedule (Table 6.1 of HUD Guidelines). Perform ongoing maintenance of paint and restabilize paint whenever deterioration is discovered.*

The process provided above was taken directly from HUD Guidelines, Chapter 11 - Interim Controls. This information is provided for the reader who may not have immediate access to a copy of the HUD Guidelines. Refer to the HUD Guidelines prior to executing any paint film stabilization.

Lead-Contaminated Dust

Clean all interior horizontal surfaces within the unit. Complete this cleaning using a certified HEPA vacuum followed by cleaning with TSP or a high-phosphate detergent. Notify community occupants of this particular elevated lead-contaminated household dust situation. Include in the resident notification the proper "self-help" cleaning procedures and general information regarding lead-contaminated household dust hazards.

The following is the HUD guidance for removal of leaded dust (Chapter 11). For additional information, refer to the step-by-step procedure in the National Institute of Building Sciences (NIBS) O&M Document.

- *Correct any known or suspected lead-based paint hazards before dust removal.*

- *Visually inspect other dust traps, such as radiators and floor grates. If visible dust is found, the component should be cleaned.*

- *Distribute educational materials prepared by EPA or State or Local Government agencies to occupants. These materials should warn occupants that carpet, drapes, and upholstered furniture may be contaminated and should be cleaned or replaced.*

- *Prepare the work area with Interior Work site Preparation Level 1 or other proven containment method (Chapter 8 of HUD Guidelines). If contaminated carpet is to be removed, the work area should be contained with Interior Work site Preparation Level 3 or 4 (do not put down plastic sheeting on floors for carpet removal).*

- *Clean all horizontal surfaces, beginning with HEPA vacuuming, followed by wet washing with a cleaning agent suitable for lead removal, such as a lead-specific cleaner or tri-sodium phosphate detergent. Test the cleaning solution before using to determine if it will discolor or damage surfaces to be cleaned.*

- *Begin dust removal at the top rear room in the dwelling, working forward and down. Within rooms, start wit the highest horizontal surface and work down. Clean windows, other dust traps, and finally the floors. When practical, clean dirty areas last within room to avoid spreading dust.*

- *Place the HEPA vacuum on a smooth, hard surface or on a sheet of plastic during operation. Remove HEPA filters and bags off-site (not inside dwelling) in a controlled environment. Vacuum and bags should be made by the same manufacturer.*

- *During wet cleaning, replace rags, sponges, and mops frequently (at least once per dwelling). Use a two-bucket system for floors: one for the cleaning solution and the other for rinsing. Change the wash water at least once in each room.*

- *Clean until no surface dust is visible. After cleaning rinse with clean water and a new sponge or cloth.*

- *To clean area rugs, HEPA vacuum the top side with a beater bar or agitator attachment at a rate of 1 minute for each 10 square-foot area. Fold the rug in half and HEPA vacuum the backing of half the carpet without using the beater bar at a rate of 1 minute per 10 square feet. HEPA vacuum the exposed floor beneath the carpet, the bottom of the carpet,*

and the pad (if there is one), and fold the rug back into its original position. Repeat the process for the other half of the rug. Finally, HEPA vacuum the top side again with the beater bar at a rate of at least 2 minutes per 10 square feet.

- *For wall-to-wall carpeting that cannot be folded over, HEPA vacuum at a rate no faster than 2 minutes per 10 square feet in a side-to-side direction, followed by another pass at the same rate in a direction perpendicular to the direction of the first vacuuming, for 4 minutes per 19 square feet. For wall-to-wall carpeting, it is not feasible to clean the floor underneath the carpeting.*

- *Conduct clearance dust wipe sampling on rugs or furnishings that were cleaned to determine if the cleaning was effective.*

- *To clean other upholstered furnishings, HEPA vacuum each surface three to five times.*

- *Clean drop ceilings or the ductwork for forced air systems only when they are expected to be disturbed. HEPA vacuum and wet clean air vents or registers. Replace air filters in the forced air systems at the time of cleaning. Have a certified inspector technician or risk assessor conduct a clearance examination. Repeat cleaning if necessary. Conduct periodic reevaluations.*

The process provided above was taken directly from HUD Guidelines, Chapter 11 - Interim Controls. This information is provided for the reader who may not have immediate access to a copy of the HUD Guidelines. Refer to the HUD Guidelines prior to executing any lead-contaminated household dust clean up.

Lead-Contaminated Soil

Place mulch and/or groundcover over the elevated lead in soil sub-area(s) for this one particular unit to reduce the hazard. Notify community occupants of this particular elevated lead in soil situation. Include general information regarding lead hazards in the resident notification. Implement the interim controls outlined by the HUD Guidelines. These guidelines are provided below. For additional information, refer to the procedures for lead in soil work practices located in the NIBS O&M Document.

- *Use water to contain dust and clean equipment to prevent dispersion of lead*

- *Select an appropriate soil interim control, which may include impermanent surface coverings or land use controls.*

- *Impermanent surface coverings, including grass (as seed or sod), or other ground covers (e.g., ivy), artificial turf, bark, mulch, and gravel may not be permanent. If the area to be controlled is heavily traveled, surface coverings such as grass are not appropriate.*

- *If grass is selected, consult with the local agriculture extension service or a reputable local nursery to determine what grasses are appropriate for the locale, soil type, and sun/shade characteristics. Properly prepare the soil prior to seeding or sodding.*

- *If bark or gravel is selected, apply the covering a least 6 to 12 inches deep. New bark, gravel, or other materials should not contain more than 200 µg/g of lead. These materials should be tested before use unless previous testing data are available.*

- *If the soil is in a public recreation area, comply with Consumer Product Safety Commission standards on acceptable surface coverings in play areas.*

- *Land use controls include fencing, warning signs, creation of alternative play areas such as decking), and thorny bushes.*

- *Install surface coverings and/or land use controls. For live ground covers (including grass), it is imperative that they are properly watered during the first 3 months and adequately maintained thereafter. Automatic sprinkler systems are appropriate for large areas.*

- *Control water erosion by proper grading and installation of drainage channels.*

- *Control wind erosion by periodic watering, windbreaks, or foot-traffic controls.*

- *Provide walk-off doormats at all entryways to reduce the tracking of contaminated dust and soil into the dwelling.*

- *Have a certified risk assessor or inspector technician conduct a clearance examination and provide the necessary documentation.*

- *Perform ongoing maintenance and monitoring of soil coverings and land use controls. Reevaluations of the surfaces should be conducted by a certified risk assessor or inspector technician based on the specific reevaluation schedule for the property.*

- *If ongoing monitoring or reevaluations show that bare soil remains or reappears, interim controls are not effective. Soil abatement should be conducted, unless other interim controls can be shown to be feasible for the specific site.*

The process provided above was taken directly from HUD Guidelines, Chapter 11 - Interim Controls. This information is provided for the reader who may not have immediate access to a copy of the HUD Guidelines. Refer to the HUD Guidelines prior to executing any lead in soil actions.

Renovation

During upcoming renovation projects, incorporate the recommended abatement action response for all lead-based paint components present in the proposed renovation area. Refer to the ranking scheme provided for the recommended abatement action response and priority for each lead-based paint component. The Occupational Safety and Health Administration (OSHA) regulates the occupational exposure to inorganic lead. OSHA standards define the airborne lead exposure limits for workers.

