NBSIR 75-761

The Demonstration of Experimental Lead Paint Hazard Abatement Methods in Washington, D. C.

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Office of Housing Technology

Center for Building Technology
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U.S. DEPARTMENT OF COMMERCE, Rogers C.B. Morton, *Secretary*
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NATIONAL BUREAU OF STANDARDS, Ernest Ambler, *Acting Director*

Table of Contents

List of Tables

List of Figures

SI Conversion Units

The conversion factors and units contained in this report are in accordance with the International System of Units (abbreviated SI for Systeme International d'Unites). The SI was defined and given official status by the 11th General Conference on Weights and Measures which met in Paris in October 1960. For assistance in converting U.S. customary units to SI units, see ASTM E 380, ASTM Standard Metric Practice Guide, available from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA. 19103. The conversion factors for the units found in this Standard are as follows:

Length

1 in = 0.0254* meter

1 ft = 0.3048* meter

1 mil = 0.001* in

Area

1 in^2 = 6.4516* x 10^{-4} $meter^2$

1 ft^2 = 0.9290* $meter^2$

Volume

1 in^3 = 1.638 x 10^{-5} $meter^3$

1 liter = 1.000* x 10^{-3} $meter^3$

Mass

1 grain = 6.479 x 10^{-5} kilogram

1 ounce-mass (avoirdupois) = 2.834 x 10^{-2} kilogram

1 pound-mass (avoirdupois) = 0.4535 kilogram

Pressure or Stress (Force/Area)

1 inch of mercury (60°F) = 3376 $newton/meter^2$

1 pound-force/inch (psi) = 6894 $newton/meter^2$

---

*Exactly

Energy

1 inch-pound-force (in-lbf) = 0.1130 joule

Plane Angle

1 degree (angle) = 1.745×10^{-2} radian

Power

1 watt = $1.000^{*} \times 10^{7}$ erg/second

Temperature

°C = 5/9 (Temperature °F - 32)

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*Exactly

The Demonstration of Experimental Lead
Paint Hazard Abatement Methods in Washington, D.C.

Thomas H. Boone, Harvey W. Berger, A. Philip Cramp, Herbert A. Jackson

Abstract

This report describes the first stage of an experimental lead paint hazard abatement program carried out in 30 dwelling units in Washington, D.C. The entire program will ultimately involve the abatement of lead paint hazards in a total of approximately 250 dwelling units located in three or more cities.

The procedures, demonstrated in Washington, included: paint removal methods using chemical solvents and a heat producing device; the replacement of components such as windows, doors and wood trim and; the installation of flexible sheet and rigid board barrier materials over existing lead paint on wall.

The report presents procedures and the forms used in inspecting and selecting dwellings for lead paint hazard abatement, evaluations of the suitability and implementation characteristics of the abatement methods and recommendations for their use.

Subsequent reports will present the results of comparable programs in additional cities and a final report will compare the cost-effectiveness of the alternative abatement methods.

Key Words: Abatement; barrier materials; building materials; children; housing; lead-based paint; lead poisoning; paint removal.

The Demonstration of Experimental Lead Paint Hazard Abatement Methods in Washington, D.C.

1. INTRODUCTION

This report describes the process of a field demonstration of lead paint hazard abatement methods carried out in thirty dwelling units located in Washington, D.C. This on-going Experimental Hazard Abatement Program (EHAP), will ultimately involve the treatment of lead paint hazards in about two-hundred and fifty dwellings located in a number of major cities. The Department of Housing and Urban Development (HUD) is sponsoring the Program and the housing in Washington was supplied by the National Capital Housing Authority (NCHA).

The National Bureau of Standards (NBS) is providing technical assistance to HUD on the Program and is primarily responsible for the evaluation of the performance of the abatement methods and the determination of the comparative cost effectiveness of the methods being demonstrated. Housing and code officials, who are directly concerned with lead poisoning control in their own communities, require technical guidance in lead based paint hazard abatement. This report will serve: 1) to provide background on the EHAP and clarify HUD's objectives; 2) to begin to provide specific recommendations, and technical advice to decision makers, on hazard abatement processes; and 3) to provide an example to others who may be interested in carrying out their own hazard abatement evaluation programs.

Following this report, subsequent reports will present the results of comparable programs in the additional cities. Although cost data was collected during the implementation of this program, and will be collected

in each of the other cities, the final cost analysis will not be carried out until all of the data is aggregated. A final report will compare the cost-effectiveness of the alternative abatement used in the 250 dwelling units in all the cities included in the EHAP.

1.1 BACKGROUND

Lead poisoning resulting from the ingestion of lead-based paint is a serious national health problem. It primarily affects children between the ages of one through seven who live in housing where lead paint is a hazard due to deteriorating painted surfaces.

In January 1971, Congress enacted the "Lead-Based Paint Poisoning Prevention Act" (PL 91-695) (ammended as PL 93-151 in 1973) to provide Federal assistance to help eliminate this serious problem.

Title III of this Act requires HUD to conduct a research program to determine the nature and extent of lead paint hazards in housing and to identify and recommend effective methods for its abatement.

The key to the abatement and prevention of lead paint poisoning is the removal of the hazard which exists in the form of dried, aged, lead based paint on residential surfaces. This paint may be found on various substrates such as plaster, gypsum board, wood, metal, or any other type of building material. It may be found on interior and exterior walls, ceilings, floors, doors, and door frames, window and window frames, trim molding, porches and other surfaces found in a home.

Participating directly in the implementation of the Washington Phase of the EHAP were: HUD's Office of Policy Development and Research; NBS' Center for Building Technology; the Field Operations and Support Division of the Boeing Aerospace Company and the National Capital Housing Authority (NCHA).

1.2 THE EXPERIMENTAL HAZARD ABATEMENT PROGRAM

1.2.1 HUD'S RESPONSIBILITIES

HUD's legislative mandate requires that it carry out appropriate research activities to determine the feasibility, engineering properties, cost and effectiveness of materials, techniques and systems that can be used for the elimination of lead paint hazards in existing dwelling units. In addition, as the major Federal agency concerned with housing, HUD has the overall responsibility of providing technical guidance to housing authorities and the general housing community on technology, progress and policies that relate to this housing problem. HUD has the leadership role in developing technical information which is required to determine the most appropriate selection of abatement procedures and the optimum use of funds and resources to eliminate lead paint hazards in housing. The Experimental Hazard Abatement Program, to be conducted in Washington, D.C., Atlanta, Georgia and other cities is intended to contribute to the accomplishment of these goals.

HUD's operational responsbilities with regard to the implementation of the entire EHAP includes: overall planning and management; selection of cities for the Program; arrangements for the cooperation of the local housing officials in the selection of suitable housing units for the Program; management and direction of NBS's technical efforts and Boeing's field operations.

HUD is responsible for coordinating all of the phases of the Program and disseminating information and technology to the constituency that requires such assistance. Finally, HUD will make decisions and recommendations, based on the results of the Program, relating to which hazard

abatement methods are most cost effective under specific circumstances relative to hazardous situations.

1.2.2 BOEING AEROSPACE COMPANY'S RESPONSIBILITIES AND ACTIVITIES

The Boeing Aerospace Company was contracted by HUD to provide field management for the EHAP. Boeing was selected subsequent to an evaluation of competitive proposals submitted to HUD for carrying out the scope of work developed by HUD and NBS.

The Boeing staff's first activity was to evaluate the suitability of the dwellings proposed by NBS for the Program in Washington and to make a final selection of appropriate units.

Using NBS technical and materials use specifications, Boeing prepared job specifications for each dwelling unit, which identified the abatement operations required and stipulated, in detail, the procedures for each part of the operation.

Local subcontractors were hired on a competitive basis to carry out the abatement work in the units. The subcontractors were supervised to assure that the abatement was conducted under conditions required by HUD, that the work conformed with the specifications and that it was completed on schedule. As the abatement program progressed, Boeing made technical observations, collected material specimens and verified the cost information supplied by the subcontractors. After the hazard abatement work was completed, Boeing assembled lead content measurements on appropriate surfaces in the units before and after the abatement operation, and conducted a general engineering review of the abatement operations and specific abatement methods.

Finally, Boeing was responsible for returning all of the housing

units which had been abated to the NCHA in an acceptable condition.

Sufficient flexibility had to be maintained throughout the Program so that adjustments made necessary by unforeseen circumstances could be made in the operating conditions. These included such circumstances as:

(a) Conditions or situations encountered at the dwelling units which were unfavorable to the application of the abatement systems intended for that unit.

(b) The failure of an abatement method at the outset of the Program

(c) Entrance to the housing units not being possible when abatement work was scheduled.

Any significant changes in plans made necessary by such circumstances were discussed with NBS and HUD before putting them in effect.

1.2.3 NATIONAL BUREAU OF STANDARDS RESPONSIBILITIES AND ACTIVITIES

NBS's role in the EHAP is broad and touches on every aspect of its operation. As HUD's primary technical resource, NBS has major responsibilities for defining the program scope, presenting and explaining the program objectives and procedures to all parties involved, providing technical support and consultation on operational problems to all parties involved and finally, carrying out the technical evaluation and reporting on the results of the Program.

Prior to the initation of the Washington phase of the EHAP, Boeing's management and technical staff was briefed on the overall program and on the use of the specifications, data collection forms and other information gathering techniques to be used during the Program. The NCHA was also briefed on the types and numbers of dwelling units required for

the Program and on procedures to be used for inspecting for lead paint hazards.

In Washington, NBS staff inspected the units made available by the NCHA and provided Boeing with the information and data required for their final selection of the housing sample.

NBS' major technical responsibility in the EHAP is to evaluate and analyze the effectiveness and costs of the lead paint hazard abatement methods. This process involves a study of the physical properties of the products or systems, their implementation characteristics, costs, long-term durability and physical effectiveness.

The physical properties of the products and systems used in Washington were determined by means of laboratory testing prior to the Program [1]*. The field operation aspects of the EHAP have provided an opportunity to observe and evaluate the nature and performance of the abatement methods under "real-world" conditions.

In order to accomplish this evaluation and analysis, NBS staff has been directly involved in: housing inspections, (before, during and after abatement work); debriefing of subcontractors (including workmen and foremen) and discussions with the manufacturers of the products and systems.

1.3 SELECTION OF WASHINGTON, D.C. FOR THE EXPERIMENTAL HAZARD ABATEMENT PROGRAM

Washington, D.C. was selected as the first city in which the EHAP was to be carried out for several practical reasons. It has a varied

*Numbers in brackets indicate the literature references at the end of this paper.

stock of housing types which are likely to contain lead paint hazards appropriate for the Program.

Another important factor leading to the selection of Washington was its relatively high per capita incidence of children with elevated lead levels in their blood. In addition, liaison had previously been established between HUD, NBS and the National Capital Housing Authority when NBS conducted a pilot demonstration of lead paint hazards abatement methods in two dwelling units under the jurisdiction of the Authority [2] [3].

A further advantage of beginning the EHAP in Washington was logistical. NBS is located in a suburb of Washington and HUD is located in the city itself. Both agencies had ample opportunity to observe the Program's progress and make the adjustments and modifications required to resolve problems and enhance the achievements of the Program. As a result of early monitoring, significant changes were made in the following areas:

(a) Techniques for screening and selection of housing units.

(b) Forms for recording data.

(c) Liaison techniques with contractors

(d) Determination of occupant reaction to unit screening and monitoring the contractors activities.

1.3.1 ROLE OF THE NATIONAL CAPITAL HOUSING AUTHORITY

The NCHA is a public agency which manages and maintains public housing for low-income families in Washington, D.C. In this capacity it is also responsible for the construction of new housing and the leasing of housing from private landlords according to the needs of the city.

In Washington, direct authorization to conduct the experimental hazard abatement program was obtained from the NCHA. Liaison was established with the Director of the Division of Management and staff from his office was assigned to assist NBS personnel in the review, inspection and selection of the housing stock for this program.

The NCHA participated in the EHAP in a number of very important ways. Following the dwelling unit selection guidelines for the Program, NCHA personnel reviewed their stock of public housing and single family attached units, and selected housing units which were likely to meet the EHAP requirements.

Housing tours for NBS and HUD inspection teams were arranged and scheduled by the NCHA which also assigned personnel to accompany the teams and assured their entrance to housing units. The NCHA staff interpreted NCHA repair policies as they applied to some units which met necessary criteria for the Program but also required extensive repairs before being readied for lead paint abatement. Copies of the contracting documents for the deleading operations were issued to the NCHA for their review and approval prior to the deleading operation. These documents contain the specifications and scopes of work governing the abatement work.

The NCHA assured accessibility of the units to Boeing personnel for purposes of inspection and also arranged for subcontractors to conduct the abatement work at the convenience of both the subcontractor and dwelling unit occupants.

As a final responsibility NCHA personnel inspected the subcontractor's work, and informed NBS and HUD of its progress and quality from their point of view.

2. DWELLING UNIT SELECTION

2.1 NCHA HOUSING STOCK

A brief review of the NCHA files on approximately 12,000 public housing units was made in order to select properties for preliminary screening and selection. For the most part the properties are large apartment complexes comprised of garden-type walk up apartments and high rise apartment buildings. Approximately 3% of the housing units (300 to 400) are single family units which are scattered throughout the city.

Only 10 out of about 50 apartment complexes were built before 1945: 29 were constructed during or after 1960. The single family houses varied in age and were built from the 1880's to the late 1940's.

2.2 HOUSING SELECTION CRITERIA AND SAMPLING PLAN

A series of criteria were developed to control the selection of the housing sample in order to assure an appropriate number of housing units with a variety of construction types, ages, extremes in the conditions which are believed to contribute to lead paint poisoning. In addition, it was especially desirable to have units in which abatement would be carried out in wet areas* such as kitchens and bathrooms, as well as, dry areas such as bedrooms, living rooms, dining rooms and hallways.

A criterion was established for the minimum amount of surface area to be abated in each dwelling unit in order to assure an adequate amount of work which would lead to reliable cost data and a demonstration within each dwelling unit of the feasibility of the abatement methods.

*Areas frequently exposed to high humidity and splashing water.

As pointed out earlier the cost data will be evaluated as part of the final report while the factors considered in this report are basically procedural and technical.

The criteria listed below assured that the dwelling units selected for abatement in Washington were representative of housing that is believed to contribute to lead paint poisoning and were, in fact, hazardous by virtue of their lead paint content and condition of deterioration.

CRITERION 1: Lead Content

A dwelling unit shall be selected if it is found to have interior painted surfaces which contain at least 2.0 milligrams of lead per square centimeter of surface area and the surfaces satisfy both CRITERIA 2 and 3 below. [The surfaces shall be measured with a portable X-ray fluorescence (XRF) lead detector as described in Section 2.3 below.]

