Agency for Toxic Substances and Disease Registry
Division of Health Studies

FINAL REPORT
Child Lead Exposure Study
Leeds, Alabama

Alabama Department of Public Health
Division of Epidemiology

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U.S. DEPARTMENT OF HEALTH & HUMAN SERVICES
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Agency for
Toxic Substances and Disease Registry
Atlanta, Georgia 30333

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U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY
ATLANTA, GEORGIA

ALABAMA DEPARTMENT OF PUBLIC HEALTH
DIVISION OF EPIDEMIOLOGY

CHILD LEAD EXPOSURE STUDY
LEEDS, ALABAMA

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ABSTRACT

In August 1989, a human exposure study was undertaken to determine whether children residing near a secondary battery lead reclamation factory in Leeds, Alabama, had elevated blood lead values as defined by the Centers for Disease Control. A secondary objective was to determine the extent to which behavioral, demographic, and other potentially confounding factors were correlated with lead exposure. A door-to-door census survey was conducted in two targeted residential areas near the factory in order to identify children aged 9 through 71 months for inclusion in the study. Venous blood samples were analyzed for lead, erythrocyte protoporphyrin, hemoglobin, and hematocrit. In addition, parents/guardians of participants were interviewed to identify independent or potentially confounding factors that might influence the lead concentrations.

Among 81 children studied the mean blood lead value was 6.96 micrograms per deciliter (mcg/dl), with a range of 3 to 16 mcg/dl; 85% of the values were below 10 mcg/dl. A multivariate linear regression model identified the following factors as being associated with an increased blood lead value: living in the study area south of the site, lower household income, living closer to the factory, having a shorter duration of residence, and placing a toy or blanket in the mouth. Using a logistic regression model, living in the study area south of the site, staying home during daytime hours, carrying a toy or blanket during the day, living in a household where income was below the median level, and having a longer duration of residence were associated with having a blood lead concentration in the upper 15th percentile (>10 mcg/dl).

The authors recommend that children at risk of exposure to lead be tested and provided appropriate follow-up and that opportunities for exposure to dust should be minimized for young children who put objects in their mouths. Remediation efforts underway at the lead reclamation factory to minimize fugitive air emissions should be maintained so that monitoring shows consistent compliance with ambient air lead standards.

INTRODUCTION

This study was undertaken in August 1989 by the Alabama Department of Public Health (ADPH), with funding and technical support from the U.S. Public Health Service, Agency for Toxic Substances and Disease Registry (ATSDR), to determine whether children residing in neighborhoods near the Interstate Lead Company (ILCO) in Leeds, Alabama, had blood lead values >25 mcg/dl, the level defined as elevated by the Centers for Disease Control (CDC) (1). In addition, blood lead values >10 mcg/dl, the level of concern noted by ATSDR, were examined (2). Citizen concern about a local source of lead pollution had focused on ILCO, a battery lead reclamation plant listed both on the Superfund National Priority List (NPL) and as a Resource Conservation Recovery Act (RCRA) site.

Because of high air lead values detected in late 1983 and early 1984 via monitoring by the Jefferson County, Alabama, Department of Health (JCDH), the JCDH offered blood lead screening to a self-referred sample of Leeds residents of all ages in February 1984. Based on screening results, the JCDH concluded that "an imminent health hazard does not exist in the study area. However, a health hazard could develop if ambient air levels are not reduced to meet the national air standard of 1.5 mcg/cubic meter of air" (Appendix 1). The results of that screening effort suggested that, among the tested children, those residing within 1 kilometer (0.6 mile) of ILCO had higher blood lead values than those residing farther away.

Concern about untoward lead exposure continued through 1988 because air lead values were not uniformly brought into compliance, and because the U.S. Environmental Protection Agency (EPA) found high groundwater and soil lead values during its onsite evaluation of ILCO. Because lead is a known neurotoxin, the perception by some citizens that a higher proportion of Leeds children had learning disabilities than children in the Jefferson County School District as a whole also contributed to concern about untoward lead exposure.

Problems existed in (1) measuring total cumulative exposure to lead, (2) identifying all of the learning disabled children in Leeds, and (3) developing a precise and unbiased epidemiologic measure of association between learning disabilities and lead exposure attributable to ILCO. As a result, this study focused on addressing whether a highly susceptible segment of the population, children aged 9 through 71 months who resided in two neighborhoods near ILCO, had evidence of recent lead exposure at elevated levels.

The objectives of this study were to (1) assess evidence of biological exposure to lead through the analysis of venous blood of children and (2) determine the extent to which behavioral, demographic, and other potentially confounding factors (including duration of residence and distance from ILCO) were correlated with lead exposure.

BACKGROUND

History

Leeds, Alabama, is located approximately 17 miles east of Birmingham and lies predominantly in Jefferson County. Census figures for 1984 placed the population at 9,425. The median age of residents in 1980 was 29.8 years. The economy of Leeds centers around the manufacture of durable goods (accounting for the employment of nearly 33% of the work force over 16 years of age) and retail trade.

Risk of Human Exposure

Increased blood lead values, especially in young children, may be associated with exposure to soil containing high concentrations of lead (usually >500 ppm (mcg/g)) (1), or air concentrations of 1-5 mcg/cubic meter (3). Although children absorb ingested lead at a greater rate than adults, relatively little is known about the deposition of airborne lead in children because of the lack of data on pediatric respiratory aerosol physiology (4). Once deposited in the lower respiratory tract, lead is almost completely absorbed (4). The effects of exposure to lead, however, do not appear to depend on the route of entry; rather, they are correlated with internal exposure, usually measured as blood lead levels (4). Lead toxicity is evident principally in the red blood cells and their precursors, the central and peripheral nervous systems and the kidneys (2). Various degrees of biochemical and organ system effects have been observed, depending on the level of exposure. Of particular concern are behavioral and developmental problems (5-9).

Young children have greater potential exposure to lead than older persons because their normal hand-to-mouth activities introduce many nonfood items into their bodies. In addition, they absorb and retain more lead on a unit-mass basis than adults, and their bodies metabolize and store lead differently (2).

METHODS

Study Design

The specific aim of this study was to determine recent lead exposure, as measured by venous blood lead values, of children aged 9 through 71 months who resided in two residential areas close to ILCO. The study focused on young children because they are likely to have higher lead exposures and are more susceptible to the adverse effects of lead. Measurements were made in August 1989 just prior to the start of the school year, since the potential for out-of-doors contact with environmental lead during the previous 60 days would be maximized.

Data were collected in two phases. The first phase was a door-to-door census survey of all buildings located in the study areas. On the basis of inspection and interviews, buildings were classified as residences, businesses, churches, or as vacant. Length of residence, age, and gender were recorded for all residents of households in which children aged 9 through 71 months lived.

The second phase consisted of the collection of a venous blood specimen and an interview with each participant's parent or guardian to record additional environmental, occupational, demographic, and behavioral risk factors thought to influence blood lead levels. A 60-day residency requirement was included so that blood lead values would reflect exposures incurred while residing in the study areas. Blood specimens were analyzed for hemoglobin, hematocrit, erythrocyte protoporphyrin, and lead.

Site Selection

On the basis of the environmental data, the lead exposure pathways of likely concern in Leeds were inhalation and soil/dust ingestion. Residential areas of potentially highest risk were those closest to ILCO where stack and/or fugitive emission lead fallout may have occurred. Two residential areas proximal to ILCO were targeted for testing (Appendix 9). Area A consisted of residences lying to the south (Leaf Avenue and adjoining streets) interviewers were trained in administering the questionnaire. Supervisors made spot checks for completeness and accuracy during the interview phase of the study.