Depending upon the scope of the particular renovation project, the overall cost of the project may be reduced by performing additional testing prior to commencing the renovation. The supplemental testing will allow exact specification of individual lead-based paint components per unit that require abatement.

Demolition

During a demolition phase, OSHA standards regulate the occupational lead exposure and define the airborne lead exposure limits for workers. The Resource Conservation and Recovery Act (RCRA) is the basic Federal law governing waste disposal. RCRA distinguishes between solid waste and hazardous waste.

In determining whether a waste is hazardous or non-hazardous, contact the Environmental Compliance Office for housing for the latest Federal, State, and Local requirements.

ABATEMENT ACTIVITIES

Abatement is the removal of either the building component or the paint itself or the near-permanent enclosure of lead-based paint hazards. Abatement has two principal advantages: it provides a long term solution, and little if any monitoring reevaluation of the treated surface is necessary since failure is less likely to occur. Abatement treatments provide a higher margin of safety than interim controls since the effectiveness of the work is less dependent on resident action, maintenance of housing stock, the conscientiousness of property managers, and the attention of maintenance workers during repair.

Abatement refers to measures that can be expected to eliminate or reduce exposures to lead hazards for at least 20 years under normal conditions. The expected lifespan of many commonly used building components is twenty years.

Abatement strategies include removal, enclosure and encapsulation of lead-contaminated paint; replacement of building components; removal of lead-contaminated dust; removal or covering of lead-contaminated soil with a durable covering (not grass or sod, which are considered interim control measures); and preparation, cleanup, disposal, post-abatement clearance testing, record keeping, and monitoring.

For additional information concerning selection of abatement methods, see Appendix D, Abatement Method Recommendations for Building Components.

Abatement is intended to produce conditions that prevent lead exposure. Lead abatement procedures cannot guarantee that children will not be exposed to lead in the future. Paint removal is the most invasive of abatement methods and should be

avoided if possible. Enclosure and building component replacement are the least invasive and the most preferred of the abatement methods. However, enclosure systems could fail, exposing the hazard again. Soil coverings could also fail, resulting in excessive exposures. Surfaces that were made cleanable may deteriorate or may not be kept clean, allowing leaded dust levels to reaccumulate to hazardous levels. Nevertheless, abatement constitutes the most extensive and protective intervention presently available. If practiced properly, abatement will greatly reduce the risk of lead exposure.

Building component replacement is defined as the removal of doors, windows, rim, and other building items that contain lead-based paint hazards and their replacement with new lead-free components. Component replacement is the most desirable abatement method because it offers a permanent solution to the lead-based paint problem. If done properly, it also avoids contamination of the property and worker exposure. In addition, building component replacement can be integrated into general building rehabilitation activities. Components, such as doors and windows, should be replaced with more energy-efficient models, which will help to reduce energy consumption and increase cost efficiency. Component replacement may be more expensive, especially for historic preservation projects, since new building components that match the originals may have to be custom made.

Enclosure is the installation of a rigid, durable barrier that is mechanically attached to building components, with all edges and seams sealed with caulk or other sealant. Surfaces with lead-contaminated paint are enclosed in order to prevent access and exposure and to provide a dust-tight system. The enclosure system is not dependent on the paint surface of the substrate for its durability. Enclosures should have a design life of at least 20 years. While adhesives are frequently used for initial mounting purposes and for assistance in covering the lead-contaminated paint with the enclosure material, it is primarily mechanical fasteners that give enclosures their longevity. For broad surfaces such as walls, ceilings, floors, and siding, enclosure is often considerably cheaper and less hazardous than building component replacement and paint removal. However, enclosure does not remove lead from the property. Instead, it makes the dwelling lead-hazard-free.

Paint removal means the separation of the paint from the substrate using heat guns, chemicals, or certain contained abrasive measures, either onsite or offsite. As an abatement

technique, paint removal is usually reserved for limited areas and for those surfaces where historic preservation requirements may apply. While paint removal can be performed safely and effectively, it also demands the highest level of control and worker protection for several reasons. Paint removal usually creates the greatest hazard for the worker, either from the hazards associated with the removal process or from the lead that becomes airborne or is left as a residue on the surface after removal. Because of the lead residues left behind by all paint removal methods, particularly on porous surfaces such as wood or masonry, more extensive cleaning is usually required to meet clearance criteria. Paint removal methods also generate a significant amount of hazardous waste and may be the most costly of all lead abatement methods. In spite of these limitations, paint removal has the benefit of a low reevaluation failure rate. If some lead-contaminated paint is left in the dwelling, its condition will need to be monitored by the owner and by a certified risk assessor using Table 4. The reevaluation will be performed on a schedule recommended in the HUD Guidelines. The table is reproduced in Appendix E.

Lead-contaminated bare soil has been shown to cause elevations in blood lead levels of children in a number of studies. Lead in bare soil can be carried into houses on shoes, clothing, pets, or other means. Soil abatement is generally appropriate when lead is present in extraordinarily high concentrations (more than 5000 µg/g), use patterns indicate exposures are likely, or interim controls are likely to be ineffective. Soil abatement methods include: soil removal and replacement followed by offsite or onsite disposal, soil cultivation (rototilling), soil treatment and replacement, and paving with concrete or asphalt. The advantages of using soil treatment methods are threefold. The costs of hauling large quantities of contaminated soil are eliminated or greatly reduced. Disposal sites for soil are not needed except for a much smaller volume of wastes generated during the treatment process. The need for uncontaminated replacement soil is greatly reduced.

Encapsulation is the process that makes lead-contaminated paint inaccessible by providing a barrier between the paint and the environment. This barrier is formed using a liquid applied coating or an adhesively bonded covering material. While encapsulant systems may also be attached to a surface using mechanical fasteners, the primary means of attachment for an encapsulant is bonding of the product to the surface. However, this condition alone is not sufficient for encapsulations system success. All layers of the existing paint film must adhere well to each other, as well as to the base substrate. If not, the

encapsulation system may fail. Thus, proper assessment of the suitability of the surface and substrate for encapsulation is essential prior to the application and installation of the product. Encapsulation technologies can offer safe and effective control of lead hazards. Encapsulation can be less expensive than other options and may be one of the only alternatives that can be used in certain situations. Encapsulates may also be used in combination with other methods. Encapsulates can be applied with only a moderate degree of training and, unless there is significant surface deterioration, may generate low amounts of lead dust. Encapsulates are not recommended on surfaces subject to friction or water damage.

RESIDENT PROTECTION AND WORK SITE PREPARATION

- Perform work in a vacant unit, whenever possible. If occupants must remain inside the dwelling during work, an appropriate barrier should be erected.
- Permit occupants to reenter the work area only after work is complete and visual inspection has been completed and dust samples pass clearance standard. If the work is not completed at the end of the day, keep the barriers in place overnight and instruct occupants not to enter work area.
- Determine if the dwelling will require precleaning before work site containment. For example, remove paint chips by HEPA vacuuming before plastic is laid down.
- Determine requirements for relocation, isolation of work areas, and other work site preparation measure based on the type and extent of the work and the amount of dust that will be generated.
- Select and Interior Work site Preparation Level, an Exterior Work site Preparation Level, and/or a Window Work site Preparation Level, depending on the work required.
- Conduct daily cleanup.
- Perform a daily visual inspection.
- Conduct dust sampling.