CRITERION 2: Physical Conditions and Locations

A dwelling unit shall be selected if it meets CRITERION 1 and the paint on wall surfaces, is cracked, scaling, peeling or chipping and/or if the painted trim, such as windows, window sills, doors, door frames, and molding, although tight, is within five feet of the floor.

CRITERION 3: Surface Dimensions

A dwelling unit shall be selected if it meets CRITERIA 1 and 2 and one or more of the following requirements:

(a) At least 500 square feet of interior wall surface will require abatement.

(b) At least 50 linear feet of interior trim will require abatement.

(c) Four interior doors will require abatement

(d) Four windows will require abatement.

In addition to meeting the CRITERIA listed above, the units to be selected in Washington were required to fulfill a housing sample selection plan (Table 1) which specified the types and ages of dwelling units to be used in the Program.

2.3 SCREENING AND SELECTION PROCESS

The inspection procedure for screening and selecting housing units for use in the Washington Phase of the Program was as follows. A NCHA representative selected a sufficient number of housing units (six to eight) from his housing stock for a day's work and arrangements for the inspection were made by phone, prior to the inspection day,, with the occupants of these units. On visits to single family housing the NCHA representative introduced the inspection team to the housing occupant, explained the purpose of the visit, and gained entrance for the team.

The procedure for the inspection of apartment units was slightly different. In such cases the local project manager accompained the team. His presence assured easy access to the units and the team could take advantage of his detailed knowledge of the housing under his jurisdiction in appraising their condition and noting their history of construction and maintenance.

In accordance with CRITERION 1, only those walls whose painted surfaces were in a deteriorating condition were measured to determine their lead content. If none of the walls were found to be in such a condition, after a quick walk-through of the dwelling unit, the inspectors proceeded directly to the measurement of lead on doors, windows

Table 1

Number of Dwelling Units in
Housing Sample Selection Plan

	Year of Construction		
	1920-1940	1941-1950	1951-1960
MFLR[1]	5	15	5
MFHR[2]	2	6	2

[1]MFLR - Multifamily Low Rise - A multiple dwelling with or without elevator service and not exceeding three stories in height.

[2]MFHR - Multifamily High Rise - A multiple dwelling with or without elevator service and exceeding three stories in height.

and trim in each interior room.

If the XRF readings of lead content fell below 1.0 mg/cm^2 on all surfaces, the dwelling was eliminated as a potential candidate for the program. If, on the other hand, certain surfaces rendered single XRF readings greater than 1.0 mg/cm^2, more detailed XRF measurements were made according to the following procedure:

Value of "Initial" XRF Reading mg/cm^2	Number of "Additional Readings at a Single Point"
<1.0	None
1.0 to 3.4	2
>3.4	None

For each surface which indicated an average lead paint content of 2.0 mg/cm^2 or above (or single readings of 3.4 mg/cm^2 or above) additional information was recorded on its total area in square feet or length in linear feet. All of this information was recorded on an "Interior Surfaces" form (Figure 1.)

In addition, other potentially important information was noted on; the types and conditions of the substrates and surfaces in each room; the general condition of each dwelling unit including major structural defects, clearly representing an immediately dangerous situation; roof and plumbing leaks and the nature and conditions of electrical wiring, heating, and plumbing systems.

2.4 DWELLING UNIT SAMPLE CHARACTERISTICS AND CONDITIONS

The general characteristics of the dwelling units selected for abatement in Washington are shown in Table 2. Twenty-four of the units were built during the period 1920-40. Five were built prior to 1920

Figure 1

Recording Form for Interior Surfaces

FORMAT 1

INTERIOR SURFACES Room or Location _____ Assigned No _____

ITEMS		XRF MEASUREMENT 1	2	3	AVG.	DIMENSIONS SQ. FT.	LIN. FT.	SURFACE TYPE (P) (V) (W)	SURFACE CONDITION T C B P	SUBSTRATE TYPE (PL) (G) (M) (W) (ML)	SUBSTRATE CONDITION S C R B H F
WALLS	N										
	E										
	S										
	W										
BASE BOARD	N										
	E										
	S										
	W										
CEILING											
DDDR											
FRAME											
DODR											
FRAME											
DDDR											
FRAME											
DDDR											
FRAME											
WINDDW											
FRAME											
WINDDW											
FRAME											
WINDDW											
FRAME											
CABINET											

SURFACE

TYPE (P) PAINT
(V) VARNISH
(W) WALLPAPER

CONDITION T TIGHT
C CRACKED
B BLISTERING
P PEELING

SUBSTRATE

TYPE (PL) PLASTER
(G) GYPSUM BOARD
(M) MASONRY
(W) WOOD
(ML) METAL

CONDITION S SOUND
C CRACKED
R REPAIRED
B BUCKLED
H HOLES
F FALLING

BASIC ROOM DIMENSIONS

WIDTH _____
LENGTH _____
HEIGHT _____

No. of Doors _____
No. of Windows _____

USCOMM NBS-DC

Table 2

Housing Characteristics

Dwelling Unit	Dwelling Unit Type	Approx. Age			Defects		Kitchen				Plumbing & Heating	
							Cabinets		Ranges			
		Pre 1920	1920-1939	1940-1950	Roof Leaks	Plumbing Leaks	Base	Wall	Gas	Elect.	Exposed Pipes	Radiators
001	MFLR		*				*	*		*	*	*
002	MFLR		*				*	*		*	*	*
003	MFLR		*				*	*		*	*	*
004	SFA			*	*		*	*	*		*	*
012	SFA	*					*	*	*			*
014	SFA		*				*	*	*			*
015	SFA		*				*	*	*			*
018	MFLR		*				*	*		*	*	*
019	MFLR		*				*	*		*	*	*
020	MFLR		*			*	*	*		*	*	*
021	MFLR		*				*	*		*	*	*
022	MFLR		*				*	*		*	*	*
023	MFLR		*				*	*		*	*	*
024	MFLR		*				*	*		*	*	*
060	SFA		*		*		*	*	*			*
061	SFA	*			*		*	*	*			*
063	SFA	*					*	*	*			*
064	SFA	*			*		*	*	*			*
065	SFA	*			*		*		*		*	*
067	SFA		*		*		*	*	*			*
068	SFA		*				*	*	*			*
069	SFA		*				*	*	*			*
070	SFA		*				*	*	*			*
071	MFLR		*				*	*		*	*	*
072	MFLR		*				*	*		*	*	*
073	MFLR		*				*	*		*	*	*
074	MFLR		*				*	*		*	*	*
077	MFLR		*				*	*		*	*	*
078	MFLR		*				*	*		*	*	*
079	MFLR		*				*	*		*	*	*
Total	13 17	5	24	1	6	1	30	29	13	17	19	30

and one was built in the period between 1940-50.

The thirteen SFA (single family attached) units were located throughout the city. The seventeen MFLR units were located at two sites: twelve in the northeast section of the city, in a development called the Langston Dwellings, and the other five in the southeast section of the city in the Ellen Wilson Dwellings.

Although the original sample plan called for the selection of multifamily high rise and low rise (MFHR and MFLR) apartments in Washington, only SFA and MFLR units could be found that met the selection criteria pertaining to lead levels and the amounts of leaded surfaces.

The exclusion of MFHR units from the sample resulted in a lost opportunity to evaluate engineering and operational problems, costs and other factors involved in transporting and handling materials and equipment, and abating lead paint hazards above the third floor.

The single family attached units were built between the years of 1900 and 1940 and it can be assumed that they were originally intended for occupancy by upper income families. The architectural style is traditional for that period and the interiors of these units have ornamental trim on windows and door frames, base molding etc.

Of the thirty dwelling units selected for this program, twenty-seven were occupied. This situation limited, somewhat, the opportunities for comparisons of costs, ease or difficulty of implementation of the abatement procedures, and probably other factors, if the balance between occupied and unoccupied units had been more even.

Additional information of the housing characteristics and their conditions is presented in Table 3. The physical conditions of the

Table 3

Housing Conditions

Dwelling Unit	WALLS				WINDOWS				DOORS			TRIM				
	Type	Condition			Type		Condition		Type		Cond'n	Type			Cond'n	
	Plaster	Sound	Cracked	Holes	Steel Casement	Wood Doublehung	Sound	Deteriorating	Wood Flush	Wood 4 - 6 panel Colonial	Sound	Wood (ornate)	Wood (Plain)	Metal (Plain)	Sound	Deteriorating
001	*	*				*	*		*		*		*		*	
002	*	*				*	*		*		*		*		*	
003	*	*				*	*		*		*		*		*	
004	*	*				*	*		*		*		*		*	
012	*	*				*	*			*	*	*			*	
014	*	*				*	*			*	*	*			*	
015	*	*				*	*			*	*	*			*	
018	*	*			*			*	*		*			*	*	
019	*	*			*			*	*		*			*	*	
020	*		*	*	*		*		*		*			*	*	
021	*	*			*			*	*		*			*	*	
022	*	*			*			*	*		*			*	*	
023	*	*			*			*	*		*			*	*	
024	*	*				*	*		*		*		*		*	
060	*	*				*	*			*	*	*			*	
061	*		*			*	*			*	*	*			*	
063	*	*				*	*			*	*	*			*	
064	*	*				*	*			*	*	*			*	
065	*	*				*	*			*	*	*			*	
067	*	*				*	*			*	*	*			*	
068	*	*				*	*			*	*	*			*	
069	*		*			*	*			*	*	*			*	
070	*	*				*	*			*	*	*			*	
071	*	*			*		*		*		*			*	*	
072	*	*			*		*		*		*			*	*	
073	*	*			*		*		*		*			*	*	
074	*	*			*		*		*		*			*	*	
077	*	*			*		*		*		*			*	*	
078	*	*			*		*		*		*			*	*	
079	*	*				*	*		*		*		*		*	
TOTAL	30	27	3	1	12	18	25	5	18	12	30	12	6	12	30	0

dwelling units were generally fairly good. With only minor exceptions, plaster walls were sound. (The walls in three units had minor cracks and the walls in unit Number 020 had both cracks and holes caused by occupant abuse.) The steel casement windows in five units were considered non-workable and beyond repair. The doors, molding and other trim in the 30 selected units were also sound.

Other than the hazard of lead-based paint on various surfaces there were no major safety hazards or structural defects. There were no weak or unsafe floors, or falling plaster from the ceilings. The walls were not bulging, buckling, or collapsing. Six of the dwelling units had roof and plumbing leaks and attendant wall and ceiling deterioration which were repaired by the NCHA before the Program was underway.

The relatively good condition of the dwelling units severely limited the opportunities for meaningful comparisons of costs and ease or difficulty of implementation of the abatement procedures under the wide range of housing unit conditions which are typically found in Washington.

2.4.1 LEAD PAINT LOCATIONS AND LEVELS

Table 4 lists the lead paint locations and levels in each of the units which satisfied the selection criteria in Section 2.2. Only sixteen dwelling units contained walls which met the selection criteria and these were located in kitchen and bathroom areas. All of the units had doors, door frames, windows or window frames which satisfied the selection criteria. The painted surfaces which provided the highest lead measurements are indicated in Table 4 by asterisks.

The average lead levels found in the dwelling units are shown in Table 5.

Table 4

Lead Paint Locations & Levels
(before abatement)

Dwelling Unit	Dwelling Unit Type	Kitchen (Walls)	Bathroom (Walls)	Doors	Door Frames	Windows	Windows Frames	Baseboards	Chair Rails	Cabinets
001	MFLR			o	o	o	o			o
002	MFLR			o	o	o	o			
003	MFLR			o	o	o	o			*
004	SFA			o		o	o	o		
012	SFA		o	*	o	o	o			*
014	SFA				*	*	*			o
015	SFA			*	*	*	*			
018	MFLR	o	o	o		o	o		*	
019	MFLR	o	o	o			o			
020	MFLR	o	o	*						
021	MFLR	o	o	o	o		o			
022	MFLR	o	o	*			o			
023	MFLR	o	*	*		*	*		*	
024	MFLR			o	o	o	o			
060	SFA			o	*	o	o			*
061	SFA	*		*	*	*	*			
063	SFA		o	o	*				*	
064	SFA			*	*					o
065	SFA			*	*	o	o			
067	SFA				*	*	*			*
068	SFA			o	*	*	*			o
069	SFA	*			*	*	*	*		
070	SFA			*	*	*	*			
071	MFLR	o	o	*	*		*			
072	MFLR	o	o	*						
073	MFLR	o	o	*						
074	MFLR	o	o	*						
077	MFLR	o	o	*					*	
078	MFLR	o		*			o			
079	MFLR			o	o	o	o		ô	o

o Denotes Lead Levels in Range of 2.0 - 5.0 mg/cm^2

* Denotes Lead Levels in Range above 5.0 mg/cm^2

The hazardous areas were primarily found on walls in wet areas (kitchens and bathrooms), on windows and doors and on most interior trim (door and window frames and base moldings).

Table 5

Average Lead Levels Found on Surfaces Selected for Abatement in Washington, D.C.

Hazardous Areas	Average Lead Levels mg/cm SFA	MFLR
Kitchen Walls	3.5	3.5
Bathroom Walls	2.8	4.0
Doors	11.0	5.8
Door Frames	12.3	4.3
Windows	12.1	3.0
Window Frames	10.2	4.0
Cabinets	7.0	4.0

The Program plan for Washington called for the abatement of wall surfaces in dry areas (dining, living and bedrooms), as well as wet areas and a number of barrier materials were selected specifically in order to evaluate their adaptability and performance in such locations. Because there were no hazardous dry wall areas, all of the barrier materials were used in kitchens and bathrooms. For this reason, the housing sample for the Washington Phase of the Program was unsatisfactory in terms of the research needs for hazardous surfaces in a variety of dwelling locations representing areas which would not have high exposure to moisture and water.

3. ABATEMENT PROCESSES

The materials and techniques which were selected for demonstration in Washington, were chosen in part on the basis of the results of an extensive laboratory testing program carried out by NBS in which the performance and properties of seventeen potential lead paint hazard abatement methods were determined. The results of that work were reported in NBS Technical Note 808 entitled Potential Systems for Lead Hazard Elimination: Evaluations and Recommendations for Use [1].

The procedures and materials used in Washington are described below and include: three techniques for removing paint; the process of removing and replacing interior components such as doors, windows and trim; and five barrier materials for application to walls. Detailed material and installation specifications of the processes used in Washington are presented in Appendix 1.

3.1 PAINT REMOVAL METHODS

The safety of workmen and dwelling occupants was the primary consideration in the selection of paint removal methods to be demonstrated as part of this Program. The general intention was to avoid any procedures which might result in lead poisoning due to the inhalation or absorption of lead fumes or dust and there was concern for the potential fire hazard associated with the use of open flames.

