

A REPORT ON A STUDY TO DETERMINE
THE BLOOD LEAD LEVELS IN DALLAS CHILDREN

A pilot study of blood lead levels in Dallas children was done in July 1972, by members and staff of the Dallas City Health Department, and the Dallas Area Respiratory Health Association in cooperation with volunteers from the two participating areas in the city. The study had two aims:

1. To determine the range of blood lead levels in Dallas children who live in the two areas tested.
2. To determine whether residence near a point source of lead emissions to the atmosphere has any influence on blood lead levels in Dallas children.

Study Design

The Test Area, referred to as the "Cadillac addition", is bounded by Morrell, Cedar, and Sargent street, and the M.K.T. railroad. Two secondary lead smelters, Dixie Industries and National Lead, are located on the eastern border of the Test Area. Prevailing winds during much of the year are south easterly. Extensive data on the lead emissions of these smelters have been accumulated by the Air Pollution Control Division of the Dallas Health Department. The racial composition of the area is approximately 75% Mexican American and 25% black. Most homes are single dwellings approximately 20 years old.

Two Control Areas were selected since no single area with similar housing, socioeconomic level, and racial composition could be identified. One area, bounded by Canada Drive, Brantley, Pueblo, and Pastor was predominantly Mexican American; the other, bounded by McBroom, Morris, Vilbig, Shaw, and Puget was predominantly black. Both areas closely resemble the Test Area in age of homes and socioeconomic level.

All occupied homes in each area were given a number; homes were then selected for study by reference to a random numbers table. Selected homes were visited by neighborhood volunteer workers who determined whether or not children aged 2-6 years lived in the home, and whether the parents would consent to the drawing of a blood sample from the child. A future date was established for blood drawing and signed parental consent obtained.

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note

Five ml. blood samples were drawn in vacutainer tubes containing anticoagulant, and were airmailed to United Medical Laboratories in Portland, Oregon, for lead analysis. Prior to receipt of the results, study subjects from the Test and Control Areas were paired by age and race, in cognizance of the findings of others that blood lead levels are age-dependent and higher in blacks. Results were analyzed by parametric and non-parametric statistical techniques.

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note

Studies in other metropolitan areas have related elevated blood lead values in small children to the lead content of the paint in the home. Peeling paint, found especially in dilapidated housing is ingested by the children. Accordingly, the lead content of the paint on four inside walls and one outside wall was determined in each home in which the family participated in the study, using a radioisotope fluorescent analyzer borrowed from the Department of Health, Education, and Welfare, Bureau of Community Environmental Management. Readings from the five sites were averaged to obtain a single value for each home.

Samples of ambient air in both Control Areas and the Test Area were collected with hi-volume samplers by the Air Pollution Control Division and the samples obtained were analyzed for lead by their usual technique.

Samples of soil, approximately one cubic inch, were collected from the front

yard of each participating family. Sites were chosen to avoid obvious contamination by vehicular emissions. The samples were analyzed by the Air Pollution Control Division.

Results

Over half of the eligible families participated in the study (Table 1).

<u>Table 1:</u> Families Participating in Study			
	Eligible	Participating	%
<u>Control Area</u>			
Black	12	7	58
Mexican-American	<u>14</u>	<u>12</u>	<u>86</u>
TOTAL	26	19	73
<u>Test Area</u>			
Black	8	4	50
Mexican-American	<u>20</u>	<u>11</u>	<u>55</u>
TOTAL	28	15	54

Results of lead analyses are shown in Table 2. A complete listing of the data is included as Appendix 1. The frequency distribution of blood lead values is shown in Figure 1.

Comment

These data indicate that 5 of the 53 (9%) blood samples equaled or exceeded 40 mcg/100ml, a level generally accepted as a potentially harmful level.* These high levels were equally distributed between Test and Control Areas but could not be related to the lead content of household paint. However, as a group, the blood lead levels of children in the Test Area were 36% higher than that of children in the Control Areas. This difference was statistically significant by both parametric and non-parametric techniques. The Environmental impact of the two lead smelters was shown by the increase in both air and soil lead contents in the Test Areas.

