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Philadelphia School District
Franklin Learning Center
Philadelphia, Pennsylvania

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PREFACE

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ACKNOWLEDGMENTS AND AVAILABILITY OF REPORT

This report was prepared by Robert Malkin and John Decker, of the Hazard Evaluations and Technical Assistance Branch, Division of Surveillance, Hazard Evaluations and Field Studies (DSHEFS). Field assistance was provided by Max Kiefer, Vlasta Deckovic-Vukres, and Debbie Sammons. Desktop publishing by Kathy Mitchell.

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Health Hazard Evaluation Report 96-0140-2606
Philadelphia School District - Franklin Learning Center
Philadelphia, Pennsylvania
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SUMMARY

On April 15, 1996, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation (HHE) from the Philadelphia Federation of Teachers (PFT). The request expressed concerns about a possible lead-based paint hazard at the Franklin Learning Center (FLC), a magnet high school in the Philadelphia, Pennsylvania, School District. The school had been evaluated by independent consultants hired by the school board and the PFT. Deteriorating lead-based paint and lead-containing dust were found throughout the building. Because of these findings, the school district initiated a lead abatement project. At the time of the NIOSH evaluation, approximately one-third of the school had been abated, and some employees were working in abated areas.

NIOSH investigators conducted a site visit on June 3, 1996. Both environmental sampling and medical monitoring for lead exposure were conducted. The environmental measurements consisted of 118 surface wipe samples from floors, desks, and window sills. The medical component of the investigation consisted of a questionnaire and a blood lead test, offered to all employees in the building. Forty-five employees (50% of staff) participated in the blood lead testing. Wipe sampling for lead on hands was performed on all participants who had a blood lead test. The areas selected for surface sampling were based on the assigned work location (classrooms, halls, or cafeteria) of the employees participating in the blood lead testing.

No health-based federal regulations regarding lead dust levels for schools or housing exist. The U.S. Department of Housing and Urban Development (HUD) has developed guidelines which are intended as maximal levels for surfaces in public housing following lead hazard control work and are intended to protect infants and small children. The applicability of the HUD guidelines to schools has not been established.

Twenty-three window sills in non-abated areas and 16 sills in abated areas were sampled. Dust lead loadings (the amount of lead dust per unit surface area) exceeded HUD guidelines (500 micrograms per square foot [$\mu g/ft^2$]) on 26% of all window sills sampled (10 of 39). Only one sill sample from an *abated* area failed the HUD criterium. Twenty-six floors in non-abated areas and 14 floors in abated areas were sampled. The HUD guideline for lead on floors (100 $\mu g/ft^2$) was exceeded in 17 (65%) of the non-abated areas, and 3 (21%) of the abated areas. Dust lead loading on desktops (39 sampled) ranged up to 230 $\mu g/ft^2$ (no criteria exist for lead on desktops). Wipe samples from employees' hands contained from 2-160 µg lead (geometric mean: 9 µg). Correlations between surface and hand contamination were not found. All blood lead levels (BLLs) were low, ranging from 0.6-5.6 micrograms per deciliter (µg/dL). The geometric mean was 2.2 µg/dL, similar to that of the general U.S. population.

Despite severely peeling lead-based paint and significant lead dust loadings on many surfaces, a hazard from lead exposure was not found for staff at the school. In some cases, environmental lead dust loadings on various surfaces exceeded the HUD guidelines. However, all BLLs were low. There were no relationships between BLL and abatement status of assigned work area, BLL and hand lead, or surface lead and hand lead.

Keywords: SIC 8211 (Elementary and Secondary Schools) lead, blood lead levels, lead dust loadings, lead-based paint

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INTRODUCTION

On April 15, 1996, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation (HHE) from the Philadelphia Federation of Teachers (PFT). The request expressed concerns about possible exposures to lead-based paint and lead-contaminated dust at the Franklin Learning Center (FLC), a magnet high school in the Philadelphia, Pennsylvania School District. The school had been previously evaluated for lead-based paint by independent consultants hired by the school board and the PFT, and significant levels of lead dust contamination were found throughout the school. These findings resulted in health concerns among the school's staff and parents of students. At the time of the NIOSH investigation, lead abatement had been completed in approximately one-third of the school, and some employees were working in abated areas.