3.1.1 SOLVENT BASED PAINT REMOVER

A marine-industrial grade paint remover, containing methylene chloride and methyl alcohol, as its principle ingredients, was used for the removal of lead paint from windows, doors and other wood trim and components. The particular product used was a "water wash paint remover"

meaning that it is emulsifiable with water and can be cleaned up by washing. This type of product is reasonably safe for use on interior surfaces in occupied units when workmen take proper precautions with regard to open flames and adequate ventilation.

The product has good wetting properties and penetrates old paint finishes fairly well. However, depending on the nature and number of paint layers to be removed, more than one application of the remover may be required to strip the paint down to the bare wood.

After a reaction time of approximately one-half hour, the softened and blistered paint was removed with a hand scraper. Paint and remover residue on the stripped surfaces was sufficiently small to require only light sanding prior to repainting. Water was not used to wash the stripped surfaces because of the concern for damage to surrounding furnishings.

3.1.2 PAINT REMOVAL WITH HEAT

When paint is heated sufficiently, it softens, swells and usually blisters so that it can be removed easily from its substrate with metal scrapers. Several techniques are available for removing paint from doors, windows and other wood surfaces, by means of heat generation.

Until recently, the use of propane torches has been quite widespread for this purpose but they are falling into disfavor because of the extreme hazard of open flames (especially in occupied and furnished dwellings) and the danger of over-heating paints to the point of vaporization of the lead pigments. A somewhat less hazardous device also uses a propane torch but the open flame is recessed behind a wire screen which becomes heated and, in turn, radiates thermal energy to the surface being

stripped of its paint. Another device uses high intensity electric lamps to generate sufficient temperatures to blister paint. The amount of light produced is in itself an extreme hazard and workmen and bystanders must wear protective eyewear.

A portable flameless electrical hot air blowing device was selected for this Program because of its effectiveness as demonstrated in laboratory tests and its low risk of fire and injury to the operator or bystanders.

This commercially manufactured device consists essentially of an air blower attached to a reinforced flexible plastic hose through which cold air flows to a cylindrical electric heater at the outlet nozzle. The heater is heavily insulated, so that is can be hand held while in operation. This apparatus is mounted on a stand which is quite mobile. It is capable of producing a strong stream of hot air at temperatures of between 175° and 540°C (350° and 1000°F). The electric heater has two heating rates, and the rate of air flow through the hose can be varied. Electrical circuits or portable generators supplying 20 ampere currents at 115 volts AC are required for operation of the hot air blower.

3.1.3 PAINT REMOVAL BY DIP TANK METHOD

Commercial furniture stripping plants have facilities for removing old paint and varnish by totally immersing the component in large tanks containing heated alkaline solvents in an aqueous medium.

Doors which were stripped by this process required two to three hours of treatment during which time they were alternately soaked and scrubbed with heavy bristle brushes. The total stripping time is dependent on the nature of the paint, the number of paint layers and the

temperature and strength of the solvent bath. The doors can be stripped with hinges and other hardware still attached to it. After the paint is completely removed the doors are washed with water, allowed to air dry and then returned to the dwelling from which they were taken.

3.2 REPLACEMENT OF COMPONENTS

Removal of doors, windows and trim and replacement with new components was carried out as an abatement process in this Program in order to serve as a comparison with other abatement techniques. Windows and doors which were found to be seriously deteriorated or damaged so that they could no longer function were replaced. Interior doors were replaced with new plywood veneer hollow core type doors which were reinstalled on existing frames. Carpentry skills were necessary for rehanging, fitting, and remounting hardware. Carpentry was also required for replacing wooden sash windows and frames in single family units. Metal windows, which were replaced in the apartment units, were standard sizes ordered from a manufacturer. They were replaced in existing metal frames by workmen specializing in such window installations.

3.3 BARRIER MATERIALS

Materials that are applied over existing lead painted surfaces are intended to act as barriers, that is, they are required to prevent access to the lead paint beneath it by virtue of their strength and durability. The barriers also act to contain leaded paint beneath them which might also chip or become separated from the substrate at a later time if not so contained. The five barrier materials, which were demonstrated in Washington, are representative of only a small fraction

of the commercially manufactured products which could be applicable for this purpose. Nevertheless, they do represent a wide range of physical properties and include rigid board-like panels as well as flexible sheet goods.

3.3.1 GYPSUM IMPREGNATED JUTE FABRIC

This wall covering product consists of jute fabric which is impregnated wwith unhydrated gypsum. It is applied to walls, in the same manner as wallpaper,, with a water base adhesive which is recommended by the manufacturer of the fabric. As the gypsum absorbs moisture from its environment it hydrates and hardens to become a fairly rigid and impregnable material .

There are no safety hazards associated with the material and it can be used in occupied and unoccupied dwellings if adequate space is available in which to lay it out, cut it to length and apply the adhesive.

A clean substrate, in good repair, is necessary for adequate adhesion. The covering will, however, bridge minor voids and mask minor substrate imperfections.

The product is supplied in 120 cm (48 inches) wide rolls wrapped in polyethylene bags to prevent premature hydration of the gypsum. The product is available in several pastel colors and may also be painted. A clear surface protective coating can be applied if the material is to be used in wet areas.

3.3.2 CEMENT IMPREGNATED GLASS FABRIC

This product is similar in appearance to the gypsum jute fabric described above. It consists of glass fabric impregnated with portland cement and develops into a rigid, strong material by absorbing moisture from

its environment. The general comments regarding safety, application, intended use and finishing are the same for this product as for the previous one.

3.3.3 GYPSUM WALLBOARD

Gypsum wallboard is a product which is comprised of a thick layer of gypsum (hydrated calcium sulphate) to which paper or other materials are bonded to provide a finished or finishable surface. It is intended for use on walls, ceilings or partitions and can be applied directly to existing surfaces or furring strips of wood or metal.

Gypsum wallboard has been used extensively as a barrier material for lead paint hazard abatement in cities throughout the country. Its advantages are: low materials cost; familiarity with the product among contractors; and particulary, its low flammability with regard to fire protection. The product used in Washington was regular, tapered edge, 3/8-inch thick, (9.5 mm) available in 4 by 8 feet (1.2 x 2.4 m) sheets. It was applied directly to existing wall with adhesives and nails. The installed wallboard was prepared for painting by finishing the joints between the sheets with joint tape and compound, covering nail heads with compound and sanding to a smooth finish.

Gypsum wallboard was included in the Program to serve as a reference against which the performance and costs of other barrier materials could be compared.

3.3.4 MELAMINE COATED HARDBOARD

This product is a 1/4-inch (6.4 mm) thick tempered hardboard to which a 1 1/2-mil (.038 mm) thick melamine film has been laminated to provide a serviceable, decorative finish. The material is supplied in

4 x 8 feet panels (1.2 x 2.4 m) and is applied to existing walls with an adhesive. Preformed strips are used to cover vertical butted seams and as a molding at the ceiling line. Wood baseboards are applied over the paneling along the floor line.

3.3.5 GYPSUM VENEER PLASTER

The gypsum plaster used in this Program was a one-component pre-packaged material which becomes plastic when mixed with water so that it can be trowel applied to form a highly polished finish or can be worked to achieve a textured finish. It was applied to sound plaster walls which were first treated with a vinyl polymer bonding compound to improve adhesion to the existing painted surfaces. The finished thickness of the plaster was approximately 1/8-inch (3.2 mm). Skilled workmen are required for the satisfactory application of this product.

3.4 PACKAGE PLANS

The abatement methods being demonstrated in this Program were grouped in a manner to assure that specific combinations of techniques would be carried out in assigned dwelling units. The groupings or "package plans" shown in Tables 6 and 7 indicate which abatement techniques were carried out in a single dwelling after classification of the unit. according to the housing selection criteria previously discussed. This approach simplified decision making concerning the manner by which the hazard in each unit was to be abated, and ensured that each method was tested in the desired variety of housing units.

4. ABATEMENT METHOD ASSIGNMENT

A total of 35 housing units was originally required for the Washington Program. Fifteen were intended for use in demonstrating package

Table 6

ABATEMENT PACKAGE PLANS FOR DWELLING UNITS MEETING HOUSING SELECTION CLASSIFICATION I

	WALLS		TRIM		DOORS	WINDOWS
	DRY AREA	WET AREA	DRY AREA	WET AREA		
I-A	GYPSUM BOARD PAINT	GYPSUM BOARD PAINT	REPLACE WITH WOOD	REPLACE WITH WOOD	REPLACE	REPLACE
I-B	VENEER PLASTER PAINT	VENEER PLASTER PAINT	REPLACE WITH WOOD	REPLACE WITH WOOD	REPLACE	REPLACE
I-D	GYPSUM-JUTE	GYPSUM-JUTE	FILLED PAINT	FILLED PAINT	REPLACE	REPLACE
I-F	CEMENT PAINT	MELAMINE PANEL	CEMENT PAINT	MELAMINE PANEL	SOLVENT STRIP REPAINT	SOLVENT STRIP REPAINT
I-G	PLYWOOD PANEL	CEMENT-GLASS	REPLACE WITH VINYL BASE	REPLACE WITH VINYL BASE	DIP TANK REPAINT	SOLVENT STRIP REPAINT

Table 7

ABATEMENT PACKAGE PLANS
FOR
DWELLING UNITS MEETING HOUSING SELECTION CLASSIFICATION II

	WINDOWS	DOORS	BASEBOARD	ALL OTHER TRIM
II-A	REPLACE	REPLACE	REPLACE WITH WOOD	REPLACE WITH WOOD
II-B	REPLACE	REPLACE	REPLACE WITH VINYL	REPLACE WITH VINYL
II-C	SOLVENT STRIP REPAINT	SOLVENT STRIP REPAINT	VINYL	REPLACE WITH WOOD
II-D	SOLVENT STRIP REPAINT	SOLVENT STRIP REPAINT	SOVLENT STRIP REPAINT	SOLVENT STRIP REPAINT
II-E	HEAT GUN REPAINT	HEAT GUN REPAINT	HEAT GUN REPAINT	HEAT GUN REPAINT
II-F	HEAT GUN REPAINT	HEAT GUN REPAINT	HEAT GUN REPAINT	HEAT GUN REPAINT
II-G	SOLVENT STRIP REPAINT	DIP TANK REPAINT	SOLVENT STRIP REPAINT	SOLVENT STRIP REPAINT

plans I-A, I-B, I-D, I-F and I-G. The remaining 20 units were to be used for demonstrating package plans II-A through II-G. Unfortunately only 15 units meeting the criteria for Classification II could be found during the time allotted for housing selection and, therefore, a total of 30, instead of 35 units were included in the Washington Program. In 15 of these units, Package Plans series II were assigned to abate the lead paint hazard on walls, doors, windows and trim.

The detailed assignment of the package plans and abatement methods, to all 30 units, are shown in Tables 8 and 9.

5. EVALUATION OF THE ABATEMENT PROCESSES.

This section of the report is a critique and commentary on the effectiveness of the plans and systems under test for lead paint hazard abatement in the Washington Program. It contains discussions of the suitability of the abatement process assignments, adequacy of the abatement specifications, implementation characteristics of the abatement methods and the effectiveness of the lead abatement techniques.

5.1 SUITABILITY OF ABATEMENT PROCESS ASSIGNMENT

The significance of the selection and assignment of specific package plans to the 30 dwellings in Washington was severely limited by the lack of variance in the physical characteristics and conditions of the units and the surface areas for which the hazard was to be abated. Barrier materials which were primarily intended for use in dry areas were applied in kitchens and bathrooms because of the nonexistence of hazardous lead paint in bedrooms and dining rooms. The almost consistent condition of sound walls in the units resulted in almost no opportunity for engineering judgement in the selection of abatement methods to be

Table 8
ABATEMENT METHODS
Package Plan and Dwelling Unit Assignment
for Housing Meeting Selection Classification I

Pkg. Plan	Dwelling Unit No.	WALLS BARRIERS	WALLS SQ.FT	WALLS KIT	WALLS BATH	DOOR Replaced (number)	DOOR TRIM Replaced (LF) *	WINDOW Replaced (number)	WINDOW TRIMS Replaced (number)
I-A	022	gypsumboard	550	1	1	8	---	---	4
	078		550	1	1	8	---	---	2
		TOTALS	1,100	2	2	16	---	---	6
I-B	023	Veneer -	550	1	1	8	---	3	3
	077	Plaster	550	1	1	8	---	---	---
		TOTALS	1,100	2	2	16	---	3	3
I-D	071		550	1	1	6	15	---	2
	072	Gypsum/Jute	550	1	1	4	---	---	---
	073	fabric	550	1	1	6	---	---	---
		TOTALS	1,650	3	3	16	15	---	2
						Solvent on-site	Solvent on-site		Solvent on-site
I-F	063		200	---	1	3	3	---	---
	069	Melamine	300	1	---	2	11	---	12
	074		600	1	1	5	---	---	---
		TOTALS	1,100	2	2	10	14	---	12
						off-site	on-site		Replace
I-G	018		500	1	1	5	---	---	3	3
	019		550	1	1	6	---	---	3	4
	021	Cement/Glass	550	1	1	10	1	1	2	2
	020	Fabric	575	1	1	8	2	---	---	---
	061		510	1	---	---	1	2	---	Solvent (2) on-site
		TOTALS	2,685	5	4	29	4	3	8	9 (2)

* Linear Feet

Table 9

ABATEMENT METHODS

Package Plan and Dwelling Unit Assignment for Housing Meeting Selection Classification II

PKG. PLAN	DWELLING UNIT ASSIGNMENT DESIGNATION	DOORS REPLACED (Number)	DOORS TRIM REPLACED (LF)*	DOORS TRIM REPLACED (No)	WINDOWS REPLACED (Number)	WINDOWS TRIM REPLACED (Number)	CABINETS SOLVENT ON-SITE
II-A	001	8	155	10	6	6	--
	002	1	113	6	3	3	--
	003	8	158	10	7	7	Kitchen
	024	1	78	5	4	4	Medicine
	TOTALS	18	504	31	20	20	
II-B	064	3	142	10	--	--	Kitchen
	065	1	224	15	14	14	---
	067	1	176	12	8	8	Medicine
	TOTALS	5	542	37	22	22	
		SOLVENT -ON-SITE (Number)	SOLVENT ON-SITE (LF)	SOLVENT ON-SITE (No)	SOLVENT ON-SITE (Number)	SOLVENT ON-SITE (LF)	SOLVENT ON-SITE (No)
II-C	114	--	140	14	4	34	4	Medicine
	060	5	80	8	10	47	10	kitchen
	068	8	210	21	--	66	13	---
	070	10	90	9	7	33	7	Medicine.
	TOTALS	23	520	52	21	180	34	
II-D	004	3	---	--	5	33	5	
		HEAT (Number)	HEAT (LF)	HEAT (No)		HEAT (LF)	HEAT (No)	
II-E	015	3	40	4	1	6	1	
II-F	079	--	60	6	2	64	6	Kitchen medicine
		SOLVENT (Number) on	SOLVENT (Number) off	SOLVENT (LF) Number	SOLVENT (No) Number		SOLVENT (LF) Number	SOLVENT (No) Number	
II-G	012	6	3	120	12	4	18	4	

* Linear Feet

used in particular cases. In short, there were no substantive decisions made in the match-up of dwellings with package plans at the beginning of the Program.