Blood Collection

Venous blood specimens were obtained by two trained pediatric phlebotomist prior to the parents'/guardians' answering the questionnaire. Venous blood was drawn into a 3.5 ml vacutainer tube with EDTA anticoagulant and labeled with the same identifying number used on the subject's questionnaire and consent form. Vacutainer tubes were placed upright in racks and refrigerated as soon as blood specimens were drawn. Specimens were logged onto a master inventory sheet and were transported daily to the Bureau of Clinical Laboratories of the ADPH in Montgomery. This laboratory, certified proficient in blood lead and erythrocyte protoporphyrin analysis by the CDC, determined the values of lead, erythrocyte protoporphyrin, hemoglobin, and hematocrit for each specimen (Appendix 14).

Environmental Samples

No additional environmental sampling was done during the survey.

Privacy and Notification

This final report and all other reports made available to the public contain no laboratory results or findings for any individual person and will be reported only as aggregate data and their analysis. The individual records are maintained as nondisclosable records under Code of Alabama 1975, Section 41-13-1.

Individual biologic test results were provided to the parents/guardians of each subject when the results became known. In early September 1989, parents/guardians received letters from the Alabama Department of Public Health with results and recommendations concerning individual tests (Appendix 15). The letters included the telephone number and address of the principal investigator. Copies of these letters were also sent to the physicians of record reported by the parents/guardians when registering for the interviews.

Data Analysis

Census forms, questionnaire surveys, and laboratory data for all participants were entered into a master file on a personal computer and edited for accuracy. Statistical analyses were performed using SAS (SAS Institute, Inc., Cary, NC 27512-8000) and Epi-Info (Epidemiology Program Office, Centers for Disease Control, Atlanta, GA 30333) software. In univariate analysis, odds ratios and 95% confidence intervals were used to determine associations between blood lead levels dichotomized at the 85th percentile (<9 mcg/dl) and demographic and behavioral variables of interest. Independent variables not dichotomous by definition were either dichotomized at the median value or at some logical value, such as grade 12 for level of education. Missing or unknown values were excluded when computing odds ratios. Distance of residence from ILCO was estimated from a municipal map on the basis of consecutively numbered 400-foot radius concentric grids centered at ILCO. Chi-square statistics were used to compute p-values for categorical data and t-tests for mean values of continuous data.

A multivariate linear regression model was developed to assess how well the demographic and behavioral factors could predict the observed lead values.

each respective area. Participating and nonparticipating children were statistically comparable with respect to gender (43.2% (35/81) versus 50.0% (10/20) male, p = 0.58); mean age (3.6 versus 3.6 years, p = 0.98); and within each area, mean residential distance from ILCO (area A: 4,384 versus 4,684 feet, p = 0.42; area B: 2,748 vd. 2,932 feet, p = 0.56) (Tables 2 and 3). Racial data were not collected during the census and thus were not available for nonparticipant; 5 (6.2%) blacks participated in the study.

Laboratory Results

Hemoglobin and Hematocrit

Sufficient blood was available to measure hemoglobin and hematocrit for 80 of the 81 participants. Among these 80 children, 78 (97.5%) had hemoglobin values within the range considered normal (>10.4 g/dl). Values ranged from 10.0 to 13.4 g/dl (Table 4), and hematocrit ranged from 30.2% to 39.4%.

Lead and Erythrocyte Protoporphyrin

None of the blood specimens from tested children had evidence of elevated blood lead, lead toxicity, or risk classifications II, III, or IV, as defined by the CDC. The median blood lead value of the 81 participating children was 6 mcg/dl; the mean, 6.96 mcg/dl; and the range, 3-16 mcg/dl (Table 5).

The mean lead values of males and females were statistically similar (7.29 vd. 6.72 mcg/dl, respectively; p = 0.37). The five black children had a significantly higher mean lead value than the 76 white children (10.0 versus. 6.76 mcg/dl, respectively; p = 0.012). The mean lead level was also higher for children in area A than for those in area B (8.04 versus 6.45 mcg/dl, respectively; p = 0.018). The highest mean lead value (9.40 mcg/dl) occurred among children 2 years old (Table 6).

Two (2.5%) children had erythrocyte protoporphyrin levels over 34 mcg/dl (35 and 36 mcg/dl, Table 7); both children had normal hemoglobin and lead values.

Data Analysis

The univariate analyses demonstrated that several demographic and socioeconomic status indicators were associated with having a higher lead value. These included being black, having a household income below the median, staying at home during play hours, carrying or mouthing a toy during the day, having no high school graduate in the household, having a smoker in the household, having a longer duration of residence, and residing in area A (Table 8). Univariate odds ratios less than two were seen for being male, being younger than the median age, living closer than the median distance from ILCO, and residing in a home older than the median age of surveyed homes (Table 8).

Some of the measured factors which on univariate analysis were not associated with having higher lead values included household occupation (no families with current ILCO employees entered this study), adult hobbies, history of house painting, presence of a garden and/or consumption of garden vegetables, use of clay pottery or open cans for storing food, presence of household animals, location in which the child spent his/her daytime hours, daily duration of outdoor play, washing hands before eating and sleeping and after playing outside, thumb sucking, nail biting, and pica (data not shown).

The initial multivariate linear regression model was a 20-variable model (Table 9), developed on the basis of 72 records (deleting 8 records with residence closer to ILCO, and having a shorter duration of residence. On the basis of the logistic regression model, factors that were associated with having a blood lead value in the top 15% of the observed distribution were living in area A, living in a home with a household-income below the median income, carrying a toy or blanket during the day, staying at home during the daytime, and having a longer duration of residence.

DISCUSSION

The high overall participation rates during both phases of the study reflected interest in the community in determining whether children living close to ILCO were unduly exposed to lead. It is difficult to project how nonparticipation might have affected this study.

Since no current ILCO employee households participated in the study, inadvertent importation into the home of lead-laden dust from the worksite could not be evaluated as an influence on the observed lead values. Although the reason no such households participated is not known, it may reflect voluntary selection factors or an unusual pattern of residence, employment, and having children.

A higher proportion of eligible children in area A, where the mean lead value was higher, did not participate. Factors that influenced participation were not known, but the overall gender and age distributions of participants and nonparticipant were similar, as was the mean residential distance from ILCO of both groups within each area. The racial composition of non-participants was unknown, and race was one of several variables associated in the univariate analysis with higher blood lead levels. It is thus possible that more complete participation by one racial group or another might have influenced the results.

The primary goal of this exposure survey was to determine whether children residing close to ILCO had blood lead values currently thought to be elevated. The observed distribution of blood lead values fell below the leve currently defined by the CDC as elevated (>25 mcg/dl) (1). Only one child had a value >15 mcg/dl, and 85% had values <10 mcg/dl. Although current national data on blood lead values in children are not available, data for 1976 throug 1980 from the National Center for Health Statistics showed an average of 15.0 mcg/dl for white children aged 6 to 35 months and 14.9 mcg/dl for white children aged 3 to 5 years (10). The average blood lead value observed among the children in this study was 6.96 mcg/dl. Thus, there was no evidence suggesting excessive lead exposure among the children studied. Consistent with previous national observations (10), children close to 2 years of age showed the highest mean lead values.

The second goal of this study was to determine the extent to which behavioral, demographic, and other potentially confounding factors were correlated with lead exposure. Several factors were common to both the linea and logistic regression models, even though the models were designed to estimate parameters that were quite distinct from each other. Living in area A was shown in the logistic regression model to be a risk factor for being in the upper tail of the lead distribution. In addition, the linear regression model identified area as the independent variable with the most impact on the mean blood lead value. Although the linear regression model predicted an increase in the mean lead value (from area B to area A) of 4.87 mcg/dl, the observed mean difference was 1.59 mcg/dl. This observed difference, although statistically significant, is not likely to be of discernible clinical importance. Moreover, the finding of higher blood lead values in area A seem inconsistent with the hypothesis that lead-contaminated emissions from ILCO were the principal source of lead exposure. Environmental data indicated the wind direction was predominantly toward area B, soil lead values were somewha blanket. Blood lead levels were associated in one multivariate model, but not the other, with residential distance from ILCO and with staying at home during the day. Duration of residence had an opposite effect in the two models.