This study represents an admittedly small population; however, the carefully controlled random selection process used to obtain the subjects strengthens the interpretation of the results. It has not been proven that the emissions from the lead smelters are the source of the increased blood lead in Test Area children. However, no difference was found in household paint lead content between Test and Control Areas, and an increment in environmental lead in the Test Area was demonstrated.

Two conclusions can be reached from the results of this study:

1. 9% of children between 2-6 years of age in the areas tested have blood lead levels which exceed an acceptable level;*
- * 2. Living near a point source of atmospheric lead emissions [REDACTED] with a 36% increase in blood lead.

The long-range biological significance of these findings is unknown. However, in view of the known effects of lead associated with blood levels only slightly

* Medical aspects of poisoning H.S.H.M.A. Health Report Vol. 86 P. 140 1971

higher than those reported here it is clear that further studies are required.

Recommendations

1. A larger study of children should be done to evaluate lead exposure in various areas of Dallas.
2. Means now exist to pinpoint sources of environmental lead, based on the differentiation between lead isotopes by mass spectrometry. Such a study has been proposed by the University of Texas at Dallas. We recommend that this proposal be implemented and made part of the recommended study of lead exposure in Dallas.
3. The need for regulations to restrict the emission of lead to the atmosphere is confirmed by this study; it is therefore recommended that enforceable regulations to that end be adopted.

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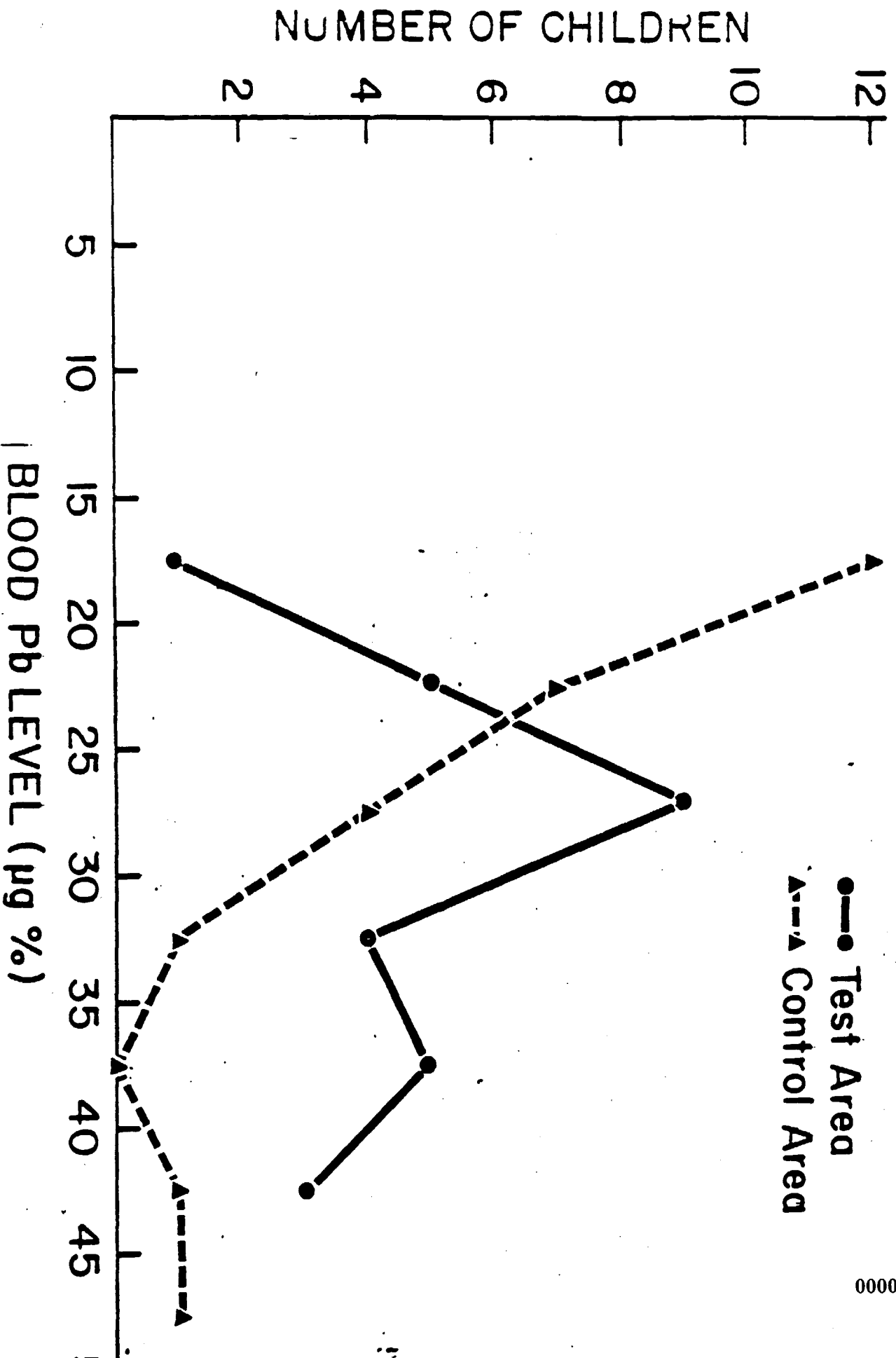
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BLOOD Pb LEVELS IN DALLAS CHILDREN