In spite of the limited opportunities, some important lessons were learned as a result of abatement method assignments that were less than optimal. Doors that were removed for stripping at the off-site dip tank had to be temporarily replaced in occupied units. That process should have been limited to use for only unoccupied dwellings. In a few cases, sound ornamental wood trim was replaced with non-ornamental molding and deteriorated trim was stripped and left in place.

5.2 ADEQUACY OF SPECIFICATIONS

The specifications used by the contractor in Washington were prepared by the Boeing field team. Using instructions for the use of materials and equipment and directions on safety precautions, waste disposal and conditions of work (supplied by NBS), Boeing developed the scope of work for each of the 30 dwelling units.

The materials and installation specifications for all of the abatement methods (as presented in Appendix 1) include the following:

Specification Title	Specification No.
General Requirements	0101*
Solvent Based Paint Remover	0922
Electrical Heat Gun	0923
Dip Tank Stripping of Doors	0925
Painting	0919
Gypsum Impregnated Jute Fabric	0906
Gypsum Wallboard	0901
Melamine Coated Hardboard	0905
Gypsum Veneer Plaster with Bonding Agent	0912

*Window, door and trim replacement are covered in part five of this specification.

Six contract document packages, each containing work scopes and specifications for three to six dwelling units per package, were prepared for the 30 dwellings. The completed documents were reviewed by HUD and NBS before the abatement contracts were advertised for competitive bids. Although each package received separate bids, the award for all six packages was made to one contractor who was the low bidder in each case.

During the contracting process the contractor was contacted several times to ascertain his suggestions, comments, or criticism of the specifications. Neither he or his foremen had any criticism.

Technical and work related problems did occur during the Program but none of the problems were related to a failure or inadequacy of the specifications. In fact, most of the problems were caused by failure of the contractor to follow the specifications.

5.3 IMPLEMENTATION CHARACTERISTICS

One of the major objectives of the field demonstrations of lead paint hazard abatement methods is the evaluation of the technical feasability and operational characteristics associated with the implementation of each method.

Implementation characteristics pertain to the working aspects of lead paint hazard abatement. The field engineer or evaluator is primarily concerned with functions such as: materials availability; the transportation of materials and equipment to the work-site; the process of applying materials or techniques to surfaces which require abatement; waste disposal; safety; finished appearance and other issues.

Implementation data and information were obtained for each abatement

method demonstrated in the Washington Program by on-the-job observations both during and after the completion of the work in each dwelling unit. The final ratings were based not only upon the observations and conclusions of those filling out the rating sheets, but also on information and opinions acquired as a result of debriefings of the contractor's workmen, their supervisors and representatives of the NCHA.

The major responsibility for rating the abatement methods was that of the NBS field staff. NBS personnel attempted to keep abreast of the progress of the work, in each of the 30 units, through frequent contact with Boeing, the contractor and the NCHA so that they could plan to be on hand to inspect each job at important stages of the work. This was in fact difficult to accomplish because the contractor could not maintain meaningful schedules due to: poor planning; late materials deliveries; unscheduled vacations by workmen, and occasional denial of entrance to the units by the tenants.

5.3.1 IMPLEMENTATION CHARACTERISTICS RATING SHEET

A rating sheet was developed, based on the Matrix Priority Rating System described by Dunford [4], in order to record and evaluate the performance of field demonstrated lead paint hazard abatement methods. The basic attributes by which the characteristics of a lead paint hazard abatement method can be defined are: safety; cost; appearance; physical properties and the effectiveness of abatement. Of these attributes only the first three (safety, cost and appearance) relate specifically to the work aspects or implementation of the abatement.

The implementation factors shown in Figures 2A, 2B, and 2C are derived from the three broad attribute catagories of safety, cost, and

Figure 2A

IMPLEMENTATION CHARACTERISTICS RATING SHEET

Subcontractor _____ Technique, System or Material Evaluated _____ Address _____

Contract No. _____ Evaluator _____ Date _____ City _____

IMPLEMENTATION FACTORS	(A) Criteria Weight	Ranking Rates (B) 5	5	4	3	2	1	Score A x B	Remarks
A. Preparation									
1. Surface preparation needed	15	N/A	none	small	med.	large	V. large		
2. Substrate preparation needed	15	N/A	none	small	med.	large	V. large		
3. Relocation or modification of fixtures utilities or heat outlets	10	N/A	none	small	med.	large	V. large		
							Total		
B. Materials Supply									
4. Adequate supply	15	N/A	yes				no		
5. Local or non-local supply	5	N/A	local				non-local		
							Total		
C. Materials and Equipment Handling & Transport.									
6. Ease of transportation of materials to the jobe site	2	N/A	very easy	easy	fairly easy	diff.	very diff.		
7. Materials damage resistance during trans.	2	N/A	very high	high	fairly high	low	very low		
8. Ease of handling and moving of materials or equipment on the job.	2	N/A	very easy	easy	fairly easy	diff.	very diff.		
9. Materials or equipment damage resistance on the job.	3	N/A	very high	high	fairly high	low	very low		
10. Ease of transportation of equipment to the job site.	1	N/A	very easy	easy	fairly easy	diff.	very diff.		

CIRCLE RANKING WORD

Total _____

Figure 2B

Implementation Factors	(A) Criteria Weights	Ranking Rates (B) 5	5	4	3	2	1	score A x B	Remarks
D. Relative Ease of Installation									
11. Ease of cutting or shaping materials	5	N/A	very easy	fairly easy	fairly diff.	diff.	very diff.		
12. Ease of application of process generally	8	N/A	very easy	fairly easy	fairly diff.	diff.	very diff.		
13. Ease of application of process to contoured surfaces	8	N/A	very easy	fairly easy	fairly diff.	diff.	very diff.		
14. Impairment or destruction of areas adjacent to those being deleaded	5	N/A	none	slight	medium	heavy dam.	destruction		
15. Amount finishing work required	8	N/A	none	small	medium	large	very large		
16. Need for non-standard fabrication	3	N/A	none		Needed for part of job		essential for all of the job		
17. Familiarity with, or adaptability to, deleading system	3	N/A	compl. fam. or very adap.		some-what fam. or adap.		not fam. or not adap-tible		
E. Special Equipment Requirement								TOTAL	
18. Need for ordinary power tools	5	N/A	no	very little	moder.	consider-able	essen-tial		
19. Need for special tools or equipment	15	N/A	no	very little	moder.	consider-able	essen-tial		
F. Finished Appearance								TOTAL	
20. General quality and appearance of finished job	20	N/A	ex-cell.	very good	accep-table	poor	very poor		
								TOTAL	

Figure 2C

Implementation Factors	(A) Criteria Weights	Ranking Rates (B) 5	5	4	3	2	1	Scores A x B	Remarks
G. Waste Disposal and Cleanup									
21. Amount of Waste	5	N/A	none	very little	medium	large	very large		
22. Ease of waste removal and disposal	3	N/A	no waste	very easy	fairly easy	diff.	very diff.		
23. Ease of cleanup after job completion	2	N/A	very easy	easy	fairly easy	diff.	very diff.		
							TOTAL ____		
H. Safety									
24. Potential danger of materials	10	N/A	none	small	moderate	high	very high		
25. Potential danger of equipment	10	N/A	none	small	moderate	high	very high		
26. Need for safety equipment at job site	4	N/A	none	small	moderate	consid.	essen. for all the job		
27. Need (if any) for special handling of toxic waste disposal	8	N/A	none	small	moderate	consid.	essen. for all waste disposal		
28. Discomfort of workmen caused by materials or equipment	8	N/A	none	small	moderate	great	very great		
							TOTAL____		

GRAND TOTAL _____

appearance. For example, preparation work, material supply and ease of installation will clearly impact the cost of hazard abatement. The factors for safety and appearance are self evident.

The total point value, for the criteria weight, is 200. The distribution of points is as follows:

Safety - 200
Cost - 700
(labor-450; materials-150; and equipment-100)
Appearance -100

The allocation of these criteria weights was, of necessity, based on engineering judgement and an intuitive feeling for those factors which are most significant in evaluating and judging alternative and varied abatement methods. The evaluation system for implementation characteristics is flexible and criteria weights can be changed as experience demands. The implementation characteristics, shown in Figures 2A, 2B, and 2C, are grouped into eight categories, (A through H as defined below).

A. Preparation of substrate prior to application - This includes surface and substrate pre-treatment, and relocation or modification of fixtures, utilities or heat outlets (if necessary) prior to application of the abatement technique, system, or material. Barrier and replacement systems and paint removal techniques generally require relocation or modification of fixtures, utilities or heat outlets.

B. Materials Supply - This deals with the relative availability of the materials in the quantities required and the sources of supply (local or not).

C. Materials and Equipment Handling and Transportation - This category refers to the ease of transportation of materials and equipment to the job sites and the relative resistance of materials to damage during transportation to, and handling at the job site.

D. Relative Ease of Installation - This category covers such characteristics as: ease of cutting or shaping materials; ease of application of materials generally; ease of application to contoured surfaces; impairment or destruction of areas adjacent to those being abated; amount of finishing work required; need for non-standard fabrication of parts or components and familiarity (of the contractor) with, or adaptability to, the deleading system being evaluated.

E. Special Equipment Requirement - This category considers the need for both ordinary and special power tools and equipment. The scores for this category grade from a maximum for those systems requiring no power tools of any kind to a minimum for those which require special power tools for installation.

F. Finished Appearance - For brevity, the lead paint hazard removal techniques or systems being evaluated in this project are named to describe only the hazard removal part of the procedures (e.g., paint removal: solvent method; replacement of doors, windows, etc.) with no reference to any finishing procedures necessary to complete the task. However, for most systems, finishing work is required. Consequently the term "finished appearance" means the appearance of the completed job after the finishing work,

such as painting, planing, or the application of beading, if necessary, has been done.

G. Waste Disposal and Cleanup - Waste disposal and cleanup consists of the following factors: amount of waste; ease of waste removal and disposal; ease of cleanup after job completion. This category is particularly important insofar as it affects labor costs and the possible need for special containers for handling the waste accumulated from an abatement method.

H. Safety - This important category includes consideration of the following factors: potential danger of materials and equipment used for the job; need for safety equipment at the job site; need for special handling of toxic waste disposal; discomfort of workmen and/or occupants caused by materials or equipment. A potential danger of injury, from the use of hazardous equipment or materials required for implementation of lead paint hazard abatement method, is a major consideration in obtaining an overall rating for the method. The safety of not only the workmen but also the tenants (especially children) is extremely important. The need for great deal of caution on the job, including special safety equipment, and special handling of waste, can cause very expensive job delays.

A numerical value called a "criterion weight" is assigned to each implementation factor. This value was based upon engineering judgement of the relative importance of each criterion in obtaining a total rating for each system. Ranking answers were assigned to each implementation factor and numerical "ranking rates" to each rank.

In using the rating sheet to evaluate a system, a ranking rate is decided upon for each implementation factor. A score is obtained by multiplying the criterion weight by the value of the ranking rate. The scores for each implementation factor are totalled for each of the eight categories in the rating sheet, (i.e., Preparation, Materials, Supply, etc.), and these, in turn are added together to obtain the total rating for the system. The higher the score obtained, the better are its implementation characteristics. A space is given on the right hand side of the rating sheet for pertinent remarks, if any, which might assist in increasing the accuracy of the appraisal of a system.

Some systems (paint removal is an obvious example) require no cutting or shaping. Consequently the meximum score available is given to such systems for this characteristics. Where ease of application, of materials, to contoured surfaces does not apply for a system, (for example in replacement of doors, windows, and trim,) the maximum score possible is given.

5.3.2 DISCUSSION OF IMPLEMENTATION CHARACTERISTICS OF ABATEMENT METHODS

The summary ratings of eleven lead paint hazard abatement methods in each of eight implementation characteristic categories are presented in Table 10. The numerical values are composites of the evaluations of the NBS technical staff and the Boeing field team. The first five entries in the Table represent barrier materials which are intended for use in abating lead paint hazards on walls. The remaining six techniques are intended for the abatement of lead paint hazards on windows, doors, trim, and similar surfaces. Although the evaluation ratings of the two groupings (barrier materials vs. replacement of paint removal) are not directly comperable, the actual values do indicate general relationships among the abatement methods.

The ratings are consistent with the general engineering sense and intuition arising from a great deal of exposure to the implementation process and the related field work. Indeed, the general consensus of the evaluators was that the fabric wall coverings were easiest to install and the replacement of windows entailed the greatest number of problems.

A general discussion of the implementation characteristics of the abatement methods and the significance of particular ratings follows.

5.3.2.1 SOLVENT BASED PAINT REMOVER

Viscous paint removers are applied to vertical and horizontal painted wood surfaces with a brush. After about twenty minutes the softened paint is scraped with a variety of metal tools and the solvent-paint waste is collected on polyethylene drop cloths.

ADVANTAGES - Paint removal using solvent-based strippers is a commonly used procedure which is extremely familiar to all types of redecoration

Table 10

Summary Ratings of Implementation Characteristics
(Abatement Processes)

Abatement Methods		Maximum Possible Score								
		Preparation (200)	Materials Supply (100)	Materials & Equip. Handling & Transportation (50)	Relative ease of Installation (200)	Special Equipment Required (100)	Finished Appearance (100)	Waste Disposal & Clean-up (50)	Safety (200)	TOTAL (1000)
Barrier Material	Gypsum Impregnated Jute Fabric	155	80	45	186	100	80	42	200	888
	Cement Impregnated Fiberglass	155	80	45	186	100	80	42	200	888
	Melamine Coated Hardboard	170	100	35	117	80	80	35	186	803
	Gypsum Wallaboard	170	100	21	109	100	60	28	192	780
	Gypsum Veneer Plaster with Bonding Agent	110	100	31	103	70	60	18	200	692
Replacement	Trim Door & Window Frames	170	100	43	161	90	80	32	168	844
	Door	160	100	41	165	90	80	32	168	836
	Window	140	20	34	141	90	80	27	138	670
Paint Removal	Electric Heat Blower	200	80	44	173	40	60	30	136	763
	Solvent	200	100	50	111	100	60	10	70	701
	Dip Tank	170	80	37	163	40	60	42	82	674

and renovation workers. It is easily done by a single unskilled laborer and no special tools or equipment are required. Adequate solvents are readily available at local wholesale and retail building materials supply outlets.