RECOMMENDATIONS

1. All children at risk of exposure to lead should be tested and provided appropriate follow-up when indicated, as recommended by the American Academy of Pediatrics (11).

2. Opportunities for exposure to dust should be minimized for young children who put objects in their mouths. For example, toys and blankets carried outside should be cleaned and floors and window sills should be kept free of dust.

3. Remediation efforts underway at ILCO to minimize fugitive air emissions should be maintained so that monitoring shows consistent compliance with ambient air lead standards.

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11. American Academy of Pediatrics. Statement on childhood lead poisoning. Pediatrics 1987;79:457-65.

Table 2 - Distribution of participants and nonparticipants by gender and age, study areas A and B, Child Lead Exposure Study, Leeds, Alabama - August 1989.

Age Group	Participants			Nonparticipants		
	Male	Female	Total	Male	Female	Total
<1	1	1	2	1	0	1
1	10	7	17	2	0	2
2	2	8	10	1	5	6
3	7	7	14	0	2	2
4	6	11	17	2	0	2
5	9	12	21	4	2	6
Total	35	46	81	10	10*	20*

*No age recorded for one nonparticipating female.

Table 4 - Frequency of hemoglobin values, Child Lead Exposure Study, Leeds, Alabama - August 1989.

Hemoglobin (g/dl)	Number	Cumulative Percent
10.0	1	1.3
10.2	1	2.5
10.6	1	8.8
10.7	1	5.0
10.8	1	6.3
10.9	3	10.0
11.0	1	11.3
11.1	3	15.0
11.2	3	18.8
11.3	4	23.8
11.4	2	26.3
11.5	2	28.8
11.6	6	36.3
11.7	7	45.0
11.8	5	51.3
11.9	3	55.0
12.0	2	57.5
12.1	4	62.5
12.2	3	66.2
12.3	5	72.5
12.4	3	76.2
12.5	3	80.0
12.6	4	85.0
12.7	2	87.5
12.8	1	88.7
12.9	5	95.0
13.1	1	96.2
13.2	2	98.7
13.4	1	100.0
Total	80	100.0

Mean = 11.89 g/dl
Standard deviation = 0.71 g/dl

Table 6 - Frequency of mean lead values by age, Child Lead Exposure Study, Leeds, Alabama - August 1989.

Age (years)	Number of Children	Mean Lead (mcg/dl)
<1	2	6.00
1	17	6.35
2	10	9.40
3	14	5.86
4	17	7.53
5	21	6.67
Total	81	6.96

Table 8 - Univariate odds ratios of selected independent variables and blood lead values dichotomized at the upper tail (85th percentile) of the distribution, Child Lead Exposure Study, Leeds, Alabama - August 1989.

Independent Variable (n=81)	Upper Tail ($\geq$10 mcg/dl)	
	Odds Ratio	95% Confidence Interval
Household smoker	undefined (very large)	1.70-very large
Below median income (<$20,000/yr) (n=73)	11.38	1.42-508.44
Black	11.17	1.07-143.04
Carried a toy or blanket during the day	5.45	1.06-25.52
Stayed at home during the day	5.04	1.16-22.75
Longer residence of the family (>4 yrs)	4.39	0.97-26.95
No high school graduate in household	3.77	0.78-16.62
Area A	3.68	0.90-15.60
Mouthed a toy or blanket	2.95	0.41-16.00
Longer duration of residence of the child ($\geq$2 years)	2.45	0.59-10.84
Closer to ILCO ($\leq$3200 ft)	1.83	0.44-8.09
Male	1.38	0.35-5.50
Below median age ($\leq$3.8 yrs)	0.97	0.24-3.85
Older home ($\geq$28 yrs) (n=56)	0.28	0.04-1.81

Table 10 - Adjusted odds ratios for variables retained in the final logistic model, Child Lead Exposure Study, Leeds, Alabama - August 1989.

Name of Variable	Adjusted Odds Ratio	95% Confidence Interval
Carries a favorite toy or blanket during the day	17.0	1.81-160.49
Household income below median (<$20,000/yr)	15.8	1.01-247.62
Stays at home during the daytime	10.1	1.40-72.08
Area A	5.0	0.78-33.33
Duration of residence (of the child)*	2.1	1.03-4.46
Note: Each odds ratio is adjusted for the other four listed in the table.		

*for durations that differ by one-year increments

STUDY OF LEAD POLLUTION

IN

LEEDS, ALABAMA

BY

JEFFERSON COUNTY DEPARTMENT OF HEALTH
BUREAU OF ENVIRONMENTAL HEALTH

AND

BUREAU OF COMMUNICABLE DISEASES

MARCH, 1984

INTRODUCTION

During the last quarter of 1983 and the first quarter of 1984, the Jefferson County Department of Health air pollution monitors located generally south and southwest of a secondary lead smelter recovery plant, located in the Leeds, Alabama Industrial Park, registered an unusually high average of ambient lead levels. Initial investigations of meteorological data, automobile traffic, and other local factors indicated the major source of ambient lead was from the Interstate Lead Company (ILCO) recovery plant. The areas of principal concern lie in a valley with the exposed population living along and in close proximity to Alabama Highway 25 and an area to the east of the secondary lead smelter.

Excessive industrial lead contamination is most likely to adversely affect three groups of people: (1) company employees; (2) household members of employees; and (3) residents living near the plant.

This study is limited to residents living near the Interstate Lead Company.

FINDINGS

Health Data

Health data for this study consist of blood lead and other indicators of lead toxicity. This study found that children 10 years of age and less who lived less than 0.5 mile from the lead plant, with homes located generally south southwest of the lead plant, had higher blood lead levels than the same age group living farther distances. This study did not show evidence of absorption of lead to the degree usually associated with clinical symptoms of lead poisoning or lead toxicity. (Toxicity = $\geq$ 30 mcg/dl)

Onsite inspection revealed approximately 120 dwellings located south south-west and within one mile of the ILCO factory which is expected to be downwind from the plant during the fall and winter seasons. Many of these homes (at least 50%) appeared to have been built prior to 1940. It was apparent from a vehicular survey on February 11, 1984, that a number of young children lived in this predominantly white, working-class community.

Thirty-two of 192 (16.7%) subjects screened had blood lead levels $\geq$10 mcg/dl. The highest blood lead level in a child (22 mcg/dl) was found in a 3-year-old boy who gave a history of pica and onychophagia. This child's mother also reported that his pediatrician had recently diagnosed anemia.

Table 2 shows the mean blood lead concentrations of fourteen white children examined. The values observed were significantly lower than the values from the NHANES II study of blood lead concentrations in white children in the years 1976 - 1980.

Figure 1 depicts the neighborhood surveyed and shows sequential areas (A through K) concentric to the ILCO lead smelter. A total of 28 children aged 10 years or less were examined. Ten of these children lived within 1 km of the plant (in areas E and F) and eighteen lived beyond this distance (in areas G, H, I, J, and K). To derive the data presented in Table 3a, those children who gave a history of pica or onychophagia (nail-biting) were excluded. (See Table 3b.) Children whose homes were within 1 km of the plant had significantly higher mean blood lead levels than children living farther away than 1 km from the plant.

Table 4 shows the mean blood lead levels by age and sex for the 87 males and 105 females who were examined. Overall, the mean blood lead level in males of 7.53 mcg/dl with a standard deviation of 5.31 was significantly higher than that of females which was 4.32 mcg/dl and a standard deviation of 3.17.

The levels among males were also significantly higher than those of females for age groups 1-2, 35-44, and 55-64. However, only one female child less than 2 years of age was examined. Higher blood lead levels among working-age men relative to similarly aged women are expected.