RESULTS OF BLOOD LEAD ANALYSIS

TEST AREA				CONTROL AREA		
T-C	Age	Ethnic Group	Test Results mcg/100ml	Age	Ethnic Group	Test Results mcg/100ml
18	2	Mex. Amer.	35	2	Mex. Amer.	17
15	2	Mex. Amer.	43	2	Mex. Amer.	28
-9	2	Mex. Amer.	31	2	Mex. Amer.	40
19	2	Mex. Amer.	38	2	Mex. Amer.	19
4	3	Mex. Amer.	28	3	Mex. Amer.	24
18	3	Mex. Amer.	34	3	Mex. Amer.	16
-2	3	Mex. Amer.	24	3	Mex. Amer.	26
-3	3	Mex. Amer.	25	3	Mex. Amer.	28
4	3	Mex. Amer.	27	3	Mex. Amer.	23
18	4	Mex. Amer.	38	4	Mex. Amer.	20
16	4	Mex. Amer.	32	4	Mex. Amer.	16
6	4	Mex. Amer.	27	4	Mex. Amer.	21
11	4	Mex. Amer.	29	4	Mex. Amer.	18
14	5	Mex. Amer.	30	5	Mex. Amer.	16
13	5	Mex. Amer.	26	5	Mex. Amer.	13
5	5	Mex. Amer.	24	5	Mex. Amer.	19
0	5	Mex. Amer.	16	5	Mex. Amer.	16
7	6	Mex. Amer.	20	6	Mex. Amer.	13
-2	6	Mex. Amer.	26	6	Mex. Amer.	28
7	6	Mex. Amer.	22	6	Mex. Amer.	15
-4	2	Black	27	2	Black	31
-18	2	Black	27	2	Black	45
	2	Black	38			
16	5	Black	36	5	Black	20
1	5	Black	24	5	Black	23
21	6	Black	40	6	Black	19
16	6	Black	40	6	Black	24

Wilcoxon Matched - Pairs Signed - Ranks Test
 Level of Significance for two-tailed test
 $p < 0.01$