DISADVANTAGES - Solvent-based strippers used in Washington were not capable of removing multiple layers of paint with a single application. The general experience was that the cycle (of solvent application, reaction time and scraping) had to be repeated 3 to 4 times on typical multi-layer painted surfaces.

The solvent-paint combination is gummy and somewhat difficult to handle and dispose of. The waste accumulated on the drop cloths does not dry hard and tends to be tracked throughout the dwelling unit.

Significant safety precautions must be followed in order to control the hazards inherent in the use of solvents. Adequate ventilation is necessary, smoking and the use of open flame must be avoided as well as direct skin contact with either the solvent or solvent-paint combination.

In general, extensive stripping of paint surfaces with solvents was a cause of discomfort and displeasure to the workmen. This lack of acceptance by the workmen could have been the cause of poorer workmanship and less efficiency compared to the use of the heat gun.

5.3.2.2 PAINT REMOVAL WITH ELECTRIC HEAT GUN

The electric heat gun delivers forced hot air at temperatures which are high enough to soften paint so that it can be scraped and removed from wood substrates with a variety of metal tools. (See Figure 3)

ADVANTAGES - Very thick layers of paint, consisting of multiple coats, can be stripped from wood surfaces at a single pass. In fact, it was

Figure 3 - Scraping lead paint softened by Electrical Heat Gun.

generally observed that the ease of stripping increased with increasing paint thickness probably because of the greater absorption and retention of heat and the greater entrapment of solvents in the old coatings.

The device is portable and is easily operated by a single unskilled laborer. The nozzle from which the heated air emanates is held in one hand, and the other hand is used for scraping the paint immediately after it is softened.

Aside from the minimal danger of being injured by misdirected hot air the entire procedure is relatively free of hazards. The paint scrapings are hazardous by virtue of their lead content but they are dry and hard almost immediately after removal from the substrate and they are easily collected and disposed of. There is no significant fire hazard.

In general the device is easily controlled, there are minimum discomforts to the operators, and target areas can be stripped quickly and neatly without damage to the substrates or adjacent areas.

DISADVANTAGES - In addition to the overall disadvantages inherent in all paint removal methods (need for refinishing, waste disposal, etc.) the use of the heat gun often requires auxilary electrical power. The device draws 20 amperes at 115 volts AC which most of the dwellings that require lead paint hazard abatement do not have. Portable generators and sufficient elecrical cable is required to reach rooms in multiple storied buildings.

5.3.2.3 REMOVAL OF PAINT ON DOORS BY DIP TANK METHOD

Selected doors were removed from their locations and taken to a local furniture stripping firm where they were immersed in large solvent filled tanks in order to remove the lead paint. Door knobs were taken off but

hinges were allowed to remain on the door. The stripped doors were dried, returned to the dwelling units, and rehung in their original locations. (see Figure 4).

ADVANTAGES - Except for the fact that the removal and disposal of lead paint occurs at a location away from the dwelling unit, no significant advantage was gained from the use of the off-site commercial paint stripping procedures in Washington. The development of dip tanks (for use especially on doors) which could be brought to the work site might lead to greater speed, efficiency and applicability to lead paint hazard abatement objectives.

DISADVANTAGES - Commercial furniture stripping establishments are not geared to the stripping of large numbers of doors which are heavily coated with pigmented paints. The turn-around time, from removal to replacement was one week. During that time, temporary doors had to be hung in the dwelling units in order to maintain privacy and security.

The prolonged exposure of the doors to aqueous based alkaline solvents resulted in excessive swelling of the wood. Carpenters were required to plane the doors before they could be rehung in their original locations.

In general, what was hoped would be a mass-production process, turned out to be a time consuming one requiring individual skilled attention, to each individual door.

5.3.2.4 COMPONENT REPLACEMENT

Selected windows, wood doors and miscellaneous wood trim were removed and replaced with components which were chosen or constructed to resemble the original items as closely as possible (See Figure 5, typi-

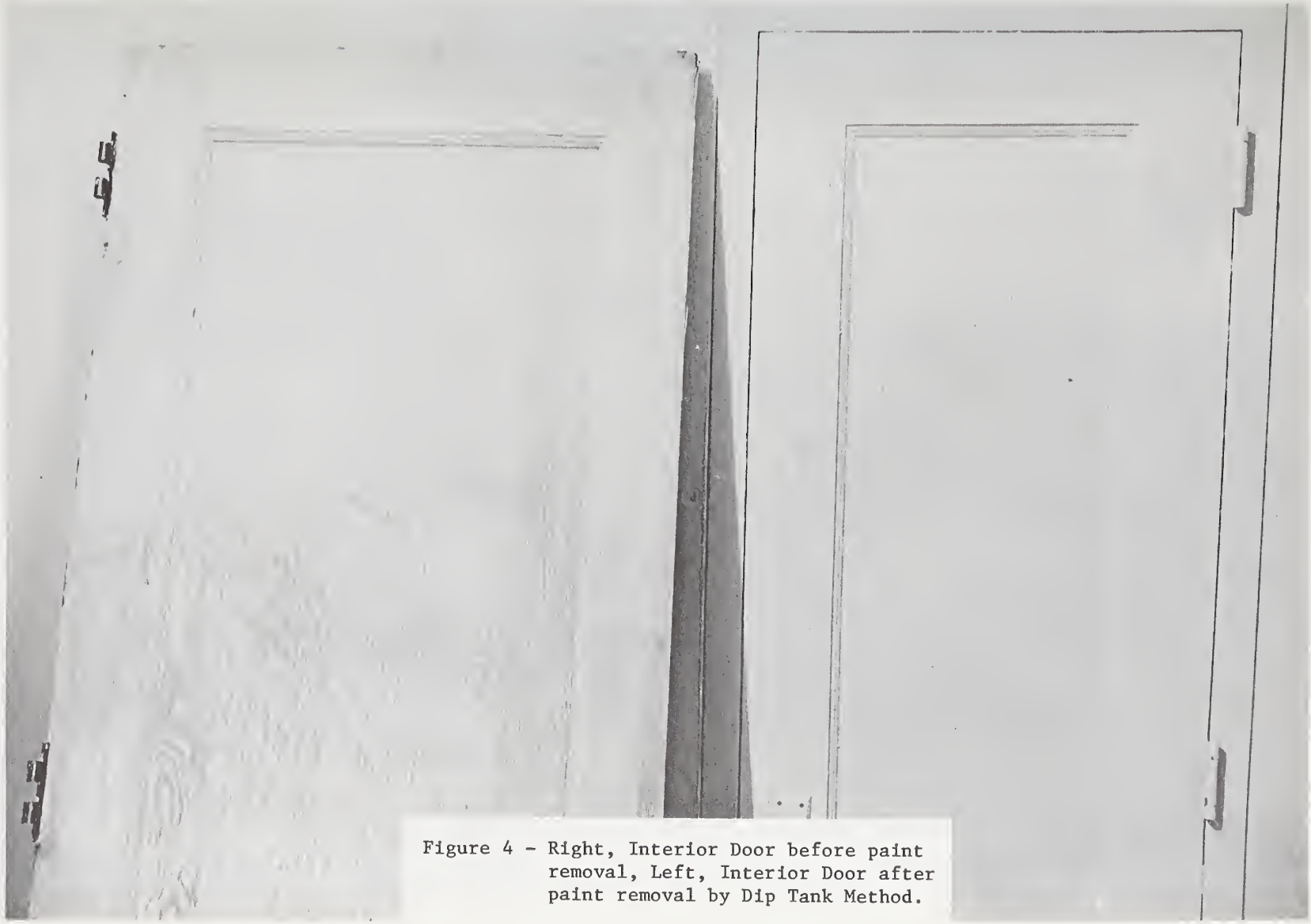

Figure 4 - Right, Interior Door before paint removal, Left, Interior Door after paint removal by Dip Tank Method.

Figure 5 - Installing wood double hung window and trim.

cal wooden window installation). Steel casement windows were replaced with aluminum double hung windows.

ADVANTAGES - Wood trim and wood doors were removed and replaced easily and quickly by skilled carpenters. Plain trim and doors were readily available at local wholesale and retail building materials suppliers.

The avoidance of paint stripping eliminates the hazards of fire and toxicity and the difficulties of clean-up and simplifies the problem of hazardous waste transportation and disposal.

The replacement of inoperative or heavily damaged windows with a functional component enhances the safety (in terms of emergency egress) and comfort control of a dwelling.

DISADVANTAGES - Ornate trim in older housing is very difficult to replace with similar or comparable trim. Such replacements are often unaesthetic and unacceptable to the dwelling occupants or owners.

Replacement doors were usually hollow core types which are not as sturdy and secure as the solid hardwood doors usually found in older dwellings.

Steel casement windows were taken out by removing bolts that hold the assembly in place. These bolts were usually corroded and difficult to loosen. Wood double hung windows were replaced by first ripping or prying away the trim molding around it. This process usually entailed considerable damage to the plaster walls around the window. Broken glass was both an inconvenience and a hazard.

The storage of replacement trim, doors and windows is a problem in occupied dwellings. There was usually insufficient work space for custom carpentry. In cases where standard or commonly available replacement

windows are not acceptable, the procurement of special order items can cause prolonged delays.

5.3.2.5 GYPSUM IMPREGNATED JUTE FABRIC AND CEMENT IMPREGNATED GLASS FABRIC

The impregnated jute and glass fabric are applied to walls in the same manner as wallpaper or any heavy duty wall covering. (See Figures 6 and 7). The two products demonstrated in Washington were supplied by the same manufacturer and were installed by the same workmen with no differences in techniques or procedures. The following comments refer to both materials because of the similarity of their installation.

ADVANTAGES - The jute and glass fabrics are capable of bridging minor cracks and wall surface imperfections. The wall coverings are very easily applied by workmen who are familiar with wallpapering. Only one skilled workman is required to handle the job but a helper increases speed and efficency to a significant degree. The materials are cut easily and adhesive is applied by roller. (See Figure 8). No toxic waste is generated, no other hazards are involved and cleanup is minimal.

In general, there are no significant problems associated with the use of these products. They are easily manipulated and applied.

DISADVANTAGES - Surfaces must be adequately prepared prior to installation in order to assure proper adhesion. Loose or cracked paint must be scraped and damaged areas have to be repaired, sealed or primed. Dirty or grease laden surfaces require cleaning.

5.3.2.6 MELAMINE COATED HARDBOARD

This rigid board product was applied to flat wall surfaces with adhesive. Trim molding was nailed to the hardboard and through to the walls at the ceiling, floor, and wall corners and edges.

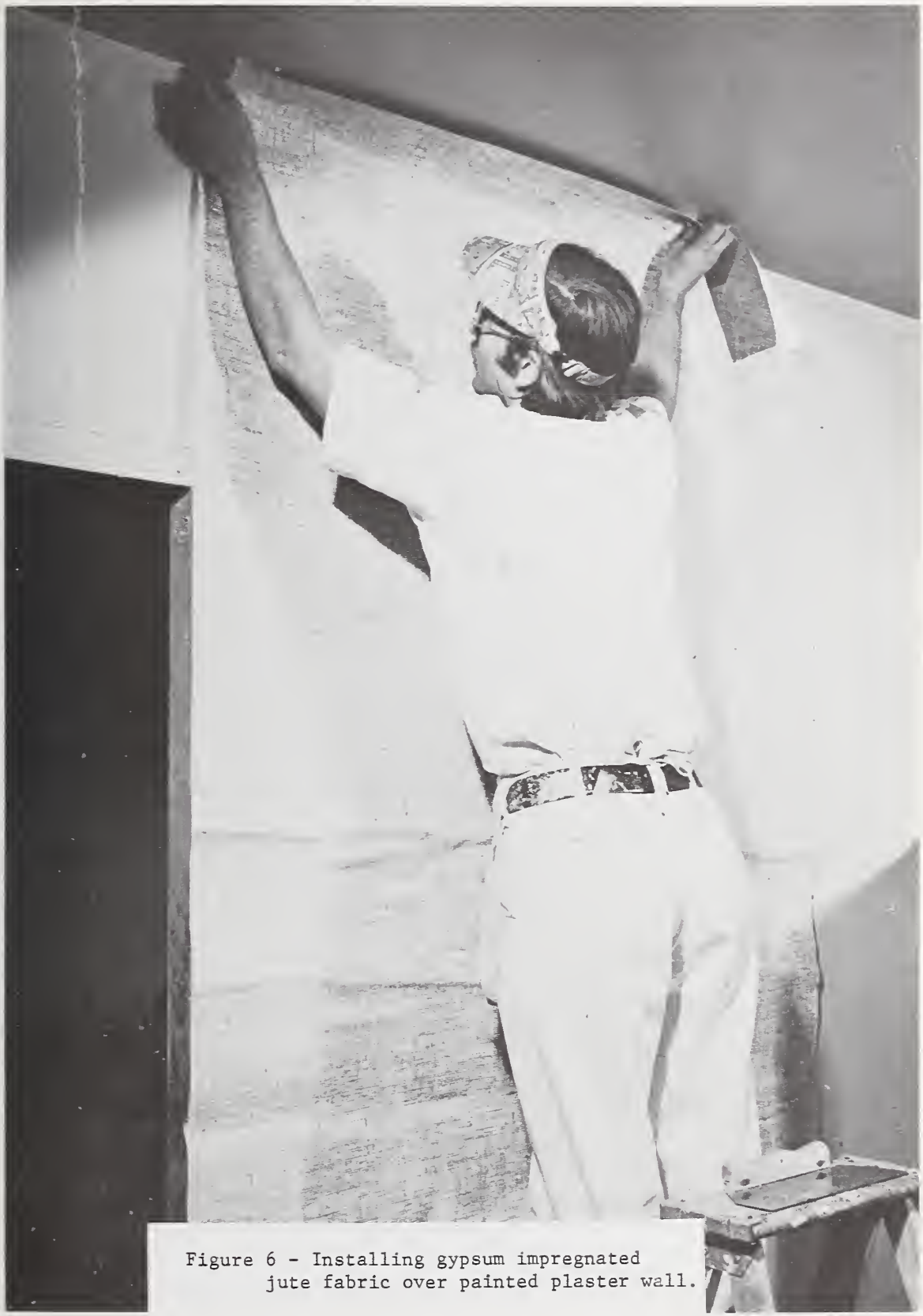

Figure 6 - Installing gypsum impregnated jute fabric over painted plaster wall.