The observed mean blood lead level of 8.5 mcg/dl among fifteen children aged 1-5 years (9.4 mcg/dl in children aged 1-2 and 7.7 mcg/dl in children aged 3-5) is significantly lower than the values of 15.9 to 16.2 mcg/dl reported for children of these ages in the NHANES II survey. (1) Moreover, since fourteen of the fifteen children screened were white, the NHANES II values of 14.9 and 15.0 mcg/dl should represent more appropriate comparison figures, still significantly higher than were observed in this 1984 study.

Between 1976 and 1980, the mean blood lead level in the United States population fell from 15.8 to 10.0 mcg/dl, paralleling a decrease in the use of leaded gasoline. (2) A study of cord blood lead levels has recently shown a decline of 11 percent annually between 1979 and 1981. (3) Therefore, it is realized that a projected mean blood lead level in the United States in 1984 could be as low as 6.2 mcg/dl, if the 11 percent per year decline has continued since 1981.

Given the above suppositions, the mean blood lead level observed in children living in areas E and F (Figure 1 and Table 3a) are probably not significantly different from the national average. However, if children are selected with no history of pica who live in areas E and F and compared to a control group of similarly aged children living in G, H, I, J, and K, again selected for absence of

SUMMARY

In reviewing the environmental data available, it is reasonable to conclude that deposition of lead from air to soil has taken place since 1967 when the Interstate Lead Company plant was constructed, accounting for the elevated soil lead levels near the plant. Air emissions appear to be a major contributor to young children's blood lead levels.

Food

The average daily intake of lead from food has been estimated at 100 ug/day for children 0-2 years old and 150 ug/day for children 2-3 years old. Compared to the 100 to 150 ug/day maximum tolerated daily intake limit, the contribution from eating garden vegetables grown in the areas south southwest and east of the lead plant appears to be mino: Most importantly, it is assumed that all vegetables are thoroughly washed. Eating unwashed leafy or root vegetables could greatly increase lead ingestion.

Overall Assessment

The preceding evaluations and assessments, based upon studies in other areas, indicate that an imminent health hazard does not exist in the study area. However, a health hazard could develop if ambient air levels are not reduced to meet the National Air Standard of 1.5 ug/cubic meter of air. Garden vegetables grown in the vicinity of the lead plant do not appear to pose a significant risk if all vegetables are thoroughly washed before eating.

Preliminary findings from the blood lead screening indicate that unusually high blood lead levels are not present. This may be partially explained by the fact that the samples were taken during February, 1984, when children were not spending many hours playing outdoors.

Although contamination exists in the study area, and evaluation of the data collected must continue, the preliminary assessment is that a major risk to public health is unlikely to exist if ambient air quality levels do not significantly exceed the National Ambient Air Quality Standard and that routine personal health and hygiene measures are followed.

RECOMMENDATIONS

In reviewing the findings and results of this preliminary study, the Jefferson County Department of Health recommends the following:

(1) Air quality be brought into attainment with the National Ambient Air Quality Standards for lead as soon as possible.

(2) Good housekeeping practices be continually emphasized.

TABLE 1

Blood Lead Levels by Age in all Races in
Participants in the Southwest Leeds, Alabama Survey
February, 1984

Age Group Year	No. of Persons Examined	Blood Lead Level+* mcg/dl
1-2	7	9.4
3-5	8	7.9
6-8	10	4.8
9-11	6	5.2
12-14	12	5.4
15-17	12	5.9
18-24	18	5.4
25-34	20	3.4
35-44	42	5.5
45-54	20	7.6
55-64	21	5.7
65-74	10	6.1
≥ 75	6	6.8
Total	192	5.8

+Levels reported as < 5 mcg/dl were calculated as 2.5 mcg/dl
*Means

TABLE 3a

Concentration of Lead in Blood of Resident Children $\leq$10 Years of Age
Without Pica or Nail-Biting (Onychophagia)

Distance Living from Smelter	Number of Children	Blood Lead Concentration (mcg/dl)	
Less than 1016.5 meters	7	10.86 $\pm$ 4.14	$p < .01$
Greater than 1016.5 meters	9	4.39 $\pm$ 3.88	

TABLE 4

Blood Lead Levels by Age and Sex in All Races in
Participants in the Southwest Leeds, Alabama Survey
February, 1984

Age Group Year	Males: No. of Persons Examined	Males: Blood Lead Level mcg/dl+*	Females: No. of Persons Examined	Females: Blood Lead Level mcg/dl+*
1–2+	6	10.58 ± 5.08	1	2.50
3–5	4	10.75 ± 9.84	4	4.75 ± 2.60
6–8	4	7.50 ± 5.79	6	3.08 ± 1.43
9–11	2	6.00 ± 1.41	4	4.75 ± 3.07
12–14	8	4.50 ± 4.73	4	7.13 ± 9.25
15–17	4	8.50 ± 8.26	8	4.19 ± 2.33
18–24	10	6.60 ± 4.59	8	4.00 ± 1.96
25–34	8	4.31 ± 2.63	12	2.71 ± 0.72
35–44+ǂ	16	7.25 ± 5.38	26	3.60 ± 2.12
45–54	10	9.10 ± 4.25	10	6.10 ± 3.83
55–64+§	6	8.42 ± 3.61	15	4.63 ± 3.24
65–74	6	6.33 ± 3.71	4	5.75 ± 4.97
≥ 75	3	6.83 ± 4.80	3	6.83 ± 4.25
Total+	87	7.53 ± 5.31	105	4.34 ± 3.17

+Levels reported as > 5 mcg/dl were calculated as 2.5 mcg/dl
*Means ± standard deviations

+p < .001; significant difference between males and females in this age group.
+ǂp < .01; significant difference between males and females in this age group.
+§p < .05; significant difference between males and females in this age group.

TABLE 6

Ambient Lead Monitoring Data Summary

Quarterly Averages (ug/m^3)

Yr/Qtr	New Jerusalem ILCO	New Jerusalem Hol. Church
1983-1	1.66	1.57
1983-2	0.69	0.32
1983-3	0.96	1.17
1983-4	3.04	4.17
1984-1*	6.11	3.58

*Averages through March 14, 1984

References:

1. Mahaffey KR, Annest JL, Roberts J, Murphy RS. National estimates of blood lead levels: United States, 1976-1980. N Eng J Med. 1982; 307:573-579.

2. Centers for Disease Control. Blood - lead levels in U. S. population. Morbid Mortal Weekly Rep. 1982; 31:132-134.

3. Rabinowitz MB, Needleman HL. Temporal trends in the lead concentrations of umbilical cord blood. Science. 1982; 216:1429-1431.

APPENDIX 2

Soil Lead Values at Sites around ILCO,

Alabama Department of Environmental Management

1983

Soil Lead Values (mcg/g) by Distance from ILCO; ADEM, 1983

Direction	200 meters	300 m	400 m	500 m	1,000 m	2,000 m
0 N.	64,000	148	N.S.	514	115	50
60 N.E.	3,000	N.S.	523	202	76	35
120 S.E.	443	221	220	244	315	46
180 S.	879	214	346	105	135	56
240 S.W.	831	337	1,300	299	141	90
300 N.W.	1,170	167	634	179	105	59
Mean	11,700	217	605	257	148	56

N.S. - Not sampled

APPENDIX 3

Soil, Groundwater, Surface water, and

Sediment Lead Values at Leeds NPL Sites

Environmental Protection Agency

1987

EPA Remedial Investigation/Feasibility
Study Data; ILCO NPL Sites; 1987

ILCO NPL Site	Soil (mg/kg)	Ground Water (mg/l)	Surface Water (mg/l)	Sediment (mg/kg)
ILCO Main Facility	33032 (9)*	350 (5)	678 (4)	43282 (5)
ILCO Parking Lot	3860 (18)	76 (2)	48 (5)	7275 (5)
F & L Fabricating	260 (7)	45 (3)	Not Done	41 (6)
Fleming's Patio	148 (4)	7 (2)	350 (2)	82 (8)
Frank Connell	714 (3)	38 (4)	Not Done	75 (5)
Gulf Station	2100 (1)	69 (2)	Not Done	90 (5)
Church of God	960 (1)	Not Done	Not Done	20 (4)