An investigation was undertaken on June 3-6, 1996, to determine whether the lead contamination at the school constituted a health hazard for employees at the school. This evaluation involved both environmental sampling (consisting of lead wipes of floors, sills, desks, plus hand wipe samples) and blood lead testing. Participants were informed of their blood lead results by letter.

BACKGROUND

The FLC is approximately 85 years old and has been slated for replacement for the last decade. The school is a magnet high school in the Philadelphia Public Schools and has approximately 1000 students, grades 9-12. Lead-based paint was used in the building in the past. Because the building was continually slated for demolition, maintenance and improvements on the building were deferred, and deteriorating lead-based paint is still present in the building. The school has approximately 90 teachers, administrators, clerical personnel, custodians, cafeteria workers, and aides.

For an extended time, there has been concern about the deteriorating lead-based paint in the school. In many areas, large pieces of paint were peeling off the walls and ceilings. The recent health concerns began in March 1996, when community groups raised health and safety issues, particularly concerning lead and asbestos. Independent consultants were hired by the Philadelphia School District (PSD) and the Philadelphia Federation of Teachers. Concerns were expressed by the community about the presence of a Head Start/Comprehensive Day Care Center housed in the building since the enrollees were all under the age of six. This center has since been relocated.

In March 1996, an X-ray fluorescence (XRF) survey conducted by consultants confirmed the presence of lead-based paint (as defined by the Department of Housing and Urban Development [HUD] criteria) throughout the school, particularly on the plaster walls and wood window sills. The guidelines state that the term "lead-based paint" means paint containing $\geq$1 milligrams of lead per square centimeter (mg/cm^2) or $\geq$ 0.5% lead by weight. [1] Subsequent lead dust wipe sampling by consultants showed lead-containing dust in many areas, although a systematic wipe sampling evaluation had not been conducted. Consequently, removal of lead paint or encapsulation of areas having deteriorating paint was initiated and was continuing at the time of the NIOSH survey. The areas being abated were isolated with polyethylene plastic and maintained under negative pressure to protect other areas of the building. After abatement, clearance wipe sampling was conducted, and the results were compared to the HUD lead guidelines (created as clearance criteria for public housing) as a way of determining if abatement was properly done. Water and air sampling for lead was also conducted. Water sampling showed concentrations of lead less than 3 parts per billion (ppb), well under the Environmental Protection Agency (EPA) National Primary Drinking Water Regulations that establish a treatment trigger at 15 ppb lead. In addition, private consultants conducted area air sampling for lead in March

1996, in various locations. The results showed very low or non-detectable concentrations of airborne lead.

According to the custodial supervisor, the classrooms and hallways are swept daily, and mopping is conducted as needed. However, all areas are reportedly mopped at least once per week. In the cafeteria, the floor is swept and mopped daily, and the table tops are cleaned with soap and water daily. Large areas of the building have lead-based paint peeling off the walls, and the floors and furniture frequently need to be cleaned of flaked paint.

METHODS

Industrial Hygiene Evaluation

Surface Sampling

One-hundred eighteen wipe samples were collected to determine the extent of lead dust surface contamination (the amount of lead dust per unit surface area, referred to as lead loading) at various locations in the school. The areas sampled were determined based on the work location of the participants volunteering to provide blood for lead analysis. The objective was to determine if there was a correlation between surface lead contamination and blood lead levels. Exact locations sampled are listed in Table 1. For each room or area, wipe samples were collected from the floor in the center of the room, an interior window sill, and the participant's desktop. The samples were collected with pre-moistened Wash n' Dry® towelettes using the standard wipe procedure recommended by HUD.[1] For floors and desktops, an approximately one-square-foot (ft^2) surface area was sampled using one towelette for each surface. For window sills, an approximately 0.5 ft^2 surface area was wiped with each towelette. The procedure was as follows: (1) identify the area to be sampled; (2) put on pair of disposable gloves; (3) place wipe flat on surface as defined by the template and wipe marked surface in an overlapping "S" pattern, side-to-side so that entire surface is covered; (4) fold wipe in half and repeat the procedure; and (5) place into 30-milliliter (mL) Nalgene® wide-mouth container. Because of differences in wiping efficiency on various surfaces, wipe sampling results should be considered semi-quantitative.

The samples were sent to the NIOSH contract laboratory for analysis. The wipe samples were analyzed for lead according to NIOSH method 7082 (flame atomic absorption spectrometry), modified to accommodate the sample matrix.[2] The insides of the containers were washed in the laboratory to include any residual lead dust in the analyses. Depending on the sample subset, the limits of detection were 2 or 3 µg/wipe and the respective limits of quantification were 6.6 or 6.8 µg/wipe.