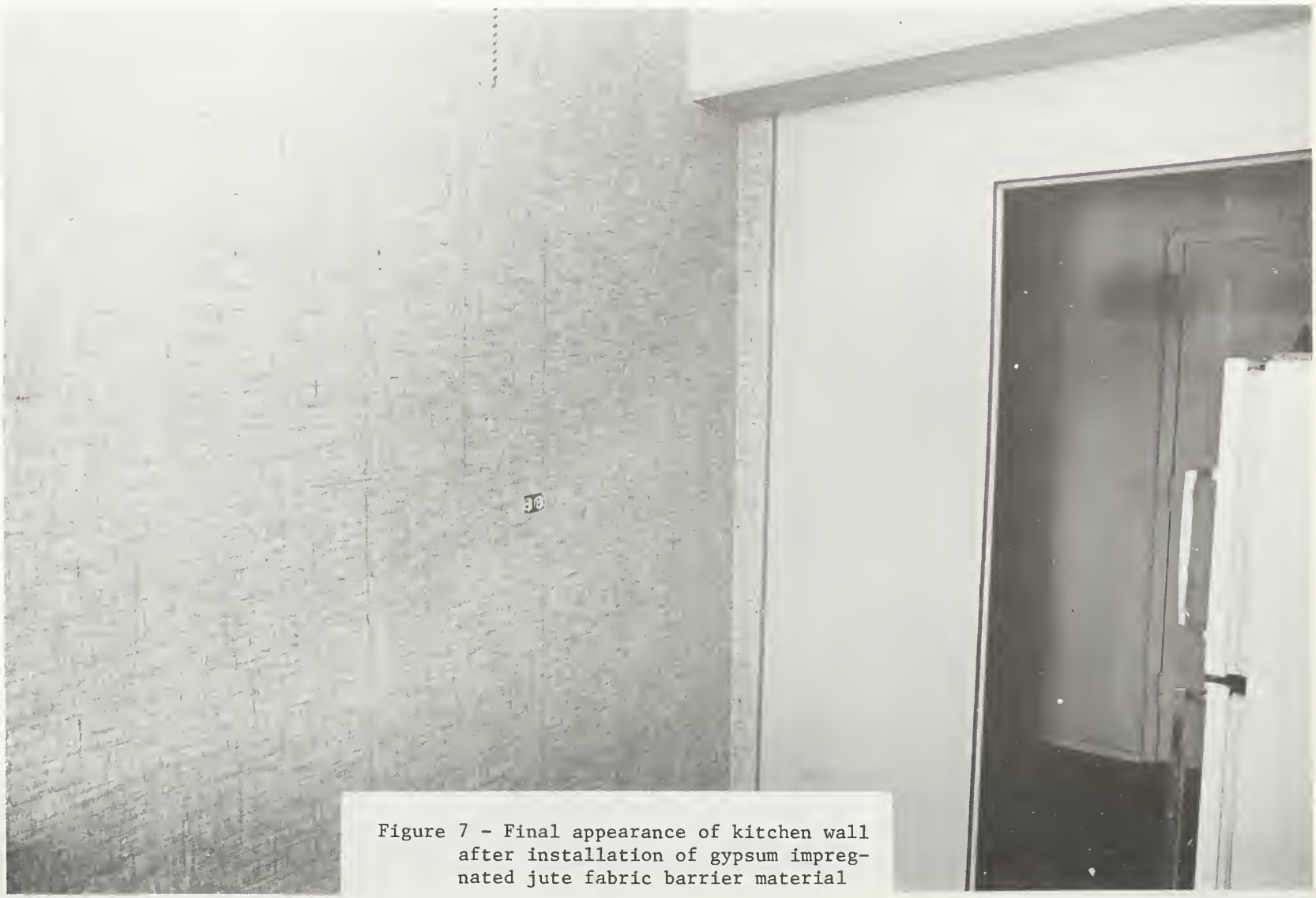

Figure 7 - Final appearance of kitchen wall after installation of gypsum impregnated jute fabric barrier material

Figure 8 - Applying latex based aqueous adhesive to gypsum jute fabric

ADVANTAGES - As in the case of similar rigid board products, with high impact resistance, this material can be applied directly over seriously deteriorated walls, with large voids, without prior repair. The melamine surface is factory applied and offers an attractive, durable finish. The product is non-toxic and presents no significant hazard to workmen or occupants during the installation. It is readily available at local retail and wholesale building materials suppliers.

DISADVANTAGES - Melamine coated hardboard cannot be installed easily with nails or other metal fasteners. The use of adhesives necessitates a fair amount of surface cleaning and other preparation (scraping loose paint) to assure proper adhesion. The product should be installed by skilled workmen because errors in measurement and cutting, and damage to the melamine surface, cannot be compensated for or repaired easily, as in the case of gypsum wallboard.

Power tools are required to cut the hardboard. A properly finished job includes the installation of trim molding at the floor and ceiling and at all corners and edges.

There are difficulties in manipulating, cutting and placing large rigid boards in the confined working environment of occupied dwellings.

5.3.2.7 GYPSUM WALLBOARD

This rigid board product was applied to flat wall surfaces with adhesives and nails. (See Figure 9).

ADVANTAGES - This material can be applied directly over seriously deteriorated walls, with fairly large voids, without prior repair. It is easily cut with hand tools and can be nailed easily to a wall surface by hand or with automatic staplers. Although gypsum wallboard is usually

Figure 9 - Adhesive bead being applied to gypsum wallboard. Wallboard is placed directly on old walls, nailed, joints filled and taped. Joint compound is applied to all depressions and joints to provide a uniform surface, and sanded to provide a surface ready for painting.

installed by skilled workmen, damages and mis-cuts can be repaired easily and it can, therefore, be applied by semi-skilled workmen.

Gypsum wallboard is widely available in various thicknesses and lengths at local retail and wholesale building materials suppliers. Contractors are extremely familiar with the product and the procedures for its installation and finishing. There are no toxic hazards involved in its application.

DISADVANTAGES - Installation with adhesives and nails was the method of choice by the sub-contractor on the job. The use of adhesives necessitated surface preparation, including scraping loose paint and cleaning dirt and grease, which would not have been necessary if only nailing had been done.

A substantial amount of finishing work was required including: spackling nail holes; spackling and taping joints; installing and spackling corner beads; finish sanding and finally applying at least two coats of paint.

The product is heavy and is difficult to manipulate, cut and place in the confined working environment of occupied dwellings. The various stages of installation and finishing usually involves various building trades and several days elapsed time between each operations which is generally an inconvenience to occupants.

A considerable amount of gypsum dust results from cutting, and clean-up is a problem. Baseboard trim must be removed prior to installation and then replaced. Electrical switch plates, outlet plates and heat registers have to be reset outwards to accomodate the thickness of the wallboard.

5.3.2.8 GYPSUM VENEER PLASTER

This product is applied to wall surfaces, with a trowel, to a thickness of 3/32 inch (0.79 mm) after the application of a bonding agent which is used to improve the adhesion between the old painted surfaces and the plaster. The one-component plaster is mixed with water at the job-site and is immediately applied as shown in Figure 10.

ADVANTAGES - Veneer plaster can be applied to curved as well as planar wall surfaces. It can fill cracks and can fill other minor voids in otherwise sound substrates. It can be applied rapidly and provides an excellent surface for final finishes.

Because it is essentially a thin coating it can be feather-edged into trim and other molding and there is no necessity for resetting cover plates for electrical fixtures or heat registers. It can be applied easily in confined work areas and around cabinets and other fixtures in kitchens and bathrooms.

DISADVANTAGES - In addition to the application of a bonding agent, other preparatory work, including scraping loose paint and repairing major wall damage, is required prior to troweling on the plaster. A fairly large work area is needed to set up a work table for mixing and preparing the plaster and the work must be done by skilled workmen. (See Figure 11).

After drying, of three to seven days, at least two coats of paint must then be applied and the total elapsed time is generally an inconvenience to occupants. A substantial amount of plaster dust and waste results in a difficult clean-up problem.

5.4 LEAD PAINT HAZARD ABATEMENT EFFECTIVENESS

The effectiveness with which a hazard abatement method prevents a child's access to lead paint depends on either, the degree to which the

Figure 10 - Gypsum veneer plaster being applied over old painted plaster wall.

Figure 11 - Table for mixing plaster and water on the job site.

lead is removed from the child's environment, or the permanence of the physical barrier set up to prevent that access.

The permanence or durability of barrier materials is a function not only of its basic strength and resistance to abuse but its adhesion to the lead paint coated substrate it is meant to defend against. Physical properties, measured in the laboratory can be indicative of the potential performance of a material in actual use. Nevertheless, a real environment may present conditions and forces, which are unpredictable or unreproducible in the laboratory, that may be the cause of the ultimate failure of materials in the field.

A long-term evaluation of the materials used in the dwellings in Washington, by means of periodic inspections, is within the framework of HUD's research objectives. However, at this time, only the results of laboratory tests are available upon which to base an estimate of the durability and performance of those materials.

5.4.1 PHYSICAL PROPERTIES OF MATERIALS USED FOR HAZARD ABATEMENT

The data in Table 11 is abstracted from NBS Technical Note 808 [1] to which the reader is referred for additional details on test methods and conclusions.

5.4.2 REDUCTIONS OF LEAD PAINT CONTENT BY REMOVAL METHODS

Table 12 presents average measurements of lead paint content of specific surfaces before abatement and after paint removal,with solvents, with the electric heat gun or by the dip tank method. Surfaces which were covered with barrier materials were not measured after abatement.

With the exception of the work done in one dwelling unit (Number 069) the paint removal methods achieved reductions of substantial amounts of

Table 11

Physical Properties of Materials

Physical Properties	Materials		
	Gypsum Wallboard	Veneer Plaster	Gypsum Impregnated Jute
Max. Supported Impact Resistance in-lbf. (joule)	80+ (9.0)	80+ (9.0)	80+ (9.0)
Max. Unsupported Impact Resistance in-lbf. (joule)	38 (4.4)	<1 (0.11)	12 (1.4)
Max. Adhesion Bond Strength PSI (MN/m^2)	(a) 40+ (.28)	45 (.31)	20 (.14)

NOTES: Physical properties of cement impregnated glass fabric are comparable to gypsum impregnated jute fabric.

Laboratory data on Melamine coated Hardboard are not available but should be comparable to that of 1/4 in. (6.350 mm) tempered hardboard.

(a) - For adhesive systems only

Table 12
Effectiveness of
Lead Paint Removal
(Before & After Readings mg/cm²)

Methods	Dwelling Unit	Dwelling Unit Type	Doors		Door Frames		Windows		Window Frames		Baseboards		Chair Rails		Cabinets	
			B	A	B	A	B	A	B	A	B	A	B	A	B	A
Solvent	001	MFLR													4.7	0.7
	003	MFLR													5.2	0.4
	004	SFA	2.2	1.4			2.5	1.3	2.9	1.5	3.2	1.3				
	012	SFA			3.8	0.7	3.7	1.4	3.1	0.6					7.0	0.6
	014	SFA			12.7	0.7	7.5	0.8	6.9	0.8					4.7	0.1
	060	SFA	4.6	0.9	5.7	1.1	4.7	0.7	3.6	1.0					8.2	0.4
	061	SFA			8.5	1.0	13.9	1.7	9.8	1.3						
	063	SFA	3.7	0.8	5.3	1.7							10.9	1.8		
	064	SFA													3.4	0.5
	067	SFA													13.2	1.1
	068	SFA	2.4	0.8	6.9	0.2	8.6	0.5	12.5	0.8					6.0	0.6
	069	SFA			22.1	2.6	19.6	5.4	25.5	4.4						
	070	SFA	8.7	0.4	9.0	0.3	10.1	1.7	6.7	1.7	17.6	1.8				
Heat Gun	015	SFA	19.0	0.4	20.0	1.0	19.5	0.8	20.9	1.0						
	079	MFLR	2.9	0.0	4.1	0.2	3.2	0.2	3.5	0.4			3.2	0.1	3.2	0.2
Dip Tank	012	SFA	8.5	0.1												
	018	MFLR	4.0	0.7												
	019	MFLR	4.0	0.9												
	020	MFLR	6.1	0.7												
	021	MFLR	4.6	0.9												
	061	SFA	11.6	1.4												

SFA - Single Family Attached

MFLR - Multifamily Low Rise

B- Before XRF Reading

A - After XRF Reading

lead paint to less than 2.0 mg/cm^2. Residual levels of lead are probably due to the presence of lead which penetration into the wood fibers during the first application of lead-containing sealers or primers. Sub-surface lead pigments or compounds cannot be removed with solvents or the heat gun but this low level residue is not likely to represent a real lead poisoning hazard. Obviously the hazard from chipping and flaking paint is eliminated.

6. PRELIMINARY CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations, pertaining to the abatement methods demonstrated in Washington, are preliminary because of program plans to demonstrate the same methods in the subsequent stages of the EHAP. Variations in the capabilities and responsiveness of sub-contractors; variations in housing conditions and other unpredictable factors will impact the implementation of the abatement methods and consequently their technical evaluation. Final recommendations will be presented at the conclusion of the Program.

6.1 SOLVENT BASED PAINT REMOVER

Solvent based paint remover should be used primarily when only small amounts of trim require abatement, and should be avoided in occupied units.

6.2 PAINT REMOVAL BY ELECTRIC HEAT GUN

Paint removal by electric heat gun is the method of choice for paint removal from trim, especially in occupied or furnished dwellings. Portable electrical generators should be readily accessible because of 20 ampere current requirement.

6.3 PAINT REMOVAL OF DOORS IN DIP TANK

Paint removal of doors in dip tank should be done only if a local

firm can be found which will assure a 1 to 2 day turn-around time for large numbers of doors.

6.4 REPLACEMENT OF COMPONENTS

Windows - should be done primarily if they are no longer functional.

Doors - replacement is preferable to paint removal only if the quality or functionability of the door will be up-graded.

Trim - replacement is the abatement method of choice unless ornate trim cannot be replaced with an equivalent or acceptable substitute.

6.5 GYPSUM IMPREGNATED JUTE FABRIC AND CEMENT IMPREGNATED FIBERGLASS FABRIC.

Gypsum impregnated jute fabric and cement impregnated glass fabric are the materials of choice when walls are in sound condition and there is minimal or (preferably) no peeling paint. They should not be used on walls or ceilings where there is high moisture content or direct water contact such as in tub-shower areas.

6.6 GYPSUM WALLBOARD

Gypsum wallboard is the material of choice when walls are in poor to bad condition with large voids and peeling paint beacuse of it's ease of application with adhesive and/or mechanical fasteners. When coated with water resistant enamel paint it is suitable near tub-shower areas.

6.7 MELAMINE COATED HARDBOARD

Melamine coated hardboard offers no outstanding physical advantages over coated gypsum wallboard.

6.8 VENEER PLASTER

Veneer plaster offers no outstanding advantage over gypsum wallboard

except for its applicability over curved surfaces. It's use should be avoided in occupied dwellings.

7. ACKNOWLEDGEMENTS

The authors express their sincere appreciation to Mr. Marcellus Manley, Architect, NCHA, for his very valuable contribution to the Program in scheduling inspection tours of housing, assisting in the inspections, and help in monitoring the lead abatement work in Washington. Special thanks are also extended to Mr. Stefan Williams, Manager, Langston Dwellings, for his cooperation and help in inspections of the housing, and monitoring the lead paint abatement work at Langston Dwellings.