*Number in parentheses refer to number of samples analyzed

adapted from Technical Direction Memorandum; ILCO Site; Leeds, Al; EPA Work Assignment No. 73-4LJ4

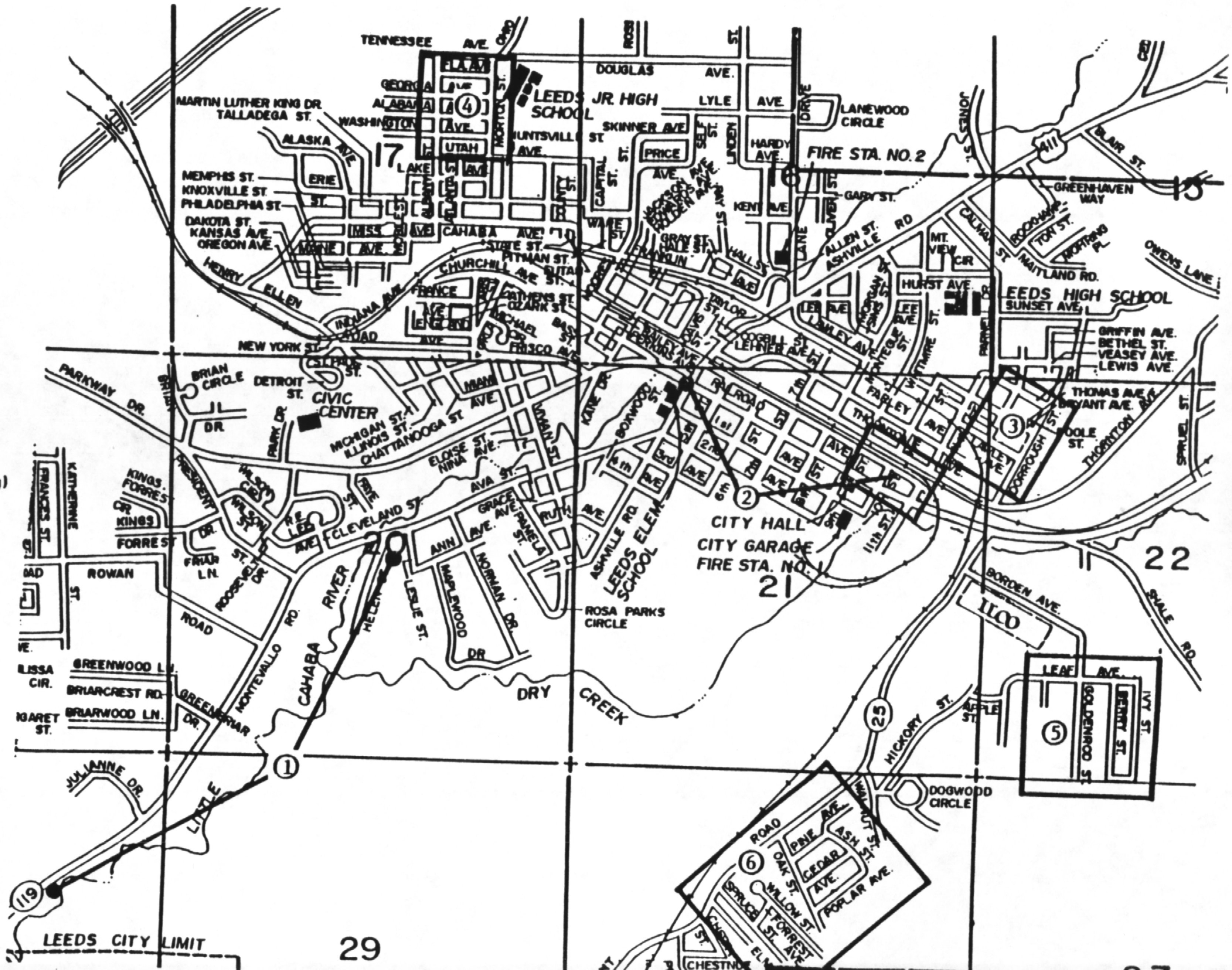
APPENDIX 4

Residential Soil Lead Values, Leeds

Alabama Department of Environmental Management

1988

RESIDENTIAL SOIL
LEAD VALUES: LEEDS, AL
ADEM, 1988



LEGEND

Data Grouped by Area of Town

① Background Samples (ug/g)
- #1 - 31
- #2 - 43
- Ave - 35 Range (31-43)

② Downtown Area (ug/g)
- #3 - 104
- #4 - 519
- #5 - 555
- #6 - 215
- Ave - 348 Range (104-555)

③ Durrough Street Area (ug/g)

#7 - 170	#12 - 270
#8 - 193	#13 - 111
#9 - 98	#14 - 169
#10 - 113	#15 - 161
#11 - 91	#16 - 97

Ave - 147 Range (91-270)

④ Leeds Jr. High School Area (ug/g)

#17 - 23	#21 - 111
#18 - 46	#22 - 26
#19 - 144	#23 - 33
#20 - 35	#24 - 79

Ave - 62 Range (23-144)

⑤ Leaf Ave. Area (ug/g)
- #25 - 95
- #26 - 83
- #27 - 41
- #28 - 98
- #29 - 68
- Ave - 77 Range (41-98)

⑥ Oak Street Area (ug/g)

#30 - 52	#35 - 40
#31 - 57	#36 - 91
#32 - 98	#37 - 39
#33 - 49	#38 - 59
#34 - 73	#39 - 64

Ave - 62 Range (39-98)

APPENDIX 5

Wind Direction, Leeds

Jefferson County Department of Health

1987

The following information collected by the Jefferson County Health Department Air Program during 1987 depicts wind direction in percentage of time over a 5900 hour interval in the Leeds area. Direction given is that in which the wind is blowing.

	%
N ——S	1.77
NNE ——SSW	7.59
NE ——SW	5.95
ENE ——WSW	4.44
E ——W	6.05
ESE ——WNW	4.74
SE ——NW	3.57
SSE ——NNW	3.26
S ——N	4.64
SSW ——NNE	13.52
SW ——NE	31.74
WSW ——ENE	8.54
W ——E	2.16
WNW ——ESE	.79
NW ——SE	.50
NNW ——SSE	.74

APPENDIX 6

Air Lead Values, Leeds

Jefferson County Department of Health

1983-1988

Air Lead Values (mcg/cubic meter) by Quarter
Leeds, AL; ADEM; 1983-1988

Air Monitoring Site	Quarter	1983	1984	1985	1986	1987	1988
		Year					
Church	1	1.55	2.96	0.68	0.41	0.57	0.67
	2	0.32	0.39	0.84	0.5	0.29	0.38
	3	1.17	0.64	0.54	0.73	0.17	
	4	4.17	1.89	0.46	2.3	0.79	
Pasture	1	1.66	5.37	1.42	1	0.5	0.84
	2	0.69	0.61	0.85	0.87	0.48	0.58
	3	0.96	0.52	0.43	0.68	0.21	
	4	3.04	2.46	0.6	1.54	1.29	
Caldwell	1	ND	ND	ND	2.4	3.04	1.67
	2	ND	ND	ND	1.78	1.13	1.2
	3	ND	ND	ND	3.06	1.91	
	4	ND	ND	1.32	5.1	2.16	
Hayes	1	ND	ND	ND	1.13	0.95	1.41
	2	ND	ND	ND	1.09	0.47	0.95
	3	ND	ND	ND	0.84	0.49	
	4	ND	ND	0.79	0.71	1.12	
Mont. Oil	1	ND	ND	ND	6.16	2.65	3
	2	ND	ND	ND	4.38	2.24	2.81
	3	ND	ND	ND	4.67	1.97	
	4	ND	ND	6.27	4.82	3.33	
Elementary School	1	ND	ND	ND	ND	ND	0.16
	2	ND	ND	ND	ND	0.08	0.1
	3	ND	ND	ND	ND	0.08	
	4	ND	ND	ND	ND	0.13	