For each area sampled, a visual assessment of the paint condition for each component (walls, ceiling, window sills) was conducted. The surface was rated as "intact" if the entire painted surface was intact. The surface was rated "fair" if there was 2 ft^2 or less of deteriorated paint ($\leq$ 10% of total surface area of small components such as window sills). The surface was rated "poor" if there was more than 2 ft^2 of deteriorated paint (or more than 10% total surface area of small components). Deterioration was defined as any breakdown of the paint film including chalking, wear due to friction, cracking or flaking, alligatoring, blistering, peeling, or water damaged. A room was considered to be abated if deteriorated paint had been repaired. Although non-deteriorated lead-based paint was generally not encapsulated in the abated areas, these areas were considered abated for the purposes of this report.

Handwipe Sampling

Handwipe samples were taken from all medical study participants to assess lead contamination on skin. Participants were instructed to simultaneously wipe both hands (including between the fingers) for 30 seconds using a pre-moistened Wash n' Dry® towelette. Participants were then instructed to place the towelette into a

Nalgene® 30 milliliter (mL) wide-mouth jar. The samples were sent to the NIOSH contract laboratory and analyzed for lead according to NIOSH method 7300 (inductively coupled plasma/atomic emission spectroscopy), modified to accommodate the sample matrix.[2] The insides of the containers were rinsed to remove any residual lead. The limits of detection and quantification were 0.08 and 0.27 µg/wipe, respectively. The participants were asked to estimate the time since they last washed their hands.

Statistical Analysis

Lead dust loadings on sills, desks, and floors were compared between abated and non-abated areas. Log transformations and geometric means were computed because the data were found to be log-normally distributed, as is the case with most industrial hygiene data.[a] Thus, t-tests utilizing natural log-transformed data were performed to compare mean (average) lead levels.[b] F-tests[c] were used to determine whether variances between abated and non-abated areas were equal. *P* values < 0.05 were considered to be statistically significant.[d] Correlation coefficients[e] and 95% confidence intervals[f] were computed for 'minutes since hand washing' and hand-wipe lead levels, desktop lead levels and hand-wipe lead levels, floor lead levels and hand-wipe lead levels, and window sill lead levels and hand-wipe lead levels.

Medical Evaluation

All employees at the FLC were invited to participate in the study. Employees were contacted by the PFT or the school administration prior to the arrival of the NIOSH investigators and again on the days of the study. In addition, NIOSH investigators were available at the start of the day to explain the study to employees.

The medical evaluation consisted of a self-administered questionnaire and a test measuring blood lead levels (BLLs). NIOSH investigators were given exclusive use of a vacant classroom for the purposes of questionnaire administration and the blood draw. Employees who wished to participate were instructed to report to this room either during their preparation period or lunch. All participants read and signed a NIOSH Human Subjects Review Board-approved consent form prior to participation.

The questionnaire contained questions concerning other possible exposures to lead including smoking, handwashing, hobbies, age of the participant and his/her home, and renovation work in the home. Blood collection was done in accordance with the Centers for Disease Control and Prevention (CDC) Center for Environmental Health (CEH) laboratory guidelines, using lead-free needles and tubes. The blood was refrigerated after collection and sent to the laboratory for analysis. The BLLs were determined using the CDC graphite furnace atomic absorption method as used in the third

[a] The geometric mean is an average that accounts for the skewed distribution of the data.

[b] The t-test is a statistical method to assess the difference in the averages between two groups of data.

[c] The F-test is another statistical method to assess the differences between two or more groups of data.

[d] The *p* value is the statement that the probability of an observed difference could have occurred by chance. Generally, a *p* value that is less than 5% ($p<0.05$) is considered unlikely to have occurred by chance.

[e] The correlation coefficient is a measure of association between two variables and can vary between +1 and -1.

[f] The 95% confidence interval is a range in values constructed such that there is a 95% probability of including the true value of the variable. When the 95% confidence limits for the correlation coefficient includes 0, the correlation is not statistically significant.

National Health and Nutrition Examination Survey.[3] Five participants had a third tube of blood drawn as a quality control measure for BLL; it was submitted to the laboratory identified as if it were from another participant. The geometric mean for BLL was calculated in the same fashion as by Brody et al.[4], by taking the antilog of the mean of $\log_{10}$ BLLs.