8. REFERENCES

[1] Waksman, D., Ferguson, J.B., Godette, M. and Reichard, T., "Potential Systems for Lead Hazard Elimination: Evaluation and Recommendations for Use" National Bureau of Standards Technical Note 808, (December 1973).

[2] Boone, T.H., Ray, T.R., and Street, W.G., "Pilot Demonstration of Lead-Based Paint Hazard Elimination Methods, Report on Field Study No. 1", National Bureau of Standards Report, NBSIR 73-231, June 1973.

[3] Boone, T.H., Ray, T.R., and Street, W.G., "Pilot Demonstration of Lead-Based Paint Hazard Elimination Methods, Report on Field Study No. 2", National Bureau of Standards Report NBSIR 74-438, December 1973.

[4] Dunford, R.R., "Decisions, Decisions", Industrial Research p. 27, (July 1974).

9. APPENDICES

Specifications for Abatement Methods used in Washington, D.C.

Appendix

SECTION 0101

General Requirements

Part 1 General

1.1 Work Included in This Section:

Work included under this section of these specifications include providing all utilities, security, safety services, and waste disposal required to complete work covered in statement of work and not specifically eliminated in this section of these specifications.

1.2 Workmanship:

All work performed under this contract shall be accomplished by qualified craftsmen for each task performed and shall be in accordance with good workmanship.

1.3 Codes:

All work shall be accomplished in accordance with all applicable national and local codes.

1.4 Permits:

The contractor shall obtain and pay cost of all required building permits.

1.5 Safety:

The contractor shall take all necessary precautions to assure all work is accomplished in a safe manner and that all materials are used and stored in accordance with the manufacturer's recommendation.

No poisonous or harmful material or dangerous equipment shall be left accessible to tenant of occupied units. All such material and equipment shall be removed from the site at the end of each work day.

The contractor shall provide all required safety equipment for his workmen to assure that the workmen are not exposed to hazards.

Part 2 Utilities

2.1 Public Housing:

In public housing units which are occupied, normal potable water and 120 volt, 15 amp, single phase power (convenience outlets) will be available for use by the contractor at no cost.

In public housing units which are vacant, it shall be the responsibility of the contractor to provide all utilities as required to accomplish work.

2.2 FHA Acquired Properties:

In acquired property units the contractor shall provide all utilities required to accomplish all work covered under this contract at no additional cost.

Part 3 Security

3.1 Public Housing:

In public housing units which are occupied, the contractor shall take every precaution to safeguard property of the occupant during construction. Care must be taken to assure no door or windows are left unsecured when room is not occupied. No window shall be left open at the end of the shift which will expose tenant to danger of falling.

In public housing units which are not occupied, the contractor shall have total responsibility for security during the construction period. It shall be his responsibility to assure the building is secured (locked) at the end of each work day. Boards removed from doors and windows must be replaced at the end of each work shift. The contractor will not be responsible for vandalism which is deemed beyond his control.

3.2 Acquired Properties:

The contractor shall have total responsibility for the security of the dwelling during the construction period. Where units are "boarded up" the contractor shall replace any removed boards at the end of each work shift to prevent any unauthorized entry.

This contractor will not be responsible for any vandalism which is deemed beyond his control.

3.3 Materials and Equipment:

The contractor shall be responsible for the security of all construction equipment and materials stored on site.

Part 4. Dimensions

All dimensions shown in the Technical Scope of Work are approxmate; exact dimensions shall be verified by the contractor.

Part 5 Window, Door, and Trim Replacement

All windows, doors, and trim to be replaced shall be replaced with like quality and to match existing, except where specified otherwise in Technical Scope of Work. Where vinyl base is specified, base shall be 4" top set cove base as manufactured by the Burke Co. or equal. The contractor shall submit to construction engineer, for approval, all replacement items not specified herein.

Part 6 Disposal of Waste Material

The contractor shall remove all waste material from the work site and dispose of it in a safe manner.

Material containing lead-based paint shall not be salvaged.

Part 7 Definitions

The following definitions are for clarification and shall apply to all references herein and the Technical Scope of Work.

Window - (wood) - shall include the glass and the wood casing holding the glass in place.

Window Frame - (wood) - shall include the head, jamb, sill, and all associated trim of frame.

Door Frame - (wood) - shall include the jamb and head and all associated trim of the frame.

Door Stiles - shall include the vertical edges of all doors.
- shall include edges and both faces of panel doors.
- shall include edges and minimum of 4" from edges of flush doors.

SECTION 0922

Solvent Based Paint Remover

Part 1. GENERAL

1.1 Work Covered Under Other Sections:

The scope of work for providing temporary utilities, security, safety and disposal of waste materials is covered under Section 0101 of these specifications.

1.2 Work Included Under This Section:

Work included under this section includes the furnishing of all labor, materials, and equipment required to remove lead bearing paint by scraping after the paint has been softened with a water wash paint remover, as called out in these specifications.

Part 2 PRODUCTS

2.1 Water Wash Paint Remover:

Remover shall be Marine-Industrial grade and shall contain methylene chloride, methyl alcohol, and an agent to cause the paint to emulsify with water.

Part 3 EXECUTION

3.1 Paint shall be allowed to blister and soften.

3.2 Softened paint shall be removed down to the substrate surface as completely as possible using scraping or brushing. In some cases, pigment may remain embedded in wood grain and similar porous materials.

Part 4 DAMAGES

4.1 The contractor shall protect adjacent areas from damages from solvent during the course of his work.

SECTION 0923

Paint Removal by Electric Heat Gun

Part 1. GENERAL

1.1 Work Covered Under Other Sections:

The scope of work for providing temporary utilities, security, safety, and disposal of waste materials is covered under Section 0101 of these specifications.

1.2 Work Included Under This Section:

Work included under this section includes the furnishing of all labor, materials, and equipment required to remove lead bearing paint by scraping after heating and softening with an electrically operated heat blower gun as called out in these specifications.

Part 2. EXECUTION

2.1 Paint shall be allowed to blister and soften.

2.2 Softened paint shall be removed down to the substrate surface as completely as possible using scraping and/or brushing. In some cases, pigment may remain embedded in wood grain and similar porous materials.

SECTION 0925

Paint Removal of Doors in Dip Tank

Part 1 GENERAL

1.1 Work Covered Under Other Sections:

The scope of work for providing temporary utilities, security, safety and disposal of waste materials is covered under Section 0101 of these specifications.

1.2 Work Included Under This Section:

Work included under this section includes the furnishing of all labor, materials, and equipment required to remove paints with a hot alkaline solution complete as called out in these specifications.

Part 2 PRODUCTS

2.1 Paint Remover:

A hot alkaline process shall be used.

2.2 Neutralizer:

Shall be as recommended by the paint remover manufacturer.

Part 3 EXECUTION

3.1 All metal components that could be attacked by paint remover shall be removed or treated as recommended by the paint remover manufacturer.

3.2 Paint shall be allowed to blister and soften.

3.3 Softened paint shall be removed as completely as possible using scraping or brushing. In some cases, pigment may remain embedded in wood grain and similar porous materials.

SECTION 0919

Painting

Part 1. General

1.1 Work Covered Under Other Sections:

The scope of work for providing temporary utilities, security, safety and disposal of waste materials is covered under Section 0101 of these specifications.

1.2 Work Included Under This Section:

Work included under this section includes the furnishing of all labor, materials, and equipment required to paint over surfaces previously covered with lead based paint as called out in these specifications.

Part 2. Products

2.1 Acceptable Manufacturers and Materials:

Except as otherwise specified, materials shall be equivalent to the "best line" or "first line" products of the following manufacturers:

Benjamin Moore & Co.,
Sherwin Williams,
Glidden, or
PPG, Industries or
Sears, Roebuck & Co.

Materials selected for coating systems for each type surface shall be the product of a single manufacturer.

Select types of coatings listed for specific application in Part 3 - Execution of this specification.

Paint shall contain no more than 0.5% lead by weight.

2.2 Colors:

As called out in the Technical Scope of Work.

2.3 Mixing and Tinting:

Deliver paints and emamels ready-mixed to job sites.

Use tinting colors recommended by manufacturer for the specific type of finish.

Fungicidal agent, when applicable, shall be incorporated into the paint by the manufacturer.

Part 3. Execution

3.1 Inspection:

Examine surfaces scheduled to receive paint and finishes for conditions that will adversely affect execution, permanences or quality of work and which cannot be put into an acceptable condition through preparatory work as included in Article 3.2, Preparation.

Do not proceed with surface preparation or coating application until conditions are suitable.

3.2 Preparation of Surfaces:

Wood:

Clean soiled surfaces (with alcohol wash).

Except where rough exterior surface is specified, sand to smooth and even surface, then dust off.

Apply knot sealer to all knots, pitch and resinous sapwood before priming coat is applied.

Fill nail holes, cracks, open joints, and other defects with wood filler after priming coat has dried. Color to match finish color.

Plaster (and Gypsum Wallboard)

Fill narrow, shallow cracks and small holes with spackling compound.

Rake deep, wide cracks and deep holes. Dampen with clear water. Fill with then layers of patching plaster. Fill with thin layers of drywall joint cement.

Allow to dry. Sand smooth. Do not raise nap of paper on wallboard.

Ferrous Metal Surfaces:

Perpare surface in accordance with recommendations of directions of manufacturer of rust-inhibitive primer.

Feather edges of sound paint by grinding, if necessary.

Galvanized Metal:

Clean surface with mineral spirits to remove oily residue. Dry with clean cloth.

Aluminum:

Clean surface with mineral spirits.

3.3 Application:

General Requirements:

Do not apply initial coating until moisture content of surface is within limitations recommended by paint manufacturer.

Apply paint enamel (stain) and varnish with suitable brushes, (or) rollers, (or spraying equipment).

Rate of application shall not exceed that as recommended by paint manufacturer for the surface involved.

Keep brushes, (and) rollers, (and spraying equipment), clean, dry, free from contaminates and suitable for the finish required.

Apply stain with brush, or as recommended by manufacturer.

Comply with recommendation of product manufacturer for drying time between succeeding coats.

Sand and dust between each coat to remove defects visible from a distance of 5 feet.

Finish coats shall be smooth, free of brush marks, streaks, laps or pile up of paints, and skipped or missed areas.

Leave all parts of molding and ornaments clean and true to details with no undue amount of paint in corners and depressions.

Make edges of paint adjoining other materials or colors clean and sharp with no overlapping.

Change colors at locations where colors differ between adjoining spaces or rooms and where door frames do not match wall colors.

Painted Work:

Back prime all exterior woodwork with house paint primer.
Back prime all interior trim.
Runs on face not permitted.

3.4 Cleaning:

Touch up and restore finish where damaged. Remove spilled, splashed, or splattered paint from all surfaces. Do not mar surface finish of item being cleaned. Leave storage space clean and in condition required for equivalent spaces in project.

3.5 Painting Schedule:

A. Surfaces not to be painted:

Face Brick
Pre-finished wall, ceiling and floor coverings.
Items with factory applied final finish.

B. Paint Schedule:

1. Exterior Wood:

Woodwork including siding and trim where leaded paint is removed.

Painted

First coat exterior wood primer compatible with intended finish coat.

Second coat exterior flat latex wood finish.

Stained and varnished.

First coat exterior wood stain
second coat (stained) paste satin varnish
Third and fourth coats exterior satin varnish

Rub between coats with steel wool or extra fine sandpaper.

Painted trim, shutters, doors, windows, etc.

First coat exterior latex enamel wood primer.
Second coat exterior glass latex enamel.

2. Exterior Ferrous Metals.

First coat metal primer.

Touch up shop coated ferrous metals with a primer compatible with shop coat.

Second and third coats exterior enamel.
Minimum total dry film thickness shall be 5 mils.

3. Galvanized Metal:

   First coat galvanized metal primer.
   Second coat exterior enamel.
   Total minimum dry film thickness shall be 5 mils.

4. Exterior Aluminum:

   First coat wash primer
   Second coat exterior enamel

5. Exterior Copper:

   First and second coats copper clear finish.

6. Interior Wood:

   Woodwork (trim) (paneling) and (doors).

      First coat enamel undercoater.
      Second and third coat semi-gloss latex interior enamel.

7. Interior (concrete) (concrete masonry units) (plaster) - Enamel:

   First coat primer-sealer
      (Primer not-required over block filler)

   Second and third coats semi-gloss latex interior enamel.

8. Interior (concrete) (concrete masonry units (plaster) flat finish:

   First and second coats interior flat latex wall paint.

9. Interior Gypsum Wallboard - Enamel:

   First coat primer sealer, second and third coats semi-gloss interior enamel.

10. Interior Gypsum Wallboard - Flat Finish:

    First cost primer-sealer, second and third coats interior flat latex wall paint.

11. Interior Ferrous Metals:

First coat metal primer.

Touch up shop primed metals with primer compatible with shop coat.

Second coat enamel undercoat. Third coat semi-gloss interior enamel. Mimimum total dry film thickness shall be 5 mils.

SECTION 0906

Gypsum - Jute Fabric

Part 1. General

1.1 Work Covered Under Other Sections:

The scope of work for providing temporary utilities, security, safety, and disposal of waste materials is covered under Section 0101 of these specifications.

1.2 Work Included Under This Section:

Work included under this section includes the furnishing of all labor, materials, and equipment required to apply gypsum-jute fabric complete as called out in these specifications.

1.3 Storage and Handling:

Material shall be stored and handled in accordance with manufacturer's specification.

1.4 Environmental Conditioning:

Provide heat to maintain a minimum surface temperature of 40°F for a period of 12 hours before and after application of gypsum-impregnated fabric wall covering.

1.5 Maintenance Instructions:

The owner shall be furnished a copy of the fabric manufacturer's maintenance instructions containing the fabric manufacturer's recommended cleaning materials and application methods including precautions in the use of cleaning materials which may be detrimental to the surface if improperly applied.

Part 2. Products

Materials:

Gypsum-Jute Fabric shall conform to the following:

Color: selected by construction engineer.
Total wall covering weight: 21 oz/sq. yd.
Fabric Backing (count): 9 x 9 1/2
Fabric Backing: Stainless Jute
Fabric Backing Weight: 7.5 oz/sq. yd.
Coating Weight: 13.5 oz/sq. yd.

Fire Hazard Classification: As tested by ASTM E84-61 as applied with manufacturer's approved adhesive in accordance with application instructions provided with the adhesive.

A. Flame Spread: 15 (Class 1)
B. Fuel Contributed: 0
C. Smoke Development: 0

Adhesive shall be as recommended by wall covering manufacturer.