ND = not done

APPENDIX 7

Municipal Water Lead Vales, Leeds

Alabama Department of Environmental Management

1987-1988

LEED'S WATER SOURCES

LEAD SUMMARY

	10/15/87	3/8/88	3/17/88
Weems Spring	* .000 ppm	* .000 ppm	* .000 ppm
Rowan Spring	* .000 ppm	* .000 ppm	* .000 ppm
Well # 1	* .000 ppm	* .000 ppm	* .000 ppm
Well # 2	* .000 ppm	* .000 ppm	* .000 ppm
Well # 3	* .000 ppm	* .000 ppm	* .000 ppm
Well # 4	* .000 ppm	* .000 ppm	* .000 ppm

* Below detection level of .005 ppm

APPENDIX 8

Water Lead Values in Leeds Elementary School

Alabama Department of Environmental Management

1988

Water Lead Values from Leeds
Elementary School; ADEM; May 1988

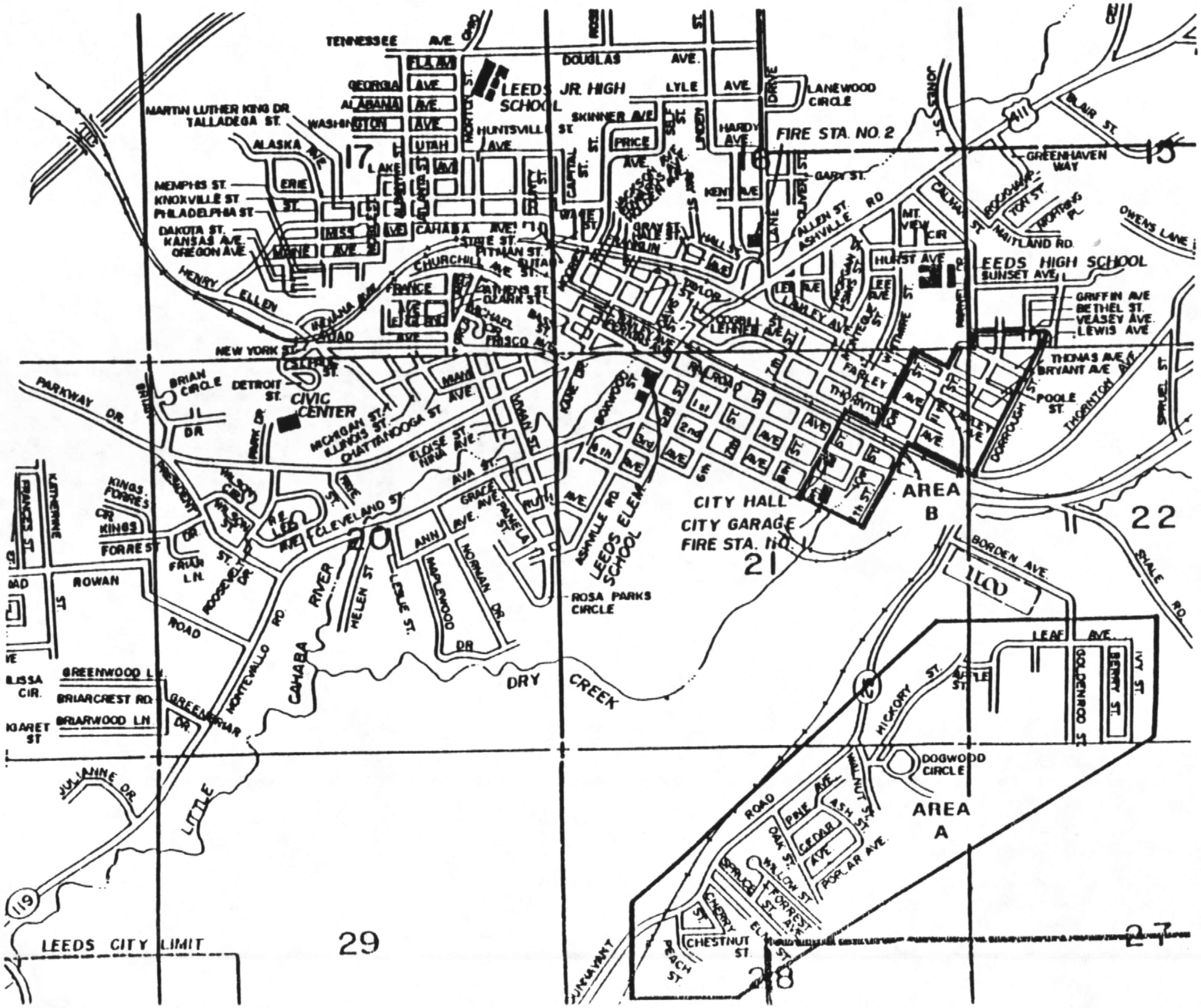
Collection Point	First draw	Post 3-minute flush
Water main	N.D.	N.D.
Kitchen	N.D.	N.D.
Kitchen Fountain	N.D.	N.D.
Room 27 Fountain	N.D.	N.D.
Office Fountain	N.D.	N.D.
Room 3 Fountain	N.D.	N.D.
Room 6 Fountain	N.D.	N.D.

N.D. = not detected (below 0.005ppm)

APPENDIX 9

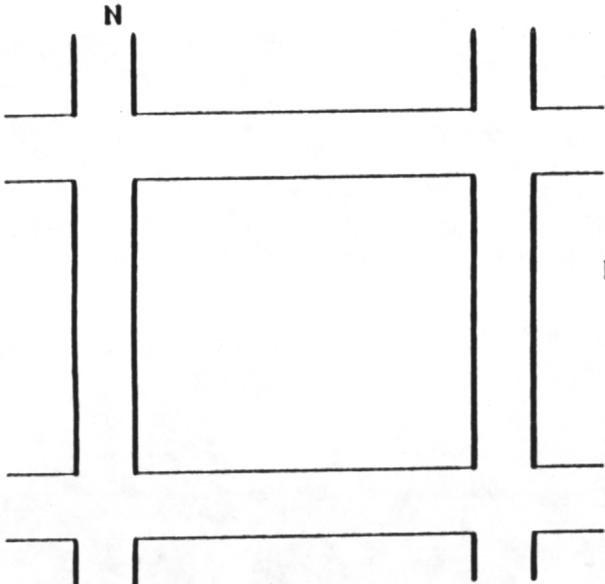
Map of Leeds Showing Areas A and B

TARGETED STUDY SITES
LEEDS, AL



APPENDIX 10

Copy of Block Survey Form



Page__of__

Leeds Lead Exposure Survey

OCTOBER 1988

BLOCK SURVEY FORM

Date _ _/_ _/88   Interviewer: ____________________

Block # _ _

Building#	Premises Address	Residential/ Single Family	Residential/ Multiple Family	Vacation/ Weekend	Business	Vacant	Eligible	Not Eligible	Completed	Refused	Comments

APPENDIX 11

Copy of Census Survey Form

Leeds Lead Exposure Survey

VISIT LOG

	#1	#2	#3
Date:			
Time:			
Status:			

____ ____ Interviewer   ____ Month ____ / ____ Date ____/87   ____ Time ____ : ____ am ____ pm   ____ Block ____ ____   ____ Building ____

Say: Hello. We are doing a census in this neighborhood for the Alabama Department of Public Health. Can you help me out with some information about this house? It should only take 5 minutes. The census is part of the exposure survey described in this fact sheet (give fact sheet). We may call or visit you later to request an interview and a blood test.