Statistical analysis was performed with SAS version 6.11. T-tests were used to determine if there were relationships between dichotomous questionnaire variables and BLL. Linear regression was used to determine if there was a relation between handwipe lead levels and BLL. Analysis of variance was used to determine if there were differences in lead levels by race of the participants.

EVALUATION CRITERIA

Lead

Lead is ubiquitous in U.S. urban environments due to the widespread use of lead compounds in industry, gasoline, and paints during the past century. Exposure to lead occurs via inhalation of dust and fume, and ingestion through contact with lead-contaminated hands, food, cigarettes, and clothing. Absorbed lead accumulates in the body in the soft tissues and bones. Lead is stored in bones for decades, and may cause health effects long after exposure as it is slowly released in the body.

Symptoms of lead overexposure include weakness, excessive tiredness, irritability, constipation, anorexia, abdominal discomfort (colic), fine tremors, and "wrist drop."[5,6,7] Overexposure to lead may also result in damage to the kidneys, anemia, high blood pressure, infertility and reduced sex drive in both sexes, and impotence. An individual's BLL is a good indication of recent exposure to, and current absorption of lead.[8] The frequency and severity of symptoms associated with lead exposure generally increase with the BLL. For example, studies have found neurological symptoms in workers with BLLs of 40 to 60 micrograms per deciliter (µg/dL), and decreased fertility in men at BLLs as low as 40 µg/dL. BLLs are associated with increases in blood pressure, with no apparent threshold through less than 10 µg/dL. Fetal exposure to lead is associated with reduced gestational age, birthweight, and early mental development with maternal BLLs as low as 10 to 15 µg/dL.[9]

The overall geometric mean BLL for the U.S. adult population (20-74 years old) declined significantly between 1976 and 1991, from 13.1 to 3.0 micrograms per deciliter of blood (µg/dL) -- this decline is most likely due primarily to the reduction of lead in gasoline. More than 90% of adults now have a BLL of <10 µg/dL, and more than 98% have a BLL <15 µg/dL.[10] The U.S. Public Health Service has established a goal, by the year 2000, to eliminate all occupational exposures that result in BLLs greater than 25 µg/dL.[11]

Lead-contaminated surface dust and soil represent potential sources of lead exposure, particularly for young children. This may occur either by direct hand-to-mouth contact, or indirectly from hand-to-mouth contact with contaminated clothing, cigarettes, or food. Previous studies have found a significant correlation between resident children's BLLs and house dust lead levels.[12]

Lead was a major component in building paint prior to 1950, at which time other non-lead containing paints began to increase in popularity. In 1973, the Consumer Product Safety Commission established a maximum lead content of 0.5% for household paint, and further lowered the standard to 0.06% in 1978. HUD has established comprehensive guidelines for the evaluation and control of lead-based paint in public housing primarily because of the harmful effects of lead exposure on children.[13]

A lead-based paint hazard, as defined by the Residential Lead-Based Paint Hazard Reduction Act of 1992 (Public Law 102-550), is considered to be any condition that causes exposure to lead that would result in adverse human health effects.[14] As such, intact lead-based paint on most walls and ceilings would not be considered hazardous under most circumstances. However, if the lead-based paint is deteriorated or damaged, then a lead-based paint hazard could be present even if the lead-based paint level was below the Department of Housing and Urban Development (HUD) definition (1 mg/cm^2 or 0.5% by weight).[1]

Currently, there are no health-based Federal regulations for lead dust in schools or homes. The Environmental Protection Agency (EPA) is in the process of developing a rule to address hazards from lead-contaminated dust and soil around homes, as required by Section 403 of the Toxic Substances Control Act. However, EPA and HUD have *recommended* "clearance levels" for surface lead in public housing following lead hazard control work. The following lead loading levels are based on wipe sampling: 100 micrograms per square foot (**µ**g/ft^2) on uncarpeted floors, 500 **µ**g/ft^2 on interior window sills, and 800 **µ**g/ft^2 on window wells or troughs.[1,15] These clearance levels are intended to "indicate whether a lead hazard exists for young children following hazard control efforts."[1] However, the basis for these levels is not entirely health-related, but based on empirical evidence that the levels were achievable by prudent cleanup procedures. Regardless, the presence of lead on surfaces represents a potential exposure for ingestion, especially for young children. For other environments, such as a high school or office building, a health-based rationale for applying the HUD clearance criteria to environments occupied by adults has not been demonstrated. Additionally, there are no recommended criteria for lead contamination on hands.