LEAD ANALYSIS OF PAINT SAMPLES

Test and Control Area

Lab Number Code For Participants	Living Room Wall mg/cm ²	Bedroom Wall mg/cm ²	Bedroom Window Sill mg/cm ²	Kitchen Wall mg/cm ²	Outside Wall mg/cm ²
S-101	.0	.0	1.3	.0	1.7
S-102	1.2	.0	.0	.0	3.8
S-103	2.0	.0	.0	.0	0.4
S-104	.0	.0	.0	.0	.0
S-105	.0	.2	2.1	.9	4.4
S-106	1.9	.4	.9	.9	.0
S-107	1.5	.0	.0	.0	1.9
S-108	.0	.0	.0	.0	.5
S-109	.0	.0	1.0	.0	.5
S-110	1.1	1.4	3.3	.6	10.8
S-111	.0	.0	2.0	1.9	1.2
S-112	.0	.0	.0	.0	3.8
S-113	.0	1.5	.0	.0	2.5
S-114	-	-	-	-	4.1
S-115	.0	.0	.9	2.1	1.8
S-116	.0	.0	1.2	9.2	.0
S-117	.0	.0	.0	.6	.0
S-118	.8	.8	.8	.0	4.3
S-119	.0	.0	.0	.0	1.4
S-120	0.2	.0	.0	.0	3.2
S-121	.0	.0	1.4	.0	2.4
S-122	.0	.0	1.6	.0	.0
S-123	.0	.0	.6	.5	1.2
S-124	.0	.0	1.8	.0	.7
S-125	.0	.8	2.8	.0	1.8
S-126	1.4	.6	2.4	.0	7.0
S-127	.0	.0	.0	.3	.0
S-128	.0	.0	2.1	.0	.9
S-129	1.5	2.0	1.5	2.1	.5
S-130	.9	.0	2.2	.8	1.2
S-131	.0	.6	.0	.9	3.6

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LEAD ANALYSIS OF SOIL SAMPLES

Lab Number Code For Participants	Results as ppm lead
S-247	1020
S-248	180
S-249	756
S-250	755
S-251	879
S-252	880
S-253	180
S-254	320
S-255	120
S-256	200
S-257	200
S-280	471
S-258	1139
S-259	620
S-260	1139
S-261	197
S-262	173
S-272	119
S-263	180
S-264	1011
S-265	386
S-279	119
S-267	1645
S-268	357
S-269	358
S-270	357
S-276	56
S-273	318
S-274	Less than 40
S-275	119
S-277	319
S-278	198

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INTERPRETATION OF X-R-F READINGS

Because of the nature of the technique, X-ray fluorescence results are usually presented as an average of several readings, all of which are taken without moving the probe.

Generally speaking, the results fall into three broad categories. These categories are: (1) No lead or insignificant amounts of lead present, (2) significant (though low) levels of lead present, and (3) hazardous quantities of lead present.

Interpretation of the results should be as follows:

- (1) No Lead or Insignificant Amounts of Lead Present (From Zero to 1.0 milligrams/square centimeter)

Any of the readings whose average is from zero to one milligram per square centimeter should be interpreted as having little or no lead present. This is because in this range, different background materials such as wood, plaster, brick, and drywall will bias the results somewhat, sometimes resulting in as much as a 1 milligram discrepancy.

- (2) Significant, though Low, Levels of Lead Present (From 1.0 to 3.0 Mg/cm²)

Readings of between 1 and 3 milligrams should be considered to be the threshold level of dangerous quantities of lead.

- (3) Hazardous Levels of Lead Present (Readings Above 3.0 Mg/cm²)

Readings higher than 3 milligrams per square centimeter indicate hazardous levels of lead. The higher readings indicate a greater hazard than the low readings.

A factor which is often confusing in the interpretation of results is that readings greater than 95 actually represent negative readings, due to the operation of the analyzer. For example, a reading of 97.3 actually represents a negative 2.2 and would be averaged as such.

Examples of the three levels of results would be:

- Level (1) No Lead or Insignificant Averages: 99.6, 98.3, .8, .5
Level (2) Significant Though Low Averages: 1.3, 2.1, 2.9, 1.8
Level (3) Hazardous Averages: 3.2, 3.3, 28.9, 32.1

INTERPRETATION OF X-R-F READINGS

The following guidelines have been offered by the Department of Health, Education & Welfare as an aid in interpreting the X-ray fluorescence (X-R-F) readings on lead paint in dwelling units examined by the X-R-F instrument.

The primary concern must be with the home in which a child has a blood lead level of 40 micrograms or above. In such a home the following actions are recommended for various average readings.