Adult at home? Yes=1, No=2 ____

Has any member of this household lived in this house for at least 60 days since July 1, 1988? Yes=1, No=2 ____

If NO: Has any member of this household lived in Leeds for at least 60 days since July 1, 1988? Yes=1, No=2 ____

Total number of persons who live in house ____

Contact person # ____

____ Last Name   ____ First name   ____ Number   ____ Street

Telephone Home ____ ____ ____-____ ____ ____ ____   Work ____ ____ ____ -____ ____ ____ ____

Best time to recontact: ____ ____:____ am ____ pm   ____ Sun ____ Mon ____ Tue ____ Wed ____ Thu ____ Fri ____ Sat

Completion status: 1=Refused, 2=Participated, 3= No Contact, 4=Invalid address, 5= Other ____

Start with youngest member of household.

Name	Sex 1-M 2-F	Rela- tionship 1-self 2-spouse 3-parent 4-child 5-other family 6-other	Birthdate mo-day-yr	Lived in this house 60 days? 1-yes 2-no	(If NO) Lived in Leeds 60 Days? 1-yes 2-no	Previous address and dates
1. F____ MI__ L____	__	__	__ __-__ __-__ __	__	__	
2. F____ MI__ L____	__ __	__	__ __-__ __-__ __	__	__	
3. F____ MI__ L____	__ __	__	__ __-__ __-__ __	__	__	
4. F____ MI__ L____	__	__	__ __-__ __-__ __	__	__	
5. F____ MI__ L____	__ __	__	__ __-__ __-__ __	__	__	

APPENDIX 12

Copy of Participant Consent Form

Participant Consent
for Interview and Blood Testing

The Alabama Department of Public Health, with assistance from the Jefferson County Department of Health and the Agency for Toxic Substances and Disease Registry, is conducting a survey of possible exposure to lead among selected residents of Leeds. My participation will help determine if there is exposure to lead.

The survey has two parts: a questionnaire and a blood test for exposure to lead. My part in the survey will include:

1. Answering questions about habits and activities of children in my home, the occupations of adults in my home, and hobbies of adults and children in my home.

2. Allowing blood testing (described below) on:

   (__) Myself
   (__) My child/ward,____________________________

   A blood sample, approximately 3-6 ml (about 1 teaspoon), will be taken with a needle from a vein in the arm. There is little risk associated with this procedure. Temporary discomfort and a small bruise may occur at the site where the needle enters the skin.

<u>Participation</u>: I understand that my household's participation will take about thirty minutes. There will be no physical examination. There is no provision for compensation or medical treatment in the event of injury as a result of my participation. I understand that I can stop my or my children's participation at any time. If I choose not to participate or to stop at any time there will be no penalty. Any benefits which I now receive or to which I am entitled will be not affected by this decision.

<u>Results</u>: As a result of my/my child/ward's participation in this survey I/my child/ward will receive a blood test for lead and iron deficiency anemia, at no charge. Alabama Department of Public Health will send me a letter within six to eight weeks with my/my child/ward's test results and will refer us for a medical evaluation if it is indicated from our test results.

<u>Participant Consent
for Blood Testing</u>

The Alabama Department of Public Health, with assistance from the County Department of Health and Agency for Toxic Substances and Disease Registry, is conducting a survey for possible exposure to lead among selected residents of Leeds. My participation will help determine if there is exposure to lead.

The survey has two parts: a questionnaire and a blood test for exposure to lead. The questionnaire has been or will be completed by another person in my household.

My part in the survey will be to allow blood testing (described below) on:

(__) Myself
(__) My child/ward, ____________________

A blood sample, approximately 3-6 ml (about 1 teaspoon), will be taken with a needle from a vein in the arm. There is little risk associated with this procedure. Temporary discomfort and a small bruise may occur at the site where the needle enters the skin.

<u>Participation</u>: I understand that my household's participation will take about thirty minutes. There will be no physical examination. There is no provision for compensation or medical treatment in the event of injury as a result of my participation. I understand that I can stop my or my children's participation at any time. If I choose not to participate or to stop at any time there will be no penalty. Any benefits which I now receive or to which I am entitled will be not affected by this decision.

<u>Results</u>: As a result of my/my child/ward's participation in this survey I/my child/ward will receive a blood test for lead and iron deficiency anemia, at no charge. Alabama Department of Public Health will send me a letter within six to eight weeks with my/my child/ward's test results and will refer us for a medical evaluation if it is indicated from our test results.

<u>Confidentiality</u>: I understand that the Alabama Department of Public Health will take every reasonable precaution to keep my records confidential. Any information shared with the Agency for Toxic Substances and Disease Registry or Centers fro Disease Control will be kept in accordance with the federal Privacy Act of 1974. Any reports of this survey will not identify specific individuals, and will only give group information.

APPENDIX 13

Copy of Institutional Review Board Approval

THE UNIVERSITY OF ALABAMA

Institutional Review Board for the
Protection of Human Subjects
Ronald Rogers, Chairperson, 348-1930

Notification of IRB Action

Principal Investigator(s): Charles H. Woernle, M.D.
Department of Public Health

Title of Research Proposal: "Pilot Human Lead Exposure Study, Leeds, Alabama"

Date: November 21, 1988

IRB Action:

☒ This proposal complies with University and federal regulations for the protection of human subjects (45 CFR 46). Approval is effective for a period of one year from the date of this notification.

☐ Revisions requested:

APPENDIX 14

Laboratory Procedures for Lead Testing

MODIFIED BLOOD LEAD PROCEDURE FOR HANES III

Blood lead will be determined with electrothermal atomic absorption using a L'vov platform and matrix modification. The procedure is a modification of existing methodology, and is based on recent published work on determination of lead in biological specimens.

INSTRUMENTS:

Atomic Absorption Spectrophotometer. Perkin Elmer Model 372, Model 5000, or Zeeman 5000.
Graphite Furnace. Perkin-Elmer Model 500 with controller.
Autosampler. Perkin-Elmer Model AS-40.

Instrumental Settings:

Parameter	Setting
Wavelength	283.3 nm
Lamp Current	10 ma
EDL Power	9.5 - 10W
Slit	0.7 (LOW)
Signal Mode	AA - BG
Read Time	4 sec
Insert Gas	Argon
Furnace	Pyrolytic with Pyrolytic Platform
Background Corrector	D2 Arc or Zeeman

Temperature Program:

DRY	130 - 160°C* 30 sec 5 sec RAMP
CHAR	700-800°C* 30 sec 5 sec RAMP
ATOMIZE	2400°C 4 sec 1 sec RAMP
COOL	20°C 4 sec 1 sec RAMP
Inert Gas Flow	300 mL/min 20 mL/min @ ATOMIZE

* Temperatures should be optimized for each individual set of contact rings platform, and furnace.

Recorder Perkin-Elmer Model 056, set at 5 mV; chart speed 20 mm/minute.

Automatic Pipet. Micromedic Model 25000, equipped with 1 mL dispensing pump and 1 mL sampling pump.

PLASTICWARE AND GLASSWARE:

Plasticware and glassware is cleaned by soaking 24 hours in "Sparkleen" detergent, followed by thorough rinsing with DI water. The rinsed glassware is then soaked 24 hours in 25% by volume ACS nitric acid. All cleaned materials are then rinsed with copious amounts of ultrapure water and dried under Class 100 conditions.

ANALYTICAL PROCEDURE:

1. Aspirate 100 µL of well mixed whole blood into the delivery tip of the automatic pipet. Dispense this aliquot into a precleaned plastic vial along with 450 µL of matrix modifier.