RESULTS

Environmental Monitoring

The results of lead dust wipe sampling can be found in Table 1. Twenty-three window sills in non-abated areas and 16 sills in abated areas were sampled. Lead loadings on sills ranged widely between 2 to 128,000 µg/ft^2. Some wipe samples had dramatically high lead loadings because the samples included small pieces of loose paint. The geometric mean of the sill lead loadings in non-abated rooms (342 µg/ft^2) was greater than that in abated rooms (102 µg/ft^2), although the differences were not statistically significantly different (t=-1.8, p=0.07). Overall, 26% of the window sill samples (10 of 39 sills sampled) exceeded the HUD recommended clearance criterion (500 µg/ft^2) for housing. However, only one window sill in an abated area (room 203 - computer room) failed to meet the HUD criterion. All other areas failing to meet the HUD criterion were in non-abated areas.

Twenty-six floors in non-abated areas and 14 floors in abated areas were sampled. Lead loadings for the floor samples had less variation (range: 24 to 2400 µg/ft^2) and were lower in many cases than window sills. Overall, 50% of the floor lead loadings (20 out of 40) did not meet the HUD clearance criterion (100 µg /ft^2) for lead on floors; 17 (65%) of the non-abated areas, and 3 (21%) of the abated areas exceeded this guideline. The geometric means for the non-abated areas (136 µg/ft^2) and abated areas (70 µg/ft^2) were significantly different (t= -2.7, p=0.01).

Twenty-three desktops in non-abated areas and 16 desktops in abated areas were sampled. Lead loadings ranged from less than 2-3 µg/sample (the limit of detection) to 230 µg/ft^2. There was no statistically significant difference in geometric mean lead loadings between desk tops in abated areas (15.4 µg/ft^2) and those in non-abated areas (15.8 µg/ft^2, t=-0.06, p=0.94). No surface lead dust loading criteria for desktops exist.

The amount of lead dust found on the hands ranged from 2 to 160 µg. The geometric mean lead dust on the hands was approximately 9 µg. No criteria exists for lead dust on hands. There was no statistically significant correlation between 'minutes since hand washing' and hand-wipe lead loading (r=0.21, 95% confidence interval -0.08, 0.47; Figure 1). Likewise, no correlations were found between desktop and hand-wipe lead (r=0.12, 95% confidence interval -0.18, 0.40; Figure 2), floor and hand-wipe lead (r=-0.09, 95% confidence interval -0.37, 0.21; Figure 3), and window sill and hand-wipe lead (r=0.11, 95% confidence interval -0.19, 0.39; Figure 4). No statistically significant correlations were found when any one combination of outlier data points were removed from the analysis.

Medical Testing

Forty-five employees participated in the project (50% of all employees), 15 males (33%) and 30 females (67%). Twenty (44%) were black, 15 (33%) were white-non Hispanic, and 9 (19%) were white-Hispanic. Ages ranged from 27-71 with a mean age of 47. Twenty-six (68%) of the participants were teachers, 3 (8%) were custodians, 5 (13%) were office workers, 3 (8%) were administrators, and 1 (3%) was a cafeteria worker. The mean number of years employees had worked at the FLC was 9.2 (range 1-21).

Differences in BLLs in the duplicate samples were within the range of acceptable analytical variation and no pair varied more than 0.4 µg/dL. They were not used in the statistical analysis. The mean BLL was 2.5 µg/dL (range 0.6-5.6 µg/dL) and the geometric mean was 2.2 µg/dL. There was no statistical difference in BLLs with respect to the sex of the participant (t=-0.3, *p*=0.97), race of the participant (F=0.56, *p*=.69), by whether there had been lead abatement in the area they normally worked (t=-0.91, *p*=0.37), whether the employee usually washed their hands before eating (t= -0.4, *p*=0.70), or whether they had stripped paint at home (t=0.09, *p*=0.93). Five employees currently smoked cigarettes but there was no difference in BLL for the employees who smoked (t=-0.26, *p*=0.81). Hand wipe lead levels were not statistically significantly related to BLL (F=2.19, *p*=0.15).

DISCUSSION

The BLL levels found in this study were all very low and indistinguishable from general population levels. The Third National Health and Nutrition Examination Survey (NHANES III) assessment of blood lead levels in the general population, for the period 1988-1991, revealed a geometric mean blood lead of 3.7 µg/dL for males and 2.1 µg/dL for females.[10] This compares with a geometric mean blood level of 2.2 µg/dL for both males and females in this study. This finding indicates that, despite the presence of lead in paint, dust, and wipe samples, there is very little absorption occurring in the tested employees of the FLC. The questionnaire was not fully analyzed with regards to all risk factors for exposure to lead since there apparently was no detectable occupational exposure to lead occurring in this group of employees.

Similar findings have been reported elsewhere. A study conducted at a lead contaminated building in Raleigh, North Carolina, revealed mean BLLs of 1.5 µg/dL, despite wipe sampling indicating contamination of floors, file cabinets and desk tops that ranged up to 6607 µg/m^2.[16] There are studies showing a relationship between blood lead, environmental lead, and hand lead in young children. Lead uptake in small children is most importantly related to lead content in soil, air and house dust.[17] Young children are the group most at risk from lead contaminated soil and dust because of the greater amount of hand-to-mouth activity and increased ingestion of contaminated material.[18] This route of exposure was apparently not important among the adults at the FLC, and lead levels on hands were not related to BLL.

Whether students at this school are exposed to lead while at school was not assessed in this study. National data from the NHANES III survey reveals that individuals in the 12-19 age group (similar to the students in the FLC) have a lower BLL than adults in the age group 20-49 or 50-69 for all races. To our knowledge there are no studies of exposure to environmental lead in a high school and BLLs of the students. However, since BLL of employees was indistinguishable from national norms and not indicative of any occupational exposure, we have no reason to expect that high school students' exposure to lead would be substantially different.

CONCLUSIONS

Despite the presence of notable lead dust loadings throughout the building, blood lead levels among staff (range 0.6-5.6 µg/d, geometric mean 2.2 µg/dL) were not distinguishable from national norms as determined by NHANES III study. Although there were differences in lead dust loadings between non-abated and abated areas, no significant differences in blood lead levels were observed, and no habits of teachers that might possibly result in lead absorption (smoking, frequency of hand washing) were related to BLL. Consequently, our study did not demonstrate a health hazard from environmental lead dust contamination among employees in the school, whether working in abated or non-abated areas.

RECOMMENDATIONS

1. Although this study did not demonstrate a relationship between hand lead and BLL, hand washing before eating is a general hygienic measure that reduces exposure to various contaminants, including lead-containing dust, that might be on the hands.

2. Although this study did not demonstrate absorption of lead from dust or deteriorated paint, removal of both from the environment is desirable since this will reduce the possibility of exposure for students and staff. However, our findings suggest that the decision to remove deteriorated paint in a high school should be made primarily for reasons other than the health of the teachers (i.e., aesthetics, improved housekeeping).

3. Existing procedures during abatement (isolation of area where encapsulation is conducted, clearance wipe sampling, etc.) should be continued because very high lead dust loadings can be generated from these activities. In occupied areas having deteriorating paint, lead dust loadings on floors and window sills may be reduced by more frequent custodial cleaning and use of a high efficiency particulate air (HEPA) vacuum.

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Table 1. Wipe Sampling Results: Lead Loadings - June 4-5, 1996
Franklin Learning Center, HETA 96-0140

Room Number	Window Sill (µg/ft²)[1,2]	Floor (µg/ft²)	Desktop (µg/ft²)	Paint Condition[3,4] (key below)	Area/Room Abated?
Main Office	2	26	3	i,p,f,f,i	no
100	16	41	(6)[5]	i,i,p,i,i	yes
102 TV Studio	110	31	(6)	i,i,i,p,f	yes
Hallway (102)	110	44	--	f,i,f,p,p	no
103	88	66	22	i,i,i,i,f	yes
111	104	97	(6)	i,i,i,i,i	yes
123	54	150	ND[6]	i,f,i,i,i	yes
125	--	(carpet)	26	f,p,p,f,f	no
126	540	(carpet)	10	f,p,p,p,f	no
129B	--	34	7	p,i,p,p,i	no
132	122	100	9	f,i,i,i,i	no
200 (computer)	128000	200	41	f,p,p,p,i	no
Hallway (202)	32	270	--	f,p,p,p,i	no
Library	220	(carpet)	12	i,i,i,f,i	yes
203 (computer)	3800	(carpet)	20	f,i,i,i,i	yes

