

APR 9 1970

ENVIRONMENTAL

HEALTH LABORATORIES, INC.

32740 Northwestern Highway, Farmington, Michigan 48024 (313) 526-2426

March 30, 1970

Dr. George Roush, Jr.
Ethyl Corporation, Medical Department
Laboratory of Environmental Medicine
1700 Perdido Street
New Orleans, Louisiana 70112

Dear George:

Enclosed are two copies of our report covering blood, urine and air analyses at Herman Gardens last November and December. It is brief, but complete, I believe, and contains fourteen tables, including one with most of the primary data on it, so that you can check our arithmetic and conclusions.

I think the lead data are very good, and agree well with the first set of data, but I don't know about the ALA and creatinine data - we don't get the same mean values that Bill gave me by phone for a group you have previously studied. We'll wait until you compare your results on the samples we sent you with ours, however, before worrying too much. Please call or write when you've had time to digest the report, and we'll see whether some further action is called for.

We've enjoyed doing this study, and hope that it will be possible to work with you again on similar studies in the future.

Yours very truly,



Ralph G. Smith
President

RGS/jmb

Enclosures

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A Study of Lead in Air, Lead in Blood and ALA
In Urine in Relation to Residents Near a Freeway

November, 1969

In continuation of a study at the Herman Gardens Housing Project, Detroit, Michigan which began in February, 1969 results of resampling the air at several locations, and determining blood lead levels on residents living at varying distances from the freeway are described in this report.

Air sampling was performed at three locations near and distant from the freeway in February, 1969, again in July-August, 1969 and finally in November-December, 1969. The methods of sampling and analysis have previously been described and will not be repeated. In July, 1969 blood levels were determined on residents of the area and a repeat sampling and analysis of essentially the same group in November, 1969 is reported here. In addition, urine specimens were collected from a number of the blood donors and both ALA and creatinine levels were determined. The methods used for selecting the population sampled and for determining the lead content of blood have also been previously described. It should be noted that it was not possible to sample exactly the same group each time, but the number of individuals participating in both sampling periods was high, however, and the results of each sampling period are believed to be comparable with one another. Not all of the blood donors were able to donate a urine specimen, but the great majority did, and inter-comparisons should be valid. The methods used to determine ALA and creatinine were those previously used and recommended by the Ethyl Corporation Medical Department and need not be described further in this report.

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Results of Air Sampling:

The air sampling data are presented in Table 1, using the same format as in previous reports. As expected, the air lead levels again showed a progressive decrease with distance from the freeway, and a significantly lower level inside the apartments compared to the outside locations. The mean lead levels for comparable locations were as expected, intermediate between those obtained in February and those obtained in August. These results are probably related to the frequency of favorable wind directions (westerly) and the extent of atmospheric turbulence. When all the data are grouped together, the mean outdoor lead levels, which presumably come close to annual means, are as follows:

Location A: $4.8 \pm 2.9 \mu\text{g}/\text{m}^3$

Location B: 2.6 ± 1.9 "

Location C: 1.5 ± 0.9 "

Blood Lead Results:

Blood was obtained from 112 individuals compared to 110 individuals previously. As already noted, however, the composition of the two groups was not identical. A complete presentation of data is contained in Table 11 which lists background information of significance for each individual as well as the first and second blood lead levels and ALA data (note: those individuals who donated blood July but did not donate in November have not been included in this listing). The actual composition of the study population as well as summaries of all results obtained are detailed in Tables 2-10. These tables correspond in number and format to the tables presented in our previous report. In addition, Table 12 summarizes the ALA results and Table 13 summarizes the creatinine results.

Significant tests were performed on all data using the same methods on which previous findings were based, and summary of all conclusions reached is contained in Table 14. It will be noted that individuals living at Location A had a significantly higher blood lead level than those living at

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Location C in the second test, whereas the difference, though present, was not significant in the first test results. It further appears that smokers as a group have significantly higher lead levels at Location A than C, that non-smokers less than 55 years of age exhibit similar findings, and that females less than 55 years of age, also yield the same findings. As noted in Table 10, when housewives only are considered, lead levels are once again higher at Location A than C and this relationship persists when comparisons are made based on smoking and age.