2. Aspirate air into the delivery tip, and delivery an additional 450 µL of matrix modifier into the same vial. Cap the diluted specimen.

3. Vortex the diluted specimen for 5 seconds, and allow to stand for 10 minutes.

4. Remix by vortex for 5 seconds, and pipet the diluted specimens into a precleaned autosampler cup.

5. Measure the absorbance of the diluted specimens in duplicate, using the AS-40 to dispense 20 µL into the graphite furnace.

6. Measure the absorbance of the "blank", prepared by dispensing 100 µL of water and 900 µL matrix modifier into a precleaned autosampler cup.

CALIBRATION:

1. Into a series of six precleaned autosampler cups, pipet 100 µL of well mixed whole "base" (low lead) blood, using the delivery tip of the automatic pipet. Dispense into the autosampler cup along with 400 µL of matrix modifier.

2. Aspirate air into the delivery tip, and rinse with 400 µL matrix modifier. Repeat this step three times to thoroughly rinse the dispensing tip of any remaining blood.

3. Aspirate 100 µL of: (a) matrix modifier; (b) 100 µg/L lead standard; (c) 250 µg/L lead standard; (d) 500 µg/L lead standard; (e) 750 µg/L lead standard, and (f) 1000 µg/L lead standard, and 400 µL of matrix modifier into the series of six autosampler cups. This will generate a series of spiked blood standards corresponding to an INCREASE of 0, 10, 25, 50, 75, and 100 µg/dL lead.

4. Measure the absorbance of the resulting solutions in duplicate, dispensing 20 µL of diluted blood material into the furnace with the autosampler.

APPENDIX 15

Copies of Notification Letters to Parents

State of Alabama
Department of Public Health
State Office Building
Montgomery, Alabama

Claude Earl Fox, M.D., M.P.H.
State Health Officer

MAILING ADDRESS
434 Monroe Street
Montgomery, Alabama 36130-170

August 30, 1989

Dear Doctor:

You were listed by parents as the physician of record for a Leeds, Alabama child(ren) tested for hemoglobin, lead, and erythrocyte protoporphyrin (EP) during the lead exposure study conducted during August 7-18, 1989, by the Jefferson County and Alabama Health Departments. A copy of the results sent to parents is enclosed for your information.

The health department used the following values in its reporting of results:

Hemoglobin ≥ 10.5 g/dl: Normal

Lead < 15 ug/dl and EP < 35 ug/dl: Normal

Lead < 15 ug/dl and EP ≥ 35 ug/dl: Normal blood lead value but possible iron deficiency. Followup may be indicated.

Lead 15-24 ug/dl and EP < 35 ug/dl: Blood lead value is within the Centers for Disease Control's recommended limit of 25 ug/dl, and there is no evidence for lead toxicity. However, subtle effects have been reported at blood lead values less that 25 ug/dl, and followup and repeat testing may be indicated.

I hope this information is useful. Thank you for your interest and cooperation.

Sincerely,

Charles H. Woernle

Charles H. Woernle, M.D., M.P.H.
State Epidemiologist

CHW:ah

Enclosure(s)

State of Alabama
Department of Public Health

State Office Building
Montgomery, Alabama

Claude Earl Fox, M.D., M.P.H.
State Health Officer

MAILING ADDRESS
434 Monroe Street
Montgomery, Alabama 36130

August 30, 1989

Dear Parent:

Thank you for taking part in the Leeds lead exposure study conducted by the Jefferson County Department of Health and the Alabama Department of Public Health during August 7-18, 1989. Your cooperation has been very helpful in providing information that will let us know the lead values of children in Leeds.

The results for your child are below:

Hemoglobin (g/dl)	Lead (ug/dl)	EP(erythrocyte protoporphyrin) (ug/dl)

These results show that your child has normal values for hemoglobin, lead, and EP.

A copy of this letter is being sent to the doctor or health center (listed below) you gave us when you came in for the blood test. I recommend that you contact the doctor or health center, if you have any questions about any of the results.

Again, thank you very much for your assistance.

Sincerely,

Charles H. Woernle

Charles H. Woernle, M.D., M.P.H.
State Epidemiologist

cc:

State of Alabama
Department of Public Health
State Office Building
Montgomery, Alabama

Claude Earl Fox, M.D., M.P.H.
State Health Officer

MAILING ADDRESS
434 Monroe Street
Montgomery, Alabama 36130-1701

August 30, 1989

Dear Parent:

Thank you for taking part in the Leeds lead exposure study conducted by the Jefferson County Department of Health and the Alabama Department of Public Health during August 7-18, 1989. Your cooperation has been very helpful in providing information that will let us know the lead values in children in Leeds.

The results for your child are below:

Hemoglobin (g/dl)	Lead (ug/dl)	EP (erythrocyte protoporphyrin) (ug/dl)

The results show that your child's hemoglobin and lead values are normal.

The EP level is higher than 34 ug/dl, and this might mean that your child is iron deficient. I recommend that you contact your doctor or health center for advice and followup.

A copy of this letter is being sent to the doctor or health center (listed below) you gave us when you came in for the blood test. Please contact the doctor or health center, if you have any questions about any of the results.

Again, thank you very much for your assistance.

Sincerely,

Charles Woernle

Charles H. Woernle, M.D., M.P.H.
State Epidemiologist

CHW:ah

cc:

State of Alabama
Department of Public Health

State Office Building
Montgomery, Alabama

Claude Earl Fox, M.D., M.P.H.
State Health Officer

MAILING ADDRESS
434 Monroe Street
Montgomery, Alabama 36130-1701

August 30, 1989

Dear Parent:

Thank you for taking part in the Leeds lead exposure study conducted by the Jefferson County Department of Health and the Alabama Department of Public Health during August 7-18, 1989. Your cooperation has been very helpful in providing information that will let us know the lead values in children in Leeds.

The results for your child are below:

Hemoglobin (g/dl)	Lead (ug/dl)	EP (erythrocyte protoporphyrin) (ug/dl)

The results show that your child's hemoglobin is below 10.5 g/dl, and so your child may have anemia. Also, your child's lead value is higher that 15 ug/dl, although it is within the Centers for Disease Control's recommended limit of 25 ug/dl. Because subtle effects have been reported at lead levels less than 25 ug/dl and because of possible anemia, I recommend that you contact your doctor or health center for additional advice and followup.

The EP result is normal.

A copy of this letter is being sent to the doctor or health center (listed below) you gave us when you came in for the blood test. Please contact the doctor or health center, if you have any questions about any of the results.

Again, thank you very much for your assistance.

Sincerely,

Charles Woernle

Charles H. Woernle, M.D., M.P.H.
State Epidemiologist

CHW:ah

cc:

State of Alabama
Department of Public Health
State Office Building
Montgomery, Alabama

Claude Earl Fox, M.D., M.P.H.
State Health Officer

MAILING ADDRESS
434 Monroe Street
Montgomery, Alabama 36130-1701

August 30, 1989

Dear Parent:

Thank you for taking part in the Leeds lead exposure study conducted by the Jefferson County Department of Health and the Alabama Department of Public Health during August 7-18, 1989. Your cooperation has been very helpful in providing information that will let us know the lead values in children in Leeds.

The results for your child are below:

Hemoglobin (g/dl)	Lead (ug/dl)	EP (erythrocyte protoporphyrin) (ug/dl)

These results show that your child's hemoglobin level is below 10.5 g/dl, and so your child may have anemia. I recommend that you contact your doctor or health center for advice and followup.

The results for lead and EP are normal.

A copy of this letter is being sent to the doctor or health center (listed below) you gave us when you came in for the blood test. Please contact the doctor or health center, if you have any questions about any of the results.

Again, thank you very much for your assistance.

Sincerely,

Charles Woernle

Charles H. Woernle, M.D., M.P.H.
State Epidemiologist

CHW:ah

cc: