

ETHYL CORPORATION

MANUFACTURING DEPARTMENT

July 11, 1968

PLEASE ADDRESS REPLY
TO: BOX 341
BATON ROUGE, LA. 70821

Robert A. Kehoe, M.D.,
Professor Emeritus of Occupational Medicine
University of Cincinnati
Eden and Bethesda Avenues
Cincinnati, Ohio 45219

Dear Dr. Kehoe:

Dr. Bock has asked me to furnish you with the information requested in your letter of June 21, 1968.

In reference to the case of the gasoline "sniffer" recently reported in the J.A.M.A., the most appropriate source of information would seem to be the analytical values reported for men who have been placed on lead restriction. A list covering the blood (and simultaneously - obtained urine) values for all individuals at the Baton Rouge plant who have been restricted at any time from 1944 until the present date is enclosed. Values for specimens obtained during the 3-4 months prior to restriction and after restoral are included in this list.

There are a few scattered lead values in this list that are within the range reported for the patient in the J.A.M.A. article, but none of the restricted workers have shown persistently elevated blood lead values comparable to those reported for the gasoline "sniffer".

In reference to the possible relationship between the concentration of lead in the urine and that in the blood, the above list furnishes some data. A listing of all determinations on coupled blood and urine specimens recorded for my long-term group of workmen is also enclosed. A third source of information which might have some bearing on this point consists of the Quarterly Reports: A copy of the pertinent portion of each Report from 1944 through the first quarter of this year is enclosed. Much of this information is grouped, of course. The individual values from which the Quarterly Reports were compiled cannot be recovered from the records kept in the Medical department. All three lists overlap to a greater or lesser extent, of course.

As a quick, rough check of a possible constant relationship between the concentration of lead in the urine and in the blood, I have plotted the distribution of the "ratios" obtained by dividing the milligrams of lead per liter of urine by the milligrams of lead per 100 grams of (a simultaneously obtained sample of) blood for

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those groups in which individual values are shown. The distributions so obtained are shown in the graphs attached to the back of the list of each such group. I recognize that a true ratio would necessitate conversion of values to a common denominator, but the relative relationships should not be in great error from the omission of this additional step.

Considering the vagaries of relationships in time of sampling to portion of work day and work week, the range^{9%} exposure conditions involved, and the problems inherent in the random sampling of urine, I was surprised that the values obtained by the above evaluation were as closely grouped as they proved to be. It was also interesting that, in my long-term study group, the results were similar for "pure" organic lead exposures and for "mixed" organic-inorganic lead (furnaces, melt pot, alloy) exposures.

A very hurried rough calculation of weighted values for the analytical results shown in the Quarterly Reports indicates the mean "ratio" (as previously defined) is about 2.2; this is quite close to the means of the other groups.

I lack the time to attempt a more definitive analysis of these data, but, to me, further study would appear to be indicated. Unfortunately, I have no practical experience in matters of this nature to guide my judgment. I shall be most interested to hear whether or not you consider further evaluation along these lines to be warranted and to learn the results of any such study that you might undertake.

If I can provide further information or assistance, please let me know.

Sincerely,



Theodore R. Robinson, M.D., I.M.D.

TRR/hc
Attach.

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PUNCHED
VERIFIED

II.