Gypsum-jute shall be as manufactured by Flexi-Wall Systems Division of Wall and Floor Treatment, Inc., Greenville, S.C.

Adhesive shall be recommended by the wall covering manufacturer.

Part 3. Execution

3.1 Surface Preparation:

Loose paint or scale, and any abnormal surface protrusions and water sensitive materials or pigments that bleed in water or oil shall be removed. Enamel or gloss paint surfaces shall be dulled and rinsed with clear water. Complete all other trade work that penetrates the substrate before beginning fabric installation. Starting work shall indicate acceptance of a suitable substrate surface.

3.2 Installation:

Fabric shall be installed in accordance with the recommendations of the manufacturer.

SECTION 0901

Gypsum Wallboard

Part 1 GENERAL

1.1 Work Covered Under Other Sections:

The scope of work for providing temporary utilities, security, safety, and disposal of waste materials is covered under Section 0101 of these specifications.

1.2 Work Included Under This Section:

Work included under this section includes the furnishing of all labor, materials, and equipment required to install gypsum wallboard complete as called out in these specifications.

Part 2 PRODUCTS

2.1 Gypsum Wallboard:

Wallboard shall be in accordance with ASTM C 36-70 or Federal Specification SS-L-30C, Type III, Grade R, Class 1, and shall be 3/8-inch thick (directly on walls) and 1/2-inch (when furred attachment is used.)

2.2 Molding:

Corner bead shall be U.S. Gypsum No. 101 Dura-bead or equal. Casing bead shall be U.S. Gypsum No. 200A metal trim or equal. Molding shall be installed with formed mitered, tight, smooth corners, and splices.

2.3 Furring:

Furring strips shall be 1" x 2" common 2.a.iii (PS 20-70) grade.

2.4 Adhesive:

Adhesive for bonding paneling to framing or to existing surfaces shall be as recommended by the wallboard manufacturer.

2.5 Nails:

Wallboard fastened directly to furring and framing shall be fastened with smooth shank nails, ASTM C514-70, 1 1/4" long in 3/8" wallboard, and 1 3/8" long in 1/2" wallboard.

Wallboard fastened over existing wall surfaces shall be fastened with smooth shank nails and shall penetrate framing a minimum of 7/8".

2.6 Screws:

Screws shall be self-tapping, bugle head for use with power driven tool.

Type S - 1" long, shall be used to fasten wallboard to sheetmetal.
Type W - 1 1/4" long, shall be used to fasten wallboard to wood.
Type G - 1 1/2" long, shall be used to fasten wallboard to wallboard.
Type G shall be used to fasten wallboard to an existing plaster wall; minimum penetration into framing shall be 5/8".

2.7 Joint Treatment Materials:

Perforated joint tape or tape in accordance with ASTM C475-70 or FS SS-J-570A, Type 11 shall be used.

Joint compound shall be in accordance with ASTM C475 or FS SS-J-570, Type I, or equal.

2.8 Laminating Adhesive:

Laminating adhesive shall be in accordance with wallboard manufacturer's recommendation or ASTM C557-67.

Part 3 EXECUTION

3.1 Surface Preparation:

Remove foreign material, loose plaster, and loose paint.

Where plaster has been removed, install shims (by fastening to framing) of the same thickness as the removed plaster to provide a level surface.

Frame around utility piping obstructing panel installation.

Wallboard shall be conditioned prior to application by storing in the room in which wallboard is to be applied.

Panels shall be stored vertically and separated with furring strips.

3.2 Installation Method:

Direct Adhesive Attachment: (Preferred Method)

This method is to be used when surface level and areas of loose surface materials do not prevent positive bonding of contact adhesive.

Test for soundness of paint bond where condition is questionable:

> Apply 3/8" wide x 3" long bead of adhesive to 8" square of gypsum wallboard and press wallboard square onto wall surface. Allow setting time per adhesive manufacturer's instructions. Pull square away from wall. Paint bond is acceptable if paper surface of wallboard square is separated from wallboard square. Repeat procedure wherever wall surface is questionable.

Attachment to Furring: (Alternate Method)

Install furring horizontally over existing wall surface. Space furring 16" on center. Use wooden shims to plumb furring strips.

Furring fasteners shall penetrate at least 3/4" into existing framing members, with two nails at each framing member intersection.

Install 2" x 3" or 2" x 4" vertical studs flat where surface cannot be levelled and plumbed with shims. Studs shall be 16" o.c., and nailed to top and bottom wall plates.

3.3 Wallboard Installation:

General:

Wallboards of maximum lengths shall be used to minimize end joints.

End joints shall be staggered and located as far as possible from center of wall or ceiling.

Secure all ends and edges of wallboards panels.

Direct Adhesive Attachment (Preferred Method)

Each sheet of wallboard shall be fitted before applying adhesive.

The adhesive bead shall be 3/8" diameter and installed 16" o.c. or on all framing.

One bead shall be installed at each abutting edge.

Press wallboard firmly into contact with adhesive. Nail top and bottom edges 8" o.c.

Nail Attachment (Alternate Method)

Nail wallboard directly to studs with 1 3/8" smooth shank nails. Spacing of nailing shall be 8" o.c. top and bottom and 12" o.c. elsewhere along framing.

Wallboard attached to furring shall be with 1 3/8" smooth shank nails. Spacing of nailing shall be 8" o.c. top and bottom and

Wallboard installed over existing wall surface, nails shall be sized to penetrate a minimum of 7/8" into existing framing. Spacing of nails shall be 8" o.c. along edges and 16" o.c. elsewhere along framing.

Screw Attachment (Alternate Method)

Screw spacings shall be as specified above for nailed attachment.

Joint System:

"V" grooves formed by abutting rounded edges of wallboard shall be filled with prefilled joint compound.

Prefill joint compound shall be permitted to harden prior to application of tape.

Compound shall be applied to all joints and angles to be reinforced in a thin uniform layer and reinforcing tape applied immediately.

Skim coat shall be applied immediately following tape embedment.

Dry embedding coat shall be applied prior to application of fill coat.

Fastener depressions shall be raised level with the surface by three separate applications of joint compound.

Two finish fill coats shall be applied and adequate time shall be allowed for drying between coats.

All joint compound surfaces shall be sanded to provide flat surfaces ready for decoration.

SECTION 0905

Melamine Coated Hardboard

Part 1. General

1.1 Work Covered Under Other Sections:

The scope of work for providing temporary utilities, security safety and disposal of waste materials is covered under Section 0101 of these specifications.

1.2 Work Included Under This Section:

Work included under this section includes the furnishing of all labor, materials, and equipment required to install Melamine paneling over existing interior walls as called out in these specifications.

1.3 Samples:

The sub-contractors shall submit to the construction engineer for approval prior to start of work the manufacturer's descriptive literature, a 12" x 12" sample of paneling and a 6" long sample of molding.

Part 2. Products

2.1 Melamine paneling shall be 1/8" thick, tempered hardboard with thermosetting synthetic resin finish of not less than 1 1/2" mils. The paneling shall be "Marlite" as manufactured by the Masonite Corporation or approved equal.

2.2 Finish:

The paneling finish and color shall be selected by the construction engineer. Nails shall be finish type, color to match paneling. Putty stick color shall match paneling.

2.3 Molding:

Molding shall be as recommended by the manufacturer and shall match the approved paneling sample.

2.4 Furring:

Furring strips shall be 1" x 2", common 2.a.iii (PS-20-70) grade.

2.5 Adhesive:

Adhesive for bonding paneling to framing or existing surface shall be as recommended by the paneling manufacturer.

2.6 Nails:

Paneling attached directly to furring and framing shall be fastened with 3d finish nails. If one end of the panel must be nailed, do not nail other end. Panels must be free for expansion.

Part 3 Execution

3.1 Surface Preparation:

Remove foreign material, loose plaster and, if Direct Adhesive Attachment is used, loose paint.

Where plaster has been removed, install shims of same thickness as removed plaster to provide a level surface.

Fit paneling around existing utility piping and install escutcheon plates.

Paneling shall be stored in the room to recieve paneling application for a period of 24 hours minimum. The paneling shall be stored in a vertical position. Separate each panel with furring strips.

3.2 Installation Methods:

Direct Adhesive Attachment (Preferred Method):

This method is to be used when surface level and areas of loose surface materials do not prevent positive bonding of contact adhesives.

Test for soundness of paint bond where condition is questionable:

Apply a 3/8" wide x 3" long bead of adhesive to a 8" x 8" square of gypsum wallboard, press wallboard square onto wall surface. Allow setting time per adhesive manufacturer's instructions.

Pull square away from wall. Paint bond is acceptable if paper surface of the wallboard square is separated from wallboard square. This procedure shall be repeated wherever wall surface is questionable.

Attachment to Furring (Alternative Method):

Install furring horizontally over existing wall surface. Space furring 16" o.c. Use wooden shims to plumb furring strips.

Furring fasteners shall penetrate at least 3/4" into framing members, attached with two nails at each framing member intersection.

3.3 Panel Installation:

General:

Panel clearance shall be 1/8" top or bottom. Clearance gap shall be covered with molding or base as appropriate.

Panel shall be aligned such that vertical edges are over framing or existing studs.

Direct Adhesive Attachment (Preferred Method):

Each panel shall be fitted before apply adhesive. Adhesive application shall be as recommended by the manufacturer.

The adhesive bead shall be 3/8" diameter and installed 16" o.c. or on all furring, where applicable.

One bead shall be installed at each abutting edge but not within 1" of edge.

Press firmly into contact with adhesive.

3.4 Molding:

Molding shall be installed with formed mitered, tight, smooth corners and splices.

SECTION 0912

Gypsum Veneer Plaster with Bonding Agent

Part 1. GENERAL

1.1 Work Covered Under Other Sections:

The scope of work for providing temporary utilities, security, safety and disposal of waste materials is covered under Section 0101 of these specifications.

1.2 Work Included Under This Section:

Work included under this section includes the furnishing of all labor, materials, and equipment required to apply a plaster veneer coat complete as called out in these specifications.

1.3 Product Storage, and Handling:

Plaster and other cementitious materials shall be kept dry until ready to be used, and wet or deteriorated materials shall be removed from project sites.

1.4 Job Conditions:

Temperature: Gypsum plaster shall not be applied unless a minimum temperature of 55°F has been and continues to be maintained in building for a minimum of two days prior to plaster application, during plastering, and a minimum of seven days after plaster is dry.

Ventilation: In glazed buildings, windows shall be kept open approximately 2 in. top and bottom and 4 in. for side pivoted or sliding windows.

Enclosed areas and during freezing weather, ventilation shall be provided by mechanical means.

In unglazed buildings subject to hot, dry winds or temperature differentials of 20°F or more, openings shall be screened with plastic film.

1.5 Gypsum Plaster:

Materials installed over radiant heating systems shall withstand temperatures of 115 degrees F.

Part 2. PRODUCTS

2.1 Materials:

Gauging plaster shall conform to the requirements of ASTM C 28-68.

2.1 Continued

Normal Finishing Hydrated Lime shall conform to the requirements of ASTM C 6-49, Type N.

Veneer Plaster shall conform to the requirements of ASTM C 587-68.

Bonding Agent shall conform to the following:

Must be an aqueous phase, film forming, non-oxidizing, non-deteriorating, ready-to-use composition suitable for spary, brush, or roller application.

Must re-emulsify when touch dry (approx. 40 min. after applying) and anytime up to 10 days following application.

Must demonstrate a two-hour fire rating in an assembly tested according to ASTM E 119.

Film must remain flexible indefinitely and be free from tendency to harden or craze crack.

Must be capable of 5 cycles freeze (-10°F) and thaw with no effect on bonding performance.

Must be tested in bond from -35°F to +310°F without failure.

Must be unaffected by alkalinity of cement and of resistants to mild acids.

Must have tensile strength of 600 psi, ASTM C 190.

Must have shear strength of 400 psi, ASTM C 109.

Must have flexural strength of 600 psi, ASTM C 78.

Must be color tinted for identification.

2.2 Mixing:

General

Batches shall be sized for complete use within a maximum of one hour after mixing and to set within a maximum of four hours.

Partially set plaster shall not be retempered or used.

Frozen, caked, or lumpy material shall be removed from job site immediately.

Factory-prepared plaster shall be mixed in accordance with manufacturer's written instructions for type of surface to which applied.

2.2 Continued

Mechanical mixing

Mixer shall be cleaned of set or hardened materials before loading materials for new batch.

Mixer shall be maintained in continuous operation while adding and mixing materials.

Hand Mixing

Hand mixing shall be prohibited unless authorized by the construction engineer.

Mix Proportions

Veneer Plaster: Factory manufactured veneer plaster specified be manufacturer.

White Skim Coat (Alternate material to veneer plaster) shall be mixed using 80 lbs. dry line and 60 lbs. gauging plaster, and sufficient water to apply.

Bonding agent shall be mixed in accordance with the manufacturer's instructions.

Part 3 EXECUTION

3.1 Surface Preparation:

All foreign material shall be removed including dirt, dust, oil, grease, wax, efflorescence, loose paint, plaster, casein, other water soluable paint, glue, size, and wallpaper.

Recently painted surfaces shall be allowed to cure at least 60 days before application of bonding agent.

Glossy surfaces shall be dulled with an abrasive.

Sealer shall be applied over chalky paints.

3.2 Application of Bonding Agent:

Bonding agent shall be applied over the entire surface in a continuous film with brush, roller or spray.

3.3 Application of one-coat plaster:

Plaster shall be applied within a week after bonding agent is dry (no longer tacky); preferably immediately.

Veneer Plaster (Preferred Method):

A minimum 3/32-in. thick finish coat shall be applied.
A uniformly thick, dense, and polished surface shall be provided.

3.3 Continued

White Skim Coat (Alternate Method):

A 1/16 to 3/16-in. thick coat shall be applied. A uniform, dense, and polished surface shall be provided, or textured to match existing wall surfaces.

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16. ABSTRACT (*A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.*)

This report describes the first stage of an experimental lead paint hazard abatement program carried out in 30 dwelling units in Washington, D.C. The entire program will ultimately involve the abatement of lead paint hazards in a total of approximately 250 dwelling units located in three or more cities.

The procedures, demonstrated in Washington, included: paint removal methods using chemical solvents and a heat producing device; the replacement of components such as windows, doors and wood trim and; the installation of flexible sheet and rigid board barrier materials over existing lead paint on wall.

The report presents procedures and the forms used in inspecting and selecting dwellings for lead paint hazard abatement, evaluations of the suitability and implementation characteristics of the abatement methods and recommendations for their use.

Subsequent reports will present the results of comparable programs in additional cities and a final report will compare the cost-effectiveness of the alternative abatement methods.

17. KEY WORDS (*six to twelve entries; alphabetical order; capitalize only the first letter of the first key word unless a proper name; separated by semicolons*)

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