<u>Average of X-R-F₂ Reading in mg/cm²</u>	<u>Condition of Paint</u>	<u>Recommended Action</u>
2.0 or greater	N/A	Paint removal or made ¹ inaccessible to the child
1.0 - 1.9	flaking or chipped	Paint removal or made ¹ inaccessible to the child
	tight, good condition	Investigate other possible sources of lead
0.0 - 0.9 ²	flaking or chipped	Testing by wet chemical analysis
	tight, good condition	Investigate other possible sources of lead

If X-R-F readings indicating the presence of lead paint have been obtained in homes where no child exhibits a blood lead of 40 micrograms or higher, a potentially serious situation still exists, especially if the paint is in poor condition and small children are present. Action in such cases will be determined by local housing codes and enforcement practices.

¹Covering the lead paint with a fresh coat of non-lead paint will not make the lead paint inaccessible.

²Range is below practical limits of instrument for measurement of mg/cm².

Percent Lead Vs Milligrams/cm² Lead

Most cities and states have on the books laws limiting the lead content of paint to 1%. This 1% figure originated with the U.S. Standards Institute.

While a percent figure is meaningful when evaluating the hazard posed by a specific layer of paint, its usefulness becomes dubious when applied to paint on the walls of homes. This is due to the fact that the paint on walls will be several layers thick with some layers non-lead while others may contain up to 50% lead. The hazard is determined by the total lead present by weight not by percent. Percent may eventually indicate the total lead present, but by a round about method. XRF analyzers provide a direct reading in milligrams of lead per square centimeter.

Percentage reading can be misleading. For example, assume you have one layer of paint with 1% lead. If this layer is now covered by a non-lead layer the lead percentage is reduced to .5%; another non-lead paint layer further reduces the percentage to .25%. The hazard has not changed, the same amount of lead still exists. It is the additional layers of non-lead paint that make the paint sample appear safe. The lead is still present in the original amount. With the XRF analyzer the reading in milligrams of lead would remain unchanged no matter how many additional non-lead layers of paint were added.

Several cities are now in the process of basing their court cases on milligrams instead of percent. Generally, milligram levels of 1-2 are used as a cut off point.

These levels of 1-2 mg/cm² are in excess of the 1% figure. They have been used because experience has shown that when lead is present it is generally in the range of 2-20 milligrams. Also, it is the higher lead levels that are more likely to poison.

Several labs have independently determined that a single layer paint chip 1 cm^2 weighs between 15 and 30 mg. This means that a 1 mg lead level is approximately 3.3 to 6.6 percent for a single layer.

Statistical Variations

The Model XK-2 Lead Detector readings will fluctuate from one reading to another. This is perfectly normal and should be expected. The fluctuations are due to the random emissions of the radioactive excitation source.

When the Model XK-2 is set for a 15 sec measuring time, you can expect the zero will be within $\pm .3$ mg on 70% of the readings while the remaining 30% will be outside the $\pm .3$ mg range.

A slight zero shift will be noticed from one material to another. Generally all materials will be within $\pm .3$ mg (average of 10 readings) but you may find one occasionally outside this range.

Whenever measuring below 1 mg, 5-10 readings should be taken along with their average. The average will present a truer picture than just a single reading.

CITY DallasCase Number: 64004DATE March 8, 1973Census Tract: West Dallas Health CenterADDRESS 1822 LifeNo. Rooms: 6Name of Child (s) Donald DavisCondition of Paint FairYear House Built: Before 1960Landlord: Mrs. Pearl Davis

ROOM	SPECIFIC LOCATION	LEAD READING	AVERAGE
Front porch	Wall	0.4, 0.8, 0.6	0.6
Living Room	Door	0.6, 0.2, 0.4	0.4
Living room	Wall	0.1, 0.3, 0.2	0.2
Dining	Wall	0	0
Kitchen	Woor and wall	0	0
Bath	Door	0	0
Bedroom	Wall	0	0
Bedroom	Door frame	1.2, 1.0, 1.2	1.1
Bedroom	Childrens' bed	0.2, 0.2, 0.2	0.2
Back porch	Screen	1.2, 1.0, 1.4	1.3

House burned last year and has been repainted with latex paint. However, the front door frame and back screen door are peeling and do contain significant amounts of lead-based paint.