- Never permit occupants to enter a work area where lead hazard control work is under way. Entry should be denied until cleaning and clearance have been completed.

HAZARD POTENTIALS AND RESPONSE PRIORITIES

Hazard Potentials

The potential for exposure to lead hazards involves the use of the following parameters:

- Lead in paint
- Paint condition
- Location of Lead-Contaminated Paint (LCP) (interior/exterior)
- Lead in household dust
- Lead in bare soil
- Lead in water
- Presence or absence of children

The hazard potentials are:

- High - A lead hazard has been identified. Lead exposure is likely and occupants are at risk

- Medium - A potential lead hazard has been identified. Lead exposure is possible and occupants could be at risk.

- Low - No lead hazard has been identified. Lead exposure is unlikely and occupants are not at risk.

Response Priorities

A variety of response options are available to control lead hazards and sources of those hazards. The selection of appropriate options depends upon the hazard potentials in paint, dust, and bare soil, as identified by risk assessment, and the urgency of implementing the response option.

The response priorities are:

- Short Term - Short-term actions control lead hazards between one week and three months after a high hazard potential is identified. The purpose of short-term actions is to provide a lead-hazard-free environment in target and child-occupied facilities. Immediate action must be taken to abate lead hazards in occupied facilities or to place temporary barriers to prevent exposure to children under six years of age. Short-term actions are intended to control actual lead hazards in paint, dust, and bare soil.

- Mid Term - Mid-term actions monitor and maintain a lead-hazard-free environment in target and child-occupied facilities and are normally associated with medium hazard potentials. These actions are conducted until no longer effective in preventing development of lead hazards or until it becomes economically feasible to perform abatement. Mid-term actions consist of training, occupant education, interim controls, and ongoing monitoring of surfaces that may deteriorate or accumulate lead dust. The condition of these leaded surfaces may change from intact to damaged under any number of circumstances.

- Long term - Long-term actions anticipate the need for abatement of sources of lead in paint, dust, and bare soil and require long range planning, programming, and budgeting of funds. Long-term actions require a continuing program of interim controls and ongoing monitoring to maintain facilities in a lead-hazard-free condition until abatement projects can be implemented.

Outreach and Education

It is important to develop an effective public outreach and education program to provide general information regarding the lead hazard management plan, the approach to implement the plan, and to educate occupants. Lead hazard control will include paint surface restoration, HEPA vacuuming, cleaning of horizontal surfaces to remove lead in dust, and covering bare soils that have elevated levels of lead. Initial public awareness meetings with the occupants and training for workers are of utmost importance.

A summary of hazard potentials and response priorities for paint, dust, and bare soil is provided in Tables 5, 6, and 7.

Table 5
Hazard Potential And Response Priority - Lead In Soil

	< HUD ACTION LEVEL (PPM)		=> HUD ACTION LEVEL (PPM)			
	NO CHILDREN	NO CHILDREN	CHILDREN		NO CHILDREN	
HAZARD POTENTIAL	Low	Low	>400	>5000	>2000	>5000
			High	High	Medium	Medium
RESPONSE PRIORITY	Long Term	Long Term	Mid Term	Short Term	Long Term	Mid Term

Table 6
Hazard Potential And Response Priority - Lead In Household Dust

	< HUD ACTION LEVEL			=> HUD ACTION LEVEL		
	FLOOR	SILL	TROUGH	FLOOR	SILL	TROUGH
HAZARD POTENTIAL	Low	Low	Low	High	High	High
RESPOSE PRIORITY	Long Term	Long Term	Long Term	Short Term	Short Term	Short Term

Table 7
Hazard Potential And Response Priority - Lead In Paint

	=> DETECTABLE AND < HUD ACTION LEVEL					
	INTERIOR PAINT			EXTERIOR PAINT		
	Intact	Fair	Poor	Intact	Fair	Poor
HAZARD POTENTIAL	Low	Medium	High	Low	Medium	High
RESPONSE PRIORITY	Long Term	Long Term	Short Term	Long Term	Mid Term	Mid Term

	=> HUD ACTION LEVEL					
	INTERIOR PAINT			EXTERIOR PAINT		
	Intact	Fair	Poor	Intact	Fair	Poor
HAZARD POTENTIAL	Low	Medium	High	Low	Medium	High
RESPONSE PRIORITY	Long Term	Mid Term	Short Term	Long Term	Mid Term	Short Term

APPENDIX A

MAPS AND FLOOR PLANS

(To be added by the Management Plan generator)

APPENDIX B

GLOSSARY

Section I
Abbreviations

ACSIM
Assistant Chief of Staff for Installation Management

AEHA
U.S. Army Environmental Hygiene Agency

AR
Army Regulation

ASTM
American Society for Testing and Materials

BRAC
Base Realignment and Closure

CDC
Centers for Disease Control

CERCLA
Comprehensive Environmental Response, Compensation, and Liability Act

CFR
Code of Federal Regulations

CHPPM
U.S. Army Center for Health Promotion and Preventive Medicine

CLPP
Childhood Lead Poisoning Prevention (Program)

CPSC
U.S. Consumer Product Safety Commission

DA
Department of the Army

EBL
elevated blood lead

EPA
U.S. Environmental Protection Agency

EPR
Environmental Program Requirement Report

FDA
Food and Drug Administration

HUD
U.S. Department of Housing and Urban Development

HW
hazardous waste

ISR
Installation Status Report

LBP
Lead-based paint

MACOM(s)
major Army command(s)

MCLG
maximum contaminant level goal

mg/cm^2
milligram per square centimeter

NLLAP
National Lead Laboratory Accreditation Program

OSHA
Occupational Safety and Health Administration

ppb
parts per billion

ppm
parts per million

PWTB
Public Works Technical Bulletin

RCRA
Resource Conservation and Recovery Act

TWA
time weighted average

µg/g
microgram per gram

µg/ft^2
microgram per square foot

µg/l
microgram per liter

µg/m^3
microgram per cubic meter

µg/dl
microgram per deciliter

XRF
x-Ray fluorescence

Section II
Terms

Abatement
Any measure or set of measures designed to permanently eliminate lead-based paint hazards. Abatement strategies include the removal of lead-based paint and lead-contaminated dust, the permanent enclosure or encapsulation of lead-based paint, the replacement of lead-painted surfaces or fixtures, and the removal or covering of lead-contaminated soil:, and all preparation, cleanup, disposal, and post-abatement clearance testing activities associated with such measures.

Abatement does not include renovation, remodeling, landscaping, or other activities, when such activities are not designed to eliminate lead hazards permanently, but, instead, are designed to repair, restore, or remodel a given structure or dwelling, even thought these activities may incidentally result in a reduction or elimination of lead hazards. Furthermore, abatement does not include interim controls, operations and

maintenance activities, or other measures and activities designed to temporarily, but not permanently, reduce lead hazards.

Abatement Options:

- **Encapsulation** - The application of an encapsulant that forms a barrier between lead-contaminated paint and the environment using a liquid-applied coating (with or without reinforcement materials) or adhesively-bonded covering material.

- **Enclosure** - The use of rigid, durable construction materials that are mechanically fastened to the substrate to act as a barrier between the lead-based paint and the environment.