206	9600	130	(6)	i,p,p,f,i	no
207	4400	130	30	i,p,p,i,i	no
208	400	180	12	i,p,p,p,f	no
209	36	120	(5)	i,p,p,f,f	no
318	260	52	24	i,f,i,p,f	no

[1] Limit of detection (LOD): 2-3 µg/wipe, depending on sample subset
[2] Limit of quantification (LOQ): 6.0-6.8 µg/wipe, depending on sample subset
[3] Paint condition listed in this order:
Interior door, Ceiling, Walls, Interior windows, Interior trim.
[4] Key for symbols: I = intact, f = fair, p = poor
[5] Values are between the LOD and LOQ
[6] ND = non-detected

Figure 1

Franklin Learning Center, HETA 96-0104

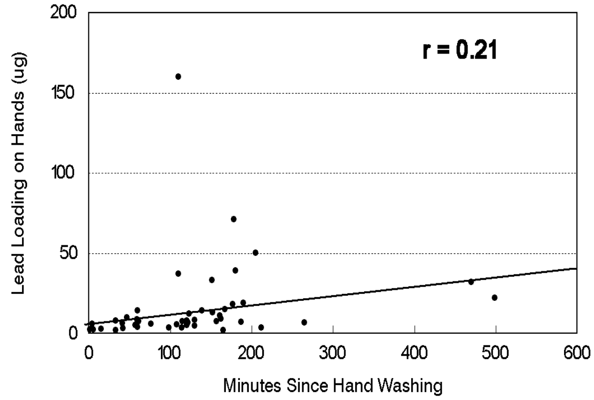


Figure 2

Franklin Learning Center, HETA 96-0140

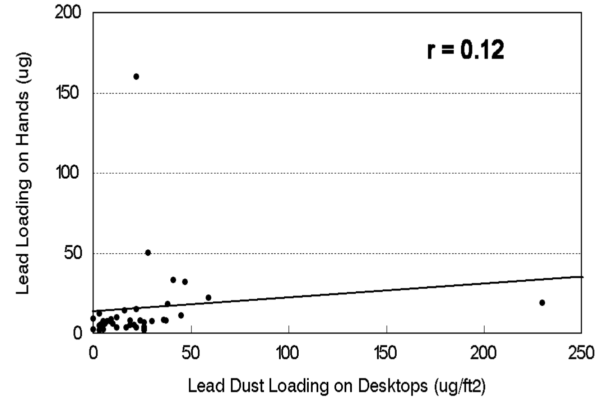


Figure 3

Franklin Learning Center, HETA 96-0140

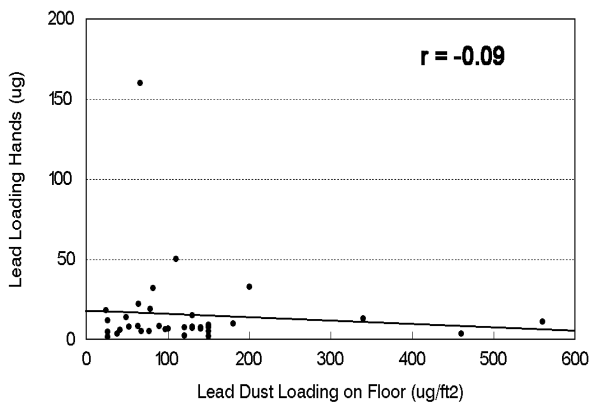
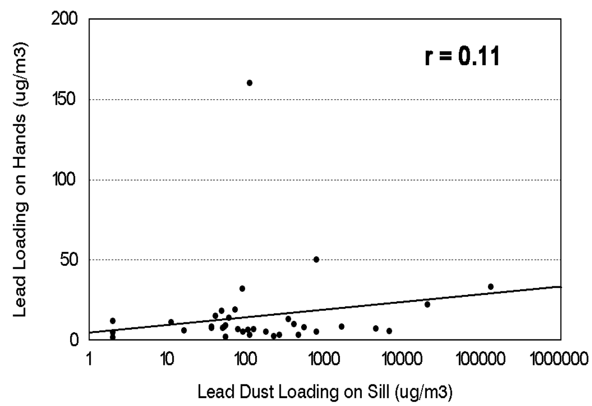


Figure 4

Franklin Learning Center, HETA 96-0140



As discussed in the report, analyses of the data contained in Figures 1-4 showed no statistically significant correlations.

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Through research and prevention