0000-NLI-000020627

Case Number: 64009

Census Tract:

No. Rooms:

Condition of Pains

Year House Built:

Landlord:

0000-NLI-000020628

CITY Dallas

Case Number: 64012

DATE March 8, 1973

Census Tract:

ADDRESS 2006 Leath

No. Rooms:

Name of Child (s) Jones

Condition of Paint

Year House Built:

Landlord:

ROOM	SPECIFIC LOCATION	LEAD READING	AVERAGE
Family not home on day of inspection.			

0000-NLI-000020629

CITY Dallas Case Number: 64,002 - 64014 - 64015DATE March 8, 1973 Census Tract: West Dallas Health CentreADDRESS 2051 Bayside No. Rooms: 5Name of Child (s) Oliver Branch and Curtis and Bobby JohnsonCondition of Paint Poor - some peeling Year House Built: Before 1950Landlord: Mrs. Louise Fletcher

ROOM	SPECIFIC LOCATION	LEAD READING	AVERAGE
Front porch	Screen door	0.3, 0.1, 0.2 , 0.2	0.2
Living	Door frame	4.6, 4.2, 4.4	4.4
Living	Wall	0.2, 0.1, 0.1	0.1
Dining	Door frame	0.5, 0.1, 0.2	0.3
Kitchen	Cabinet	0.1, 0.3, 0.2	0.2
Bath	Wall	1.3, 1.1, 2.0	1.4
Bedroom	Ceiling and wall	0.6, 0.8, 0.4	0.6
Hall	Door	4.3, 2.6, 3.1	3.4
Living	Window frame	0.8, 0.2, 0.2	0.4

This house was in generally poor condition. The woodwork contains significant amounts of lead-based paint and is peeling in some places. The bathroom wall and back bedroom ceiling is in bad condition.

0000-NLI-000020630

CITY Dallas Case Number: 64046
 DATE March 15, 1973 Census Tract: _____
 ADDRESS 4818 Tremont No. Rooms: 3
 Name of Child (s) Valderas
 Condition of Paint Good except Year House Built: Before 1950
 Landlord: Unknown

ROOM	SPECIFIC LOCATION	LEAD READING	AVERAGE
Front porch	Banister	1.6, 1.8, 1.4	1.6
Front door	Outside	0.2, 0.6, 0.1	0.3
Living and bedroom	Door frame	1.0, 1.1, 1.3	1.1
Living and bedroom	Window	1.1, 1.0, 1.3	1.1
Kitchen	Wall	1.1, 1.4, 0.8	1.1
Kitchen	Door frame	0.3, 0.1, 0.5	0.3
Kitchen	Cabinets	0.2, 0.4, 0.1	0.3
Bath	Woodwork	0 -	
Bath	Wall	0 -	
Dining	Woodwork	0.6, 0.3, 0.8	0.6

This was a second-floor apartment in an old two-story house with four other apartments. The construction was good and the paint was in generally good condition. However, paint was peeling from the living room window frame and front porch railing.

0000-NLI-000020631

ENVIRONMENTAL HEALTH AND CONSERVATION
WATER QUALITY CONTROL SECTION

SAMPLING PROGRAM
REPORT OF ANALYSIS

DATE 5-22-80	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
TIME																	
TEMPERATURE																	
SPECIFIC CONDUCTIVITY	1100																
pH	8.9																
TURBIDITY	270																
IRON	2.5																
ZINC	0.5																
CHROMIUM	0																
NITROGEN (NITRATE)	0																
PHOSPHATE (ORTHO)	0.1																
PHOSPHATE (TOTAL)	1.0																
DISSOLVED OXYGEN	34																
B.O.D.																	
FECAL COLIFORM																	

SAMPLER: _____
HOURS: _____
OFFICE FIELD TOTAL

SPECIAL SAMPLE
SECOND SAMPLE FROM CAMP
SOROPTIMIST

0000-NLI-000020632

CITY Dallas Case Number: 64,100
 DATE March 12, 1973 Census Tract: _____
 ADDRESS 2113 Fairmont No. Rooms: 5
 Name of Child (s) C. Flemming
 Condition of Paint Paper on walls old but intact Year House Built: Before 1950
 Landlord: Mrs. Charles Angelo