- **Removal** - The process of removing the lead-based paint from the component by means of chemicals, scraping, heat, or blasting. Not recommended when interim controls are effective.

- **Replacement** - Strategy of abatement that entails the removal of components such as windows, doors, and trim that have lead painted surfaces and installing new components, free of lead paint. Cost of replacement may be incidental to ongoing renovation efforts (i.e., replacement of windows eliminates primary LBP hazard source, improves buildings energy performance, increases occupant comfort level, and reduces maintenance costs).

Action Response Time-frame: (Equate these to Hazard Potential)

- *Immediate Response - Perform hazard control actions specified for lead hazards associated with deteriorated lead-contaminated paint on interior building components which is at or above HUD action levels shown on Table 3 and lead-contaminated household dust within 7 days.*

- *Short-term Response - Perform hazard control action specified for deteriorated lead-contaminated paint component and lead-contaminated dust/soil situation within 6-12 months.*

- *Interim Control - Measures that reduce control the hazard until permanent abatement occurs.*

- *Renovation - Abate specified lead-contaminated paint and lead-contaminated dust/soil, as numerically prioritized, during future renovation projects.*

- *Demolition - Adhere to city/state guidelines and regulations for waste disposal.*

Accessible Surface
Any protruding interior or exterior surface, such as an interior window sill, that a young child can mouth or chew.

Accredited Training Program
A training program that has been accredited by EPA pursuant to § 745.225 or by state or local regulations to provide training for individuals engaged in lead-based paint activities.

Bare Soil
Soil not covered with grass, sod, some other similar vegetation, or paving and including the sand in sandboxes.

Base Realignment and Closure (BRAC)
A process directed by Federal law to mandate closure, consolidation, and realignment of defense installations.

Blood Lead Levels
A measure of the concentration of lead in whole blood, typically expressed in micrograms of lead per deciliter (µg/dl). It indicates the amount of lead circulating in the bloodstream and is the best initial measurement to evaluate lead exposure. A multi-tier classification of blood lead levels established by the Centers for Disease Control (CDC) defines lead poisoning.

Blood Lead Level Screening Program
A program modeled on the Centers for Disease Control (CDC) recommendations that all children under the age of 6 be evaluated for lead exposure and tested for blood lead levels when appropriate. It is part of the Childhood Lead Poisoning Prevention Program (CLPP).

Certified Inspector
A person who has completed a training program certified by the appropriate Federal, state, or local agency and has met any other requirements for certification or licensing established by such agency.

Child-Occupied Facilities
Child occupied facilities are buildings, or portions of buildings, constructed prior to 1978, visited regularly by the

same child, six years of age or under, on at least two different days within any week, provided that each day's visit lasts at least three hours and the combined weekly visit lasts at least six hours and the combined annual visits last at least 60 hours. Child-occupied facilities may include, but are not limited to, day-care centers, pre-schools, kindergarten classrooms, and family child care homes.

Community Number
Family Housing community name and numerical designation.

Containment
Containment is a process to protect workers and the environment by controlling exposures to the lead-contaminated dust and debris created during abatement, renovation, demolition, or other construction activity.

Deteriorated Paint
Deteriorated paint is paint that is cracking, flaking, chipping, peeling, or otherwise separating from the substrate of a building component.

Disposal (of hazardous waste)
The discharge, deposit, injection, dumping, spilling, leaking, or placement of solid or hazardous waste on land or in water so that none of its constituents can pollute the environment by being emitted into the air or discharged into a body of water, including groundwater.

EBL Investigation
The process of determining the source of lead exposure for a child or other resident with elevated blood lead level. Investigation consists of administration of a questionnaire, comprehensive environmental sampling, case management, and other measures as directed by the installation medical authority.

Encapsulation
Encapsulation is the application of an encapsulant 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.

Environmental Program Requirement (EPR) Report
A report used to plan, program, budget, and forecast costs to manage the environment, to practice good environmental stewardship, and to attain and maintain compliance with existing and pending Federal, state, and local environmental laws and regulations. It is used to shop past accomplishments and

expenditures; to indicate the status of current projects; to refine and validate requirements for the budget year; and to support planning, programming and budgeting for the out-years to build the Program Objective Memorandum. The EPR Report satisfies the Army's reporting requirements identified in Executive Order 12088 and Office of Management and Budget Circulars A-106 and A-11.

Family Child Care Home
An authorized family housing unit, other than the child's home, in which a family member provides childcare to one or more unrelated children on a regular basis.

Friction Surface
Any interior or exterior surface, such as a window or stair tread, subject to abrasion or friction.

Hazardous Waste
Hazardous waste is a solid waste, not specifically excluded from the restrictions of Federal regulations, that meets the criteria listed in 40 CFR part 261 or is specifically named as a hazardous waste in Federal regulations. For lead-based paint abatement waste, hazardous waste is waste that contains more than 5 ppm of leachable lead as determined by the TCLP test, or is waste that is corrosive, ignitable, or reactive and not otherwise excluded.

Impact Surface
An interior or exterior surface that is subject to damage by repeated impacts, for example, certain parts of door frames.

Interim Controls
A set of measures designed to temporarily reduce human exposure or possible exposure to lead-based paint hazards. Such measures include specialized cleaning, repairs, maintenance, painting, temporary containment, and management and resident education programs. Monitoring, conducted by owners, and reevaluations, conducted by professionals, are integral elements of interim control. Interim controls include dust removal; paint film stabilization; treatment of friction and impact surfaces; installation of soil coverings, such as grass or sod; and land-use controls.

Lead
Lead, as used in lead hazard management regulations and policy, includes metallic lead, inorganic compounds, and lead soaps.

Lead-Based Paint
Paint or other surface coatings that contain lead equal to or in excess of the HUD standard (1.0 milligrams per square centimeter and/ or more than 0.5 percent by weight (5,000 ppm)).

Lead-Contaminated Dust
Surface dust in residential dwellings, or child-occupied facilities that contains an area or mass concentration of lead at or in excess of levels identified by EPA.

Lead-Contaminated Paint
Paint containing any detectable level of lead determined using a method acceptable to the EPA National Lead Laboratory accreditation program (NLLAP).

Lead-Contaminated Soil
Bare soil on residential real property and on the property of a child-occupied facility that contains lead in excess of levels identified by EPA.

Lead Hazard
Any condition that causes exposure to lead from lead-contaminated dust, lead-contaminated soil, or lead-contaminated paint that is deteriorated or present on accessible surfaces, friction surfaces, or impact surfaces that would result in adverse human health effects. HUD and EPA refer to lead hazards identified through risk assessments as lead-based paint hazards.

Lead Hazard Risk Assessment
(1) An onsite 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.

Lead Hazard Screen
A type of risk assessment performed only in buildings in good condition using fewer samples but more stringent evaluation criteria (standards) to determine lead hazards.

Mouthable
An interior or exterior surface that is accessible for a young child to mouth or chew.

Ongoing Monitoring Reevaluation
In lead hazard control work, the combination of a visual assessment and collection of environmental samples performed by a certified risk assessor to determine if a previously

implemented lead-based paint hazard control measure is still effective and if the dwelling remains lead-safe.

Operations and Maintenance (O&M)
A means of handling lead in paint in-place utilizing an interim control until the hazard is permanently removed.

Paint Inspection
A surface-by-surface investigation to determine the presence and location of lead-based paint and a report of the results.

Permanently Covered Soil
Soil that 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 coverings.

Similar Groups
A grouping of housing units built at approximately the same time utilizing similar materials and subjected to similar maintenance procedures.

Target Housing
Any housing constructed prior to 1978, except housing for the elderly or persons with disabilities (unless any one or more children under 6 years of age resides or is expected to reside in such housing for the elderly or persons with disabilities).

Toxicity Characteristic Leachate Procedure (TCLP)
A laboratory test to determine if excessive levels of lead or other hazardous materials could leach from a sample into groundwater; usually used to determine if waste is hazardous based on its toxicity characteristics.

UIC Number
An alphanumeric code assigned by DOD to represent each Activity/Command.

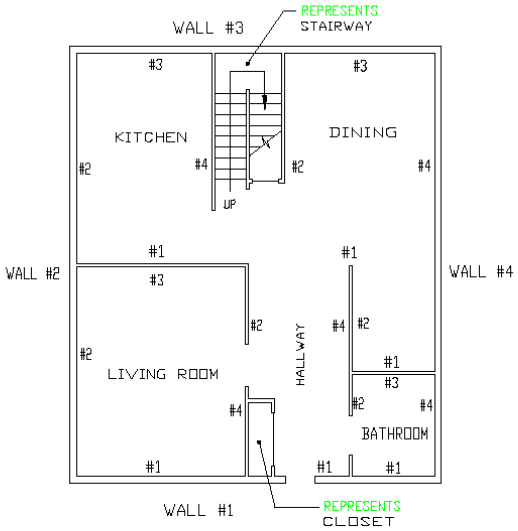
Unit Number
A numerical designation to allow for accountability of units within an inspected community; used for project management.

Visual Inspection for Clearance Testing
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.

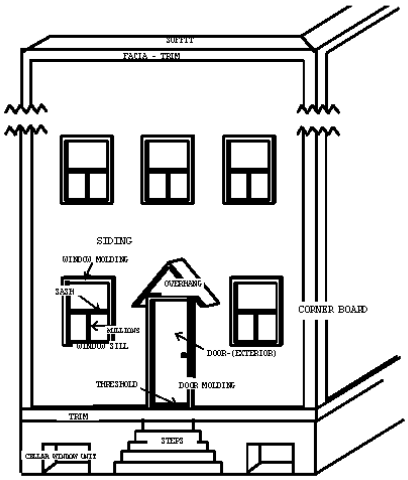
Whole-Neighborhood Revitalization
The Department of the Army has established a Whole-Neighborhood Revitalization Program to identify the required work and to provide a systematic approach to accomplishing improvement, repair, and deferred maintenance concurrently. The objective of the Whole-Neighborhood Revitalization Program is to upgrade family housing to a level comparable to new construction standards for energy efficiency, life safety, habitability, durability, and functional requirements while simultaneously improving neighborhood amenities and support facilities.

X-ray Fluorescent Spectrum Analyzer (XRF)
An instrument that determines lead concentrations in milligrams per square centimeter (mg/cm^2) using the principle of X-ray fluorescence. This type of analyzer provides the operator with a plot of energy and intensity of both "K" and "L" x-rays, as well as a calculated lead concentration.

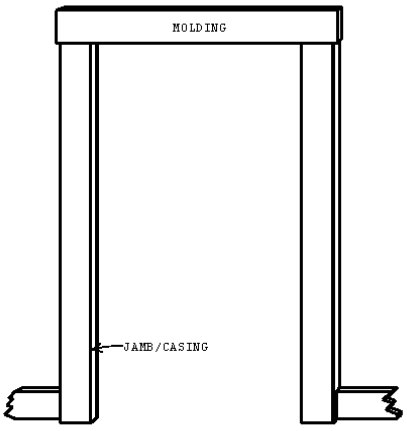
Note: The following pages contain pictorial representations of wall/room designations and component descriptions.



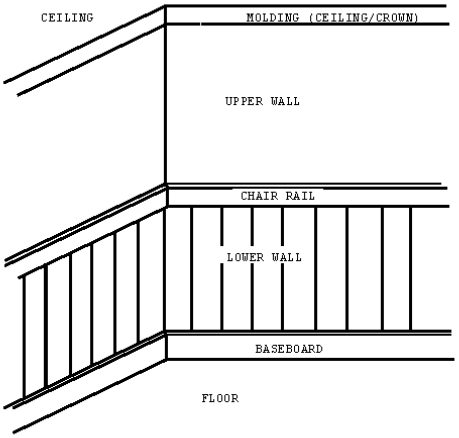
WALL NUMBERING SCHEME



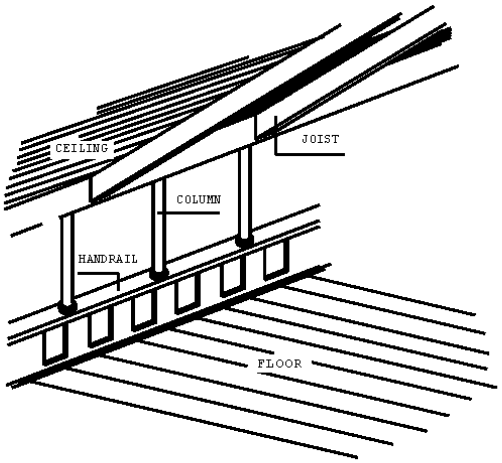
EXTERIOR



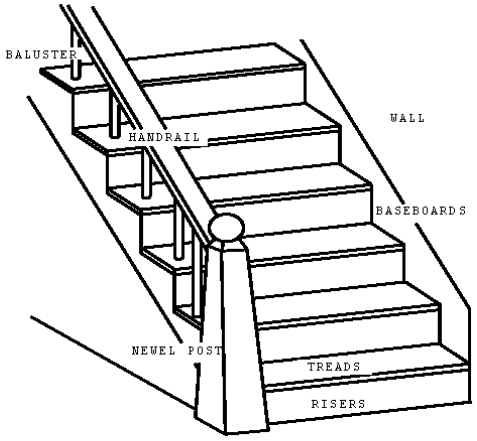
DOORWAY



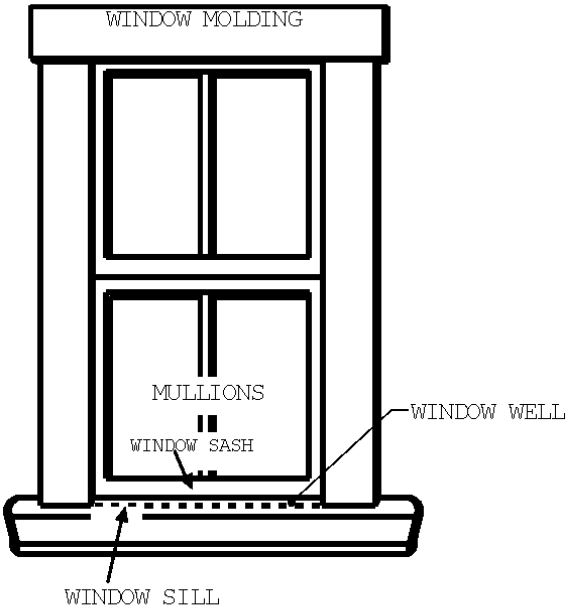
INTERIOR

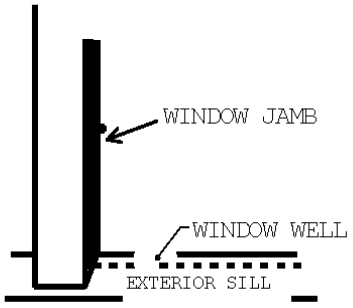


PORCH/ SUNROOM



STAIRWAY





WINDOW

APPENDIX C

ABATEMENT METHOD RECOMMENDATIONS FOR BUILDING COMPONENTS

Abatement Method Recommendations for Building Components

When it has been determined that a surface bearing lead-based paint cannot be successfully managed in place, or when lead-based paint is to be abated during whole-house renovation or revitalization, the following guidance will aid in the selection of appropriate abatement methods. The abatement methodologies given in Tables C-1 and C-2 are ranked 1 or 2 based upon the appropriateness of the method. The preferred technology(ies) for a component are ranked 1. Where paint removal is given a ranking, appropriate methods for paint removal are indicated by letters A through F and explained in Table C-3.

These rankings and recommendations are written for the typical structures, conditions and substrate materials. There will be circumstances where the best recommended abatement methods do not fit the needs of the site. For example, in historic structures it may be necessary to remove paint from components rather than removing the components and replacing with new substrate materials.

Procedure for Selecting An Abatement Method Using the Tables

1. Locate the component of interest in Table C-1 (interior surfaces) or Table C-2 (exterior surfaces). If the exact component is not given, select a component with similar substrate material, size, and configuration.

2. Read across the row to find the abatement method(s) recommended for this particular type of component. The abatement methods are ranked from 1 to 3 based on factors such as cost, labor requirements, worker protection and the amount dust and/or hazardous waste generated.

   - *A ranking of 1 implies that this method of abatement is best option in most cases.*

   - *A ranking of 2 means that the method will work, but may be more costly or present more difficulties with containment, worker protection, etc., than the method ranked 1.*

   - *If two methods have the same rank, either method can be used depending on the site circumstances.*

3. Where paint removal is to be considered, the letters in the right-hand column refer to the removal methods given in

Table C-3. Review the recommended removal methods and the applicability to the site conditions.

4. Select an appropriate abatement method based upon all of the information gathered.

TABLE C-1
ABATEMENT OPTIONS FOR INTERIOR SURFACES

INTERIOR COMPONENT	Encapsulation	Enclosure	Replacement	Removal Offsite	Removal Onsite (Method)
Walls	2	1			
Ceilings	1	2			
Floor		1			2 (A C D G)
Door			1	1	
door frame / jamb			1		2 (A B E F)
WINDOW COMPONENTS					
Sash / Mullions			1	1	
Frame			1		2 (A B F)
Jamb			1		2 (A B F)
stop/ parting beads			1		2 (A B F)
Sill			1		2 (A B F)
STAIR COMPONENTS					
Tread and riser		1			1 (A B C D E G)
Baseboard			1	2	2 (A B C D E G)
Stringer			1	2	2 (A B C D E G)
Baluster			1	2	
Newel post			1	2	
Handrail			1	2	
Baseboard			1	2	

INTERIOR COMPONENT	Encapsulation	Enclosure	Replacement	Removal Offsite	Removal Onsite (Method)
Crown molding			1	2	
Chair rail			1	2	
Fireplace			2		1 (A B D F)
Mantle				1	2 (A B D F)
Column		2			1 (A B D F)
Threshold			1	2	
Cabinetry / shelves			1	2	
Grille			1	2	
Radiators				1	1 (A B F)
Exposed piping		1			1 (A B F)
Ductwork		1			1 (A B D E F)

TABLE C-2
ABATEMENT OPTIONS FOR EXTERIOR SURFACES

EXTERIOR COMPONENT	Encapsulation	Enclosure	Replacement	Removal Offsite	Removal Onsite (Method)
Wall	2	1			2 (A B C D G)
Siding	2	2	1		
Shingles			1		
Ceiling		1	1		
deck/patio floor			1		2 (A C D G)
Door			1	1	
door frame / jamb			1		2 (A B E F)
WINDOW COMPONENTS					
Sash / Mullions			1	1	
Frame	2		1		2 (A B F)
Jamb			1		2 (A B F)

EXTERIOR COMPONENT	Encapsulation	Enclosure	Replacement	Removal Offsite	Removal Onsite (Method)
stop/ parting beads			1		2 (A B F)
Sill			1		2 (A B F)
STAIR/RAILING COMPONENTS					
Tread		2	1		2 (A B C D E G)
Riser		2	1		2 (A B C D E G)
Stringer		2	1		2 (A B C D E G)
Baluster			1	2	
Handrail			1	2	
Newel post			1	2	
Canopy trim		1		1	
Column	1	2		1	
Skirt			1		2 (A B C D E G)
Fascia board		1	1		
Cornerboard			1		2 (A B C D G)
Dripboard			1		2 (A B C D G)
Lattice			1		
Soffit	2		1		2 (A B C D G)
Gutter / downspout			1		2 (A B F)
Fence			1		
Exposed piping		1			2 (A B F)
Roof		1			
Storage tank			2		1 (A B C D E G)
Chimney			2		1 (A B F)

Table C-3
PAINT REMOVAL METHODS

	Removal Method	Appropriate Applications	Comments
A	chemical stripping	Widely applicable to may substrates and surface configurations. Works best on interior surfaces and other areas where control of ambient temperatures and protection from weather are provided.	Can damage some substrates - check with manufacturer regarding use on wood and metal substrates. Follow manufacturer's instructions for use and rinsing or neutralization. Follow manufacturer's guidance for worker protection. After stripping, do not sand surfaces without appropriate worker protection and containment.
B	heat gun with hand scraping	On limited surface areas and where thick paint layers make other methods inefficient.	Do not use open flame torches.
C	HEPA vacuum abrasive blasting	Flat surfaces, metal and masonry. Will raise grain of wood surfaces.	Attachments can be made to match surface configurations such as corners. Select abrasive media to fit work surface requirements.
D	HEPA-equipped machine sanders	Flat surfaces.	Attachments can be made to match surface configurations.
E	HEPA-equipped needle gun	Limited to metal and some masonry surfaces.	May damage masonry surfaces. Attachments can be made to match surface configurations.
F	wet hand scraping	Limited surface areas, such as trim. Where paint has poor adhesion and is easily removed.	Scraping tools can be made to match surface configuration. Supplements other methods.

	Removal Method	Appropriate Applications	Comments
G	wet abrasive blast with engineered abrasive.	Metal and some exterior wood surfaces.	Requires appropriate containment and worker protection. Waste is not likely to fail TCLP for lead.

REFERENCES

Correspondence, John Messier, Navy Public Works Center, Norfolk, Virginia, April 25, 1995.

"Lead-Based Paint: Interim Guidelines for Hazard Identification and Abatement in Public and Indian Housing" U.S. Department of Housing And Urban Development, April 1990, Revised September 1990.

APPENDIX D

STANDARD REEVALUATION SCHEDULES

Table D-1
Standard Reevaluation Schedules

Schedule	Evaluation Results	Action Taken	Reevaluation Frequency and Duration	Visual Survey (by owner or owner's representative)
1	Combination risk assessment/inspection finds no lead-contaminated dust or bare soil and no lead-contaminated paint.	None.	None.	None.
2	No lead-contaminated paint hazards found during risk assessment conducted before hazard control or at clearance (hazards include dust and bare soil).	None.	3 Years.	Annually and whenever information indicates a possible problem.
3	The average of lead-contaminated dust levels on all floors, interior window sills, or window troughs sampled exceeds the applicable standard, but by less than a factor of 10.	A. Interim controls and/or hazard abatement (or mixture of the two), including, but not necessarily limited to, dust removal. This schedule does not include window replacement. B. Treatments specified in section A plus replacement of all windows with lead hazards.	1 Year, 2 Years. 1 Year.	Same as Schedule 2, except for encapsulants. The first visual survey of encapsulants should be done one month after clearance, the second should be done 6 months later and annually thereafter.

Schedule	Evaluation Results	Action Taken	Reevaluation Frequency and Duration	Visual Survey (by owner or owner's representative)
		C. Abatement of all lead-contaminated paint using encapsulation or enclosure.	None.	Same as Schedule 3 above.
		D. Removal of all lead-contaminated paint.	None.	None.
4	The average of lead-contaminated dust levels on all floors, interior window sills, or window troughs sampled exceeds the applicable standard by a factor of 10 or more.	A. Interim controls and/or hazard abatement (or mixture of the two), including, but not necessarily limited to dust removal. This schedule does not include window replacement.	6 Months, 1 Year, 2 Years.	Same as Schedule 3.
		B. Treatments specified in section A plus replacement of all windows with lead hazards.	6 Months, 2 Years.	Same as Schedule 3.
		C. Abatement of all lead-contaminated paint using encapsulation and enclosure.	None.	Same as Schedule 3.
		D. Removal of all lead-contaminated paint.	None.	None.

Schedule	Evaluation Results	Action Taken	Reevaluation Frequency and Duration	Visual Survey (by owner or owner's representative)
5	No lead-contaminated dust or bare soil hazards identified, but lead-contaminated paint hazards are found.	A. Interim controls or mixture of interim controls and abatement (not including window replacement.	2 Years.	Same as Schedule 3.
		B. Mixture of interim controls and abatement, including window replacement.	3 Years	Same as Schedule 3.
		C. Abatement of all lead-contaminated paint hazards, but not all lead-contaminated paint.	4 Years.	Same as Schedule 3.
		D. Abatement of all lead-contaminated paint using encapsulation or enclosure.	None.	Same as Schedule 3.
		E. Removal of all lead-contaminated paint.	None.	None.
6	Lead-contaminated bare soil exceeds standard, but less than 5,000 µg/g.	Interim controls.	None.	Three months to check new ground cover, then annually to identify new bare spots.

Schedule	Evaluation Results	Action Taken	Reevaluation Frequency and Duration	Visual Survey (by owner or owner's representative)
7	Lead-contaminated bare soil greater than or equal to 5,000 µg/g.	Abatement (paving or removal).	None.	None for removal, annually to identify new bare spots or deterioration of paving.

Notes to Table D-1:

1. When more than one schedule applies to a dwelling, use the one with the most stringent reevaluation schedule. Do not use the results of a reevaluation for Schedule 2.

2. A lead-contaminated paint hazard includes, but is not limited to, deteriorated lead-contaminated paint and lead-contaminated dust and bare soil above applicable standards.

3. The frequency of reevaluations and the interval between reevaluations depends on the findings at each reevaluation and the action taken. For example, a dwelling unit or common area falling under Schedule 3-A would be reevaluated 1 year after clearance. If no lead-contaminated paint hazards are detected at that time, the unit or area would be reevaluated again 2 years after the first reevaluation. If no hazards are found in the second reevaluation, no further reevaluation is necessary, but annual visual monitoring should continue.

   If on the other hand, the unit or common area fails a reevaluation, a new reevaluation schedule should be determined based on the results of the reevaluation and the action taken. For instance, if the reevaluation finds deteriorated lead-contaminated paint but no lead-contaminated dust, and the action taken is paint stabilization, Schedule 5-A would apply, which indicates that the next reevaluation should be in 2 years. If, however, the owner of this same property decides to abate all lead-contaminated paint hazards instead of doing only

paint stabilization, the property would move to Schedule 5-C, which calls for reevaluation 4 years from the date of clearance after the hazard abatement.

Following another scenario, suppose a reevaluation of this same dwelling unit or common area finds that the average dust lead levels on sampled window troughs exceeds the applicable standard by a factor of 10 or more, but no other lead-contaminated paint hazards. The owner conducts dust removal. In this case the next reevaluation period would be 6 months after clearance followed by another a year later, followed by yet another 2 years later, as indicated by Schedule 4-A.

4. The initial evaluation results determine which reevaluation schedule should be applied. An initial evaluation can be a risk assessment, a risk assessment/inspection combination, or, if the owner has opted to bypass the initial evaluation and proceed directly to controlling suspected hazards, a combination risk assessment/clearance examination. This type of clearance must be conducted by a certified risk assessor, who should determine if all hazards were in fact controlled. The results of the initial clearance dust tests, soil sampling and visual examination should be used to determine the appropriate schedule. If repeated cleaning was necessary to achieve clearance, use the results of the dust tests *before* repeated cleaning was performed for schedule determination.

5. If a unit fails two consecutive reevaluations, the reevaluation interval should be reduced by half and the number of reevaluations should be doubled. If the deteriorated lead-contaminated paint hazards continue to occur, then the offending components/surfaces should be abated. If dwellings with dust hazards but no paint related hazards repeatedly fail reevaluations, the exterior source should be identified (if identification efforts fail, regular dust removal efforts are needed).

Based on Table 6.1 of Department of Housing and Urban Development Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing (July 1995).

APPENDIX E

STANDARD SURFACE RESTORATION COST ESTIMATES

Table E-1
Lead Based Paint Surface Restoration Cost

NOTE: REMOVAL LOOSE/SCALING LEAD BASED PAINT & SPOT PRIME (SCATTERED LOCATIONS) PRICES INCLUDE COSTS FOR LABOR, SUPPLY, CLEANUP, SETUP, 1-COAT PRIMING AND 2 COATS OF PAINT. LEAD DISPOSAL NOT INCLUDED.

Exterior

COMPONENT	UNIT	COST
COLUMN	SF	$1.99
DOOR	EA	$40.73
DOOR-FRAME	EA	$16.50
DOOR-FRENCH	EA	$48.08
DOOR-GARAGE (1-CAR)	EA	$112.77
DOOR-SCREEN	EA	$40.73
DOOR-STORM	EA	$40.73
DOOR-UTILITY	EA	$40.73
DOOR JAMB	EA	$16.50
DOOR MOLDING	EA	$16.50
DOWN SPOUT	LF	$2.34
ENTRY OVERHANG	SF	$1.78
EXHAUST VENT	EA	$3.75
FASCIA (1"x4")	LF	$1.81
FASCIA (1"x6" TO 1"x10")	LF	$1.86
FENCE (WOOD)	SF	$1.79
FENCE (WIRE METAL)	SF	$1.90
GUTTER	LF	$2.34
LATTICE	LF	$1.46
MAIL BOX	EA	$3.75
SOFFIT (12")	LF	$1.79
SOFFIT (18")	LF	$2.68
THRESHOLD	EA	$5.37
TRIM	SF	$1.79
UTILITY BOX (TYP)	SF	$10.32
WALL (WOOD, PLYWOOD)	SF	$1.79
WALL (CONCRETE)	SF	$1.83
WALL (MASONRY, BRICK)	EA	$2.38
WINDOW-APRON	EA	$12.88
WINDOW-FRAME	EA	$14.00
WINDOW-JAMB	EA	$8.00
WINDOW-MOLDING	EA	$22.54
WINDOW-MULLION	EA	$8.00
WINDOW-SASH	EA	$3.00
WINDOW-SILL	EA	$12.88
WINDOW-WELL	EA	$12.88

Interior

COMPONENT	UNIT	COST
BASEBOARD (UP TO 6" WIDE)	LF	$1.00
BASEBOARD (UP TO 12" WIDE)	LF	$1.99
BASE BOARD HEATER COVER	LF	$1.00
BEAM	SF	$1.99
CABINET	LF	$7.96
CEILING	SF	$1.78
CEILING MOLDING	LF	$1.00
CHAIR RAIL	LF	$1.00
CLOSET DOOR TRIM	LF	$1.00
CLOSET SHELF	SF	$1.99
COLUMN	SF	$1.99
CORNICE	SF	$2.37
CORNER BOARD	LF	$1.00
CROWN MOLDING	LF	$1.00
DOOR (3'6"x6'6")	EA	$45.27
DOOR-ATTIC ACCESS	EA	$45.67
DOOR-BIFOLD	EA	$45.67
DOOR-CLOSET	EA	$45.27
DOOR-FRAME	EA	$16.50
DOOR-FRENCH	EA	$48.08
DOOR-GARAGE (1-CAR)	EA	$112.77
DOOR JAMB	EA	$16.50
DOOR-LOUVERED	EA	$53.33
DOOR MOLDING	EA	$16.50
DOOR POCKET	EA	$45.27
DOOR-SCREEN	EA	$45.27
DOOR-SLIDING	EA	$45.27
DOOR-TRIM	EA	$16.50
DOOR-UTILITY	EA	$45.27
FAN/COIL HEATER COVER (TYP)	EA	$23.88
FIREPLACE	SF	$2.38
FIREPLACE MANTLE	SF	$1.99
FLOOR	SF	$1.78
HANDRAIL	LF	$1.00
PIPE (2"-4" DIA)	LF	$2.01
RADIATOR	SF	$1.72
RADIATOR COVER	SF	$1.99
STAIR-BALUSTER	LF	$1.00
STAIR-BASEBOARD	LF	$1.00
STAIR-NEWEL POST	SF	$1.99
STAIR-RISER	SF	$1.99

Interior Continued

COMPONENT	UNIT	COST
STAIR-TREAD	SF	$1.99
THRESHOLD (TYP 3 LF)	EA	$5.97
TILE (PAINTED)	SF	$1.99
TRIM	LF	$1.00
UTILITY BOX	SF	$1.72
VALANCE	EA	$2.98
VENT, HVAC (TYP)	EA	$1.72
WALL (PLASTER, DRYWALL)	SF	$1.78
WALL (WOOD, PLYWOOD)	SF	$1.99
WINDOW-APRON	EA	$12.88
WINDOW-FRAME	EA	$14.00
WINDOW-JAMB	EA	$8.00
WINDOW-MOLDING	EA	$22.54
WINDOW-MULLION	EA	$8.00
WINDOW-SASH	EA	$3.00
WINDOW-SILL	EA	$12.88
WINDOW-WELL	EA	$12.88

Table E-2

Operations and Maintenance (O&M) Cost Factor - A multiplier for calculating annual O&M costs derived from the time estimated for LBP component surveillance and record keeping.

# of LBP Components	Surveillance (time per unit)	Record Keeping (time per unit)	O&M Annual Cost Factor (time per unit)	O&M Cost per unit per year (based on $50.00 per hour labor)
1 to 30	0.50	1.00	1.50	$ 75.00
31 to 60	0.75	1.50	2.25	$112.50
61 to 90	1.00	2.00	3.00	$150.00
91 to 120	1.25	2.50	3.75	$187.50
120 +	1.25	3.00	4.25	$212.50

APPENDIX F

ASSESSMENT RESULTS

Key Sheet For F-1

Type :
- **CDC** - Child Day Care
- **SFD** - Single Family Dwelling
- **School** - School
- **MFD** - Multiple Family Dwelling
- **Industrial** - Non-Residential

Hazard :
- **Y** - Yes
- **N** - No
- **U** - Lead undetected

Matrix :
- **P** - Paint
- **S** - Soil
- **D** - Dust

Response Priority :
- **L** - Long Term
- **S** - Short Term
- **M** - Mid Term
- **U** - None Required

Hazard Potential :
- **L** - Low
- **M** - Medium
- **H** - High
- **U** - None

Table F-1 ASSESSMENT RESULTS

Housing Area	Type	Address	Loc.	Room	Component	Substrate	Paint Condition	Lead Content	Hazard	Matrix	Response Priority	Hazard Potential
Camp Humphreys		104 Humphreys	Undefined	Equipment	Monkey Bars	Metal	Intact	0.26 mg/cm²	N	COL11%	L	L
Camp Humphreys		104 Humphreys	Undefined	Fence		Metal	Intact	0.01 mg/cm²	N	P	L	L
Camp Humphreys		109 Humphreys	Undefined	Class 6	Wall	Sheet Rock	Intact	0.01 mg/cm²	N	P	L	L
Camp Humphreys		109 Humphreys	Undefined	Class 6 Entry	Ceiling	Sheet rock	Intact	0.01 mg/cm²	N	P	L	L
Camp Humphreys		109 Humphreys	Undefined	Exterior	Foundation Wall	Concrete	Intact	3.00 %	N	P	M	M
Camp Humphreys		388 Humphreys	Undefined	0-6 Years Room	Window Trim	Wood	Intact	0.00 mg/cm²	N	P	L	L
Camp Humphreys		388 Humphreys	Undefined	0-6 Years Room	Window Trim	Wood	Intact	2.00 %	N	P	M	M
Camp Humphreys		388 Humphreys	Undefined	Hall	Baseboard	Wood	Intact	0.02 mg/cm²	N	P	L	L

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14. ABSTRACT

Now that the dangers of lead and asbestos in the environment are recognized, the Army finds itself with many structures containing lead and asbestos coatings or materials. U.S. Environmental Protection Agency and U.S. Department of Housing and Urban Development rules require identification of lead hazards in paint, dust, and soil. When lead hazards are found, action must be taken to manage or remove them.

Tracking the details of an effective lead and asbestos hazard management program can present a formidable task, even for a relatively small number of buildings. A computer database program is ideally suited to this task.

Using the HALO Management System, managers collect lead-based paint data from risk assessments or paint surveys and generate the required Lead Hazard Management Plan and the Title X lead disclosure form for residential housing. The program reduces time and the amount of paperwork required for compliance with all the rules and to allow the user to produce the Army-required management plans for each installation.

15. SUBJECT TERMS
Lead-based paint, Hazardous Asbestos and Lead Optimal (HALO), managemant system, database, Navy, environmental compliance, family housing, hazardous materials

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