Delta Aminolevulinic Acid (ALA):

Samples were collected from donors who were instructed to discard the first urine voided after arising in the morning, and to thereafter collect all urine in the following two hour period. A preservative was added as directed in the methods furnished by Ethyl Corporation, volumes were noted and analyses performed. All data are presented in Table 11 and a summary of the data is contained in Table 12.

Creatinine determinations were also made and ALA values were then recalculated on the basis of creatinine levels. When ALA levels not corrected for creatinine are compared there are no statistically significant differences between any of the groups or sub-groups which were chosen. When creatinine corrected values are compared, however, it will be noted in Table 14 that a statistically significant difference between groups A and C is noted in which values for those in group C are higher than those in group A. This difference appears to be related to the female portion of the population and in particular to females greater than 55 years of age. Although the difference appears to be statistically significant, no explanation for it is offered at this time. It would seem, however, that the usefulness of making a correction based on creatinine might be questioned. Urinary volumes were also noted and are contained in Table 11 but they have not been taken into account in any of the calculations presented.

AIR LEAD DATA
Pb Conc., µg/m³

DATE 1969	DAY	LOCATION A		LOCATION B		LOCATION C		LOCAL WEATHER			PFT.
		Outside	Inside	Outside	Inside	Outside	Inside	Wind Direct	Mean Wind Speed	Mean Temp °F.	
11/18	Tues.	+	+	+	+	+	+	S	14.4	50	.66
11/19	Wed.	1.9	---	1.3	1.1	0.7	0.5	W	18.8	38	.86
11/20	Thurs.	4.35	3.25	3.2	2.7	1.6	1.6	NW	14.4	21	.04
11/21	Fri.	4.5	3.4	2.8	2.4	1.9	1.2	S	5.5	20	0
11/22	Sat.	4.5	4.15	3.4	2.8	1.7	1.0	SW	12.1	35	0
11/23	Sun.	6.8	5.8	5.3	4.65	4.6	3.3	NW	8.3	34	0
11/24	Mon.	3.5	2.9	2.6	2.5	1.6	1.2	SW	7.8	34	0
11/25	Tues.	4.6	3.95	3.1	2.8	1.6	1.2	NW	11.1	39	0
11/26	Wed.	2.5	2.65	1.9	1.6	1.0	0.75	W	9.5	36	T
11/27	Thurs.	2.0	1.9	1.3	0.9	0.7	0.3	NE	11.7	34	.09
11/28	Fri.	4.0	3.7	2.5	2.1	1.2	---	SW	10.2	26	0
11/29	Sat.	2.6	2.3	1.8	1.2	0.5	---	NW	13.4	31	T
11/30	Sun.	1.6	1.6	1.1	0.6	0.4	0.3	NW	16.3	32	T
12/1	Mon.	4.1	3.9	2.45	2.4	1.4	1.1	NW	16.5	28	T
12/2	Tues.	+	+	+	+	+	+	SW	11.5	28	0
12/3	Wed.	3.5	3.2	1.3*	2.2	0.9	0.7*	NW	15.5	27	T
12/4	Thurs.	4.7	4.6	---	---	1.3	0.5	NW	13.1	26	T
12/5	Fri.	+	+	+	+	+	+	NW	8.1	28	0
12/6	Sat.	3.0	2.95	2.6	2.0	1.8	0.7	E	8.1	30	0
12/7	Sun.	1.6	1.5	1.3	1.0	0.5	0.2	SW	18.0	38	.52
12/8	Mon.	4.1	3.8	3.0	2.6	1.7	0.4	SW	13.2	31	0
12/9	Tues.	2.2	2.0	2.2	1.6	2.5	0.8	SE	8.9	33	0
12/10	Wed.	2.2	2.2	2.1	1.7	1.7	0.65	N	8.1	33	.02
12/11	Thurs.	+	+	+	+	+	+	N	13.8	37	0.21
12/12	Fri.	5.6	2.7	4.1	2.1	0.85	0.3	SW	13/2	30	.03

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ALR LEAD DATA Pb Conc., $\mu\text{g}/\text{m}^3$

DATE	DAY	LOCATION A		LOCATION B		LOCATION C		LOCAL WEATHER			PPT.
1969		Outside	Inside	Outside	Inside	Outside	Inside	Wind Direct	Mean Wind Speed	Mean Temp °F	
12/13	Sat.	3.6	3.4	2.8	2.4	2.0	0.7	S	9.1	28	T
12/14	Sun.	2.6	2.6	2.0	---	0.6	0.3	NW	13.5	33	.02
12/15	Mon.	4.2	4.1	3.1	2.0	1.1	1.0	NW	14.1	23	T
12/16	Tues.	4.3	4.4	3.2	2.5	1.15	0.5	NW	9.8	21	T
12/17	Wed.	4.5	4.9	3.4	3.1	2.0	0.8	SW	8.1	30	.01
12/18	Thurs.	2.4	2.5	1.9	1.5	0.8	0.4	NW	13.2	28	.12
12/19	Fri.	3.1	3.3	2.6	1.85	0.7	0.4	NW	14.4	30	T
Mean		3.5	3.25	2.5	2.1	1.4	0.3	n=NW d=SW	12.0	31	.08

+ = Samplers running

* = Data uncertain

n = Nov.

d = Dec.

T = Too small to measure

--- = No sample

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Table 2

Study Population

Description - Study Population	No. of Individuals	
	Loc. A	Loc. C
Total Group	55	57
Males	13	10
Non Smokers	5	6
Smokers	8	4
Females	42	47
Non Smokers	35	30
Smokers	7	17
Housewives	34	38
Non Smokers	28	24
Smokers	6	14

In Tables 2 - 10

Location A - Adjacent to Freeway

Location C - Away from Freeway

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Table 3

Blood Lead Levels, $\mu\text{g}/100\text{g}$

Description, Subgroups	Location	
	A	C
Total Population	16.8	14.3
Males	19.8	19.7
Smokers	20.5	19.3
Non Smokers	18.8	20.0
Females	15.9	13.2
Smokers	20.1	13.6
Non Smokers	15.0	12.9
Housewives	16.0	13.6
Smokers	21.2	13.9
Non Smokers	14.9	13.4
Smokers (both sexes)	20.3	14.7
Non Smokers (both sexes)	15.5	14.1

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Table 4

Blood Lead Levels In Relation
To Sex & Location, $\mu\text{g}/100\text{g} \pm \text{S. D.}$

	A		C	
	n	Pb	n	Pb
Males	13	19.8 ± 5.6	10	19.7 ± 7.2
Females	42	15.9 ± 4.7	47	13.2 ± 4.1
Total Group	55	16.8 ± 5.2	57	14.3 ± 5.4

Table 5

Blood Lead Levels In Relation
To Age, Location & Sex, $\mu\text{g}/100\text{g}$

Sex	Age Years	A		C	
		n	Pb	n	Pb
Males	<25	1	14.0	0	
	26 - 40	3	17.0	3	25.0
	41 - 55	1	30.0	1	11.0
	56 - 70	1	21.0	4	18.8
	71 - 85	6	20.5	2	13.0
Females	<25	2	16.0	1	12.0
	26 - 40	9	16.8	12	12.0
	41 - 55	9	18.4	12	14.1
	56 - 70	9	15.1	13	13.2
	71 - 85	14	14.3	9	13.7

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Table 6

Blood Lead Levels in Relation to
Smoking Habits, Sex & Location, $\mu\text{g}/100\text{g}$

Sex	Cigarettes Per Day	A		C	
		n	Pb	n	Pb
MALES	0	5	19.0	5	18.3
	< 10	4	21.5	1	24.0
	10 - 20	0	-	0	-
	20 +	2	17.0	3	17.7
	Other	1	21.0	0	-
	Total Smokers	7	20.6	4	19.3
FEMALES	0	34	15.1	30	12.9
	> 10	5	19.8	10	14.4
	10 - 20	3	20.3	3	14.7
	20 +	0	-	4	11.0
	Other	0	-	0	-
	Total Smokers	8	20.0	17	13.6

Table 7

Blood Lead Levels in Relation to
Sex & Length of Time at Present Residence
 $\mu\text{g}/100\text{g}$

Sex	Years Residence	A		C	
		n	Pb	n	Pb
MALES	3 - 5	6	21.0	4	24.5
	6 - 10	5	17.2	3	11.3
	> 10	1	27.0	3	21.7
FEMALES	3 - 5	19	14.4	11	12.1
	6 - 10	14	16.2	19	13.8
	> 10	10	18.5	17	13.0

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Table 8

Blood Lead Levels in Relation to
Commuting Habits, Sex & Location $\mu\text{g}/100\text{g}$

Description	A		C	
	n	Pb	n	Pb
Male				
Commuter	5	19.0	3	25.0
Non - Commuter	7	20.6	7	17.4
Female				
Commuter	10	16.2	7	10.6
Non - Commuter	33	15.8	40	13.6

Table 9

Blood Lead Levels in Relation to
Occupation, Sex & Location $\mu\text{g}/100\text{g}$

Sex	Occupation	A		C	
		n	Pb	n	Pb
Male	Retired	8	21.8	6	18.5
	Office & Sales	0	-	0	-
	Industry and Other	4	16.3	4	21.5
Female	Housewife	33	16.0	38	13.6
	Office & Sales	5	17.2	6	14.2
	Industry and Other	5	18.2	3	8.7

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Table 10

Blood Lead Levels

Housewives only $\mu\text{g}/100\text{g}$

Description	A		C	
	n	Pb	n	Pb
Total Group	32	16.0	38	13.6
Smokers	6	21.2	14	13.9
Non Smokers	27	14.9	24	13.4
Age < 55	12	18.8	17	12.9
Age > 55	21	14.4	21	14.2

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Table 12

ALA In Urine, Mean Values

	Location A		Location C	
	mg/100ml	mg/g creatinine	mg/100ml	mg/g creatinine
Total Group	0.28	2.7	0.29	3.66
Males	0.38	2.7	0.42	4.1
Females	0.25	2.8	0.26	3.6
Males>55	0.29	2.7	0.32	2.6
Males<55	0.53	2.6	0.75	9.4
Females>55	0.22	2.4	0.23	3.6
Females<55	0.29	3.2	0.28	3.6
Smokers	0.27	2.8	0.33	4.8
Non Smokers	0.29	2.7	0.26	3.1

All Males (A&C) 0.38 3.3

All Females
(A&C) 0.26 3.2

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Table 13

Urinary Creatinine Levels, mg/100ml

Group	Location A	Location C
Entire group	114	89
Males	141	126
Females	105	81
Males <55	177	115
Males >55	111	129
Females <55	116	81
Females >55	96	80

All Males (A & C)	134
All Females (A & C)	92
Everyone Under 55	87
Everyone Over 55	96

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Table 14

Relationships Between Groups A & C*

Groups Compared	Lead Test #1	Lead Test #2	ALA	ALA/Creatinine
All (males & females)	---	A>C P=0.985	---	C>A P=0.97
Males	---	---	---	---
Females	A>C P=0.98	A>C P=0.995	---	C>A P=0.95
Smokers	A>C P=0.97	A>C P=0.995	---	---
Non Smokers	---	---	---	---
All persons <55	---	A>C P=0.95	---	---
All persons >55	---	---	---	---
All Males <55	---	---	---	---
All Males <55	---	---	---	---
All females <55	---	A>C P=0.99	---	---
All females >55	---	---	---	C>A P=0.999
Males, smokers	---	---	---	---
Males, non smokers	---	---	---	---
Females, smokers	A>C P=0.95	A>C P=0.99	---	---
Females, non smokers	---	A>C P=0.96	---	---

*When no figures are given, differences were not significant, based on t-test,
 ($P < 0.95$)

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