ROOM	SPECIFIC LOCATION	LEAD READING	AVERAGE
Hall	Door frame	2.4, 1.6, 1.4	1.8
Living	Door frame	1.9, 2.3, 2.1	2.1
Bed	Door frame	0.6, 0.4, 0.5	0.5
Bath	Door frame	1.4, 1.8, 1.6	1.6
Kitchen	Door	2.3, 1.7, 1.8	1.9
Kitchen	Under sink	2.6, 1.8, 1.7	2.0
Kitchen	Back door	1.7, 2.4, 1.3	1.8
Outside	Back wall	1.7, 0.8, 1.2	1.2
Bath	Door frame	2.4, 2.2, 2.3	2.3
Front bedroom	Door frame	3.6, 3.2, 3.1	3.3
Front porch	Door frame	3.6, 3.2, 3.1	3.3

Woodwork painted with lead-based paint but mostly tight. Back door and outside paint peeling and loose. Walls covered with old wallpaper.

0000-NLI-000020633

CITY Dallas Case Number: 64090
 DATE 3/13/73 Census Tract: _____
 ADDRESS 3215 Birmingham No. Rooms: 5
 Name of Child (s) Johnny Nash
 Condition of Paint Bad Year House Built: Before 1950
 Landlord: Mrs. Nash owns house

ROOM	SPECIFIC LOCATION	LEAD READING	AVERAGE
Living room	Door	20, 24, 16	2.0
Porch	Outside front door	21, 19, 23	2.1
Front bedroom	Door frame	9.4, 9.1, 9.7	9.4
Back bedroom	Door frame	18, 1.6, 2.0	1.8
Kitchen	Door frame	2.4, 2.3, 2.5	2.4
Bathroom	Door frame	1.0, 0.8, 1.2	1.0

This house is in very bad structural condition and paint is peeling on front porch and in bathroom. Owner states that it will eventually be torn down for highway construction.

0000-NLI-000020635

CITY Dallas Case Number: 64080

DATE March 13, 1973 Census Tract: _____

ADDRESS 3225 Forest No. Rooms: 5

Name of Child (s) Yolanda Kerr

Condition of Paint _____ Year House Built: Before 1950

Landlord: Mr. Tom Jackson

ROOM	SPECIFIC LOCATION	LEAD READING	AVERAGE
Living room	Front door	0	0
Front bedroom	Baby's bed	9.7, 9.9, 9.5	9.7
Kitchen	Door frame	2.8, 3.0, 2.6	2.8
Bathroom	Door frame	1.3, 1.0, 1.6	1.3
Utility room	Back door	2.1, 1.8, 2.5	2.1
Front bedroom	Window frame	0	0
	Bed frame	0	

House is in fair condition. Walls are paneled and most woodwork is varnished. However, some lead-based paint was found in kitchen and bathroom. The baby crib was peeling and the paint had a high lead content. The grandmother was advised to scrape and repaint baby crib with non-lead-based paint.

0000-NLI-000020636

CITY Dallas Case Number: 64051
 DATE March 13, 1973 Census Tract: _____
 ADDRESS 1345 Rowan No. Rooms: 3
 Name of Child (s) Anthony Conner
 Condition of Paint — Year House Built: Before 1950
 Landlord: Mr. Clifton

ROOM	SPECIFIC LOCATION	LEAD READING	AVERAGE
Front porch	Outside of front door	8.4, 8.0, 8.8	8.4
Bedroom	Door frame	8.3, 8.6, 8.0	8.3
Kitchen	Back door frame inside	5.1, 5.5, 4.7	5.1
Bathroom	Door frame	10.4, 10.5, 10.3	10.1

Family occupies only three rooms of house. Other rooms are occupied by another family. All paint is old and has a high lead content. Paint on front door is peeling badly, and potential problem for children. Occupants state that landlord is planning to demolish house or attempt to repair it. This family is looking for another house.

0000-NLI-000020637