DETERMINATIONS OF LEAD IN COUPLED
URINE AND BLOOD SAMPLES

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OCT 22 1968

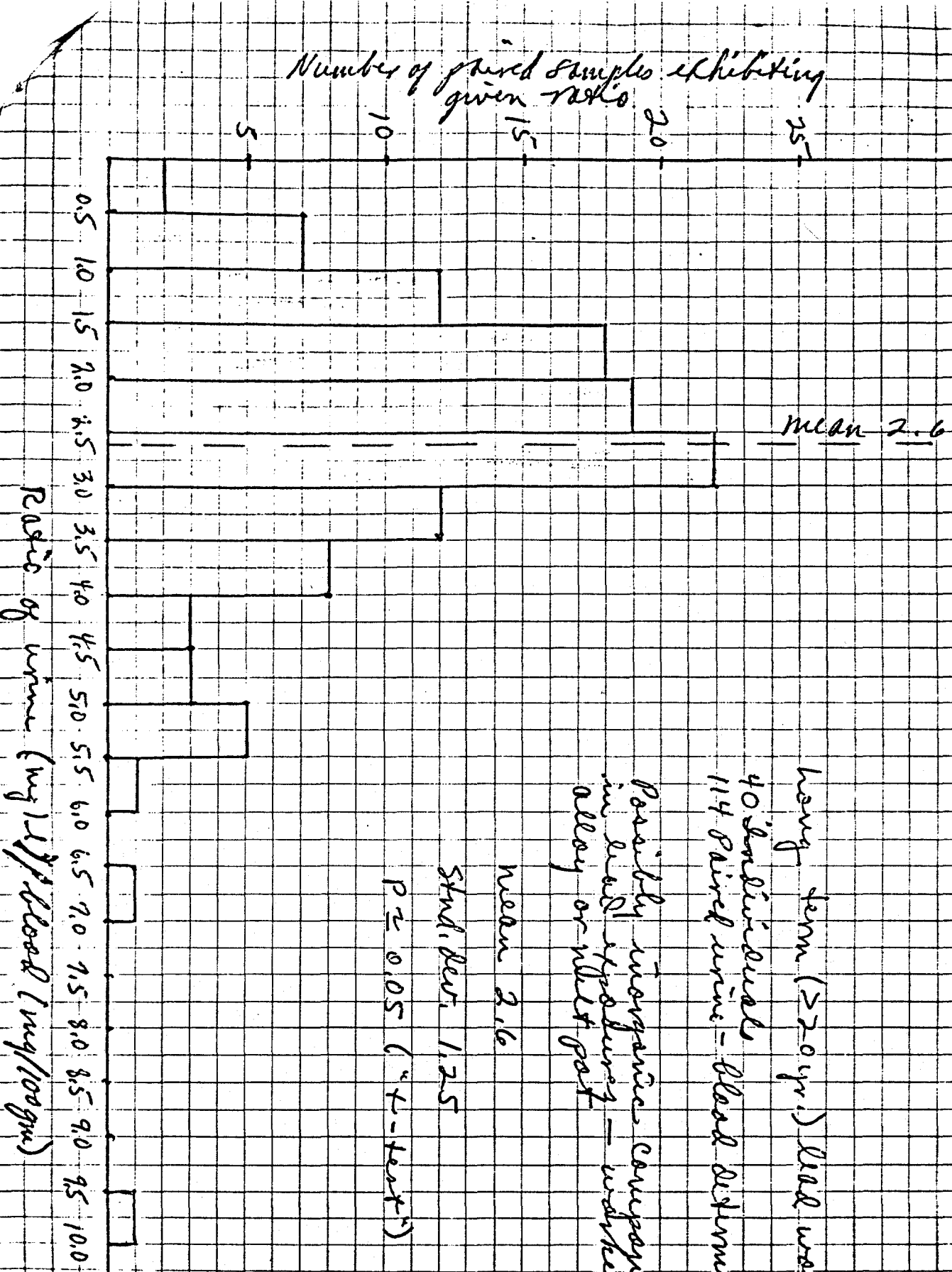
TEL Operators with 20 or more years of continuous service---working in furnaces,
alloy or melt pot at time samples taken. Records from 1955 through 1967.
Forty individuals. One hundred fourteen pairs of urine-blood determinations.

Badge #	Date	Urine, mg./l.	Blood, mg./100 gm	Ratio	Comments
120	4/28/60	0.081	0.030	2.7	
155	3/24/58	0.057	0.025	2.3	
69	3/12/58	0.045	0.015	3.0	
	6/11/59	0.046	0.013	3.5	
27	3/18/65	0.077	0.033	2.3	
448	11/7/57	0.094	0.047	2.0	
	3/4/59	0.050	0.013	3.8	
	4/6/61	0.028	0.037	0.8	
29	9/18/67	0.012	0.031	0.4	
260	1/5/56	0.121	0.049	2.5	
	4/23/57	0.081	0.040	2.0	
178	11/2/60	0.071	0.063	1.1	
	3/9/61	0.069	0.039	1.8	
	5/9/62	0.044	0.046	1.0	
189	6/13/62	0.093	0.030	3.1	
	9/11/63	0.082	0.034	2.4	
251	2/2/54	0.074	0.027	2.7	
261	9/9/63	0.033	0.036	0.9	
498	10/29/64	0.052	0.041	1.3	
490	10/7/57	0.148	0.031	4.8	
	9/8/55	0.105	0.037	2.8	
	4/29/60	0.097	0.024	4.0	
	9/23/64	0.107	0.025	4.3	
239	7/3/57	0.185	0.037	5.0	
	2/6/58	0.145	0.028	5.2	
	4/14/59	0.082	0.024	3.4	
	7/24/62	0.188	0.038	4.9	
	10/20/64	0.024	0.034	0.7	
293	12/4/58	0.242	0.056	4.3	
	6/9/66	0.089	0.060	1.5	
457	11/20/58	0.150	0.058	2.6	
	4/7/60	0.113	0.032	3.5	
	8/22/61	0.257	0.050	5.1	
	11/2/61	0.113	0.037	3.0	
	9/9/63	0.090	0.027	3.3	
	12/8/64	0.097	0.028	3.5	
24	6/4/62	0.082	0.028	2.9	
	9/17/62	0.041	0.026	1.6	
	9/18/64	0.079	0.035	2.3	
	3/2/66	0.077	0.030	2.6	
217	10/22/65	0.070	0.039	1.8	
206	9/12/60	0.081	0.033	2.5	
	9/11/63	0.154	0.038	4.0	
	12/14/64	0.083	0.033	2.5	
	10/20/65	0.190	0.049	3.9	

idge #	Date	Urine, mg./l.	Blood, mg./100 gm.	Ratio	Comments
72	1/18/58	0.122	0.049	2.5	
	2/17/59	.308	.053	5.8	
	3/12/59	.319	.058	5.5	
	3/20/59	.300	.059	5.1	
	10/31/61	.050	.032	1.6	
	9/25/63	.042	.050	0.8	
	11/6/64	.121	.063	1.9	
99	8/19/64	.189	.027	7.0	
139	6/15/59	.093	.054	1.7	
	6/8/60	.102	.035	2.9	
240	11/7/60	.057	.035	1.6	
276	6/15/59	.038	.031	1.2	
	6/8/60	.068	.035	1.9	
	9/18/63	.070	.029	2.4	
386	12/18/53	.117	.053	2.2	
	5/23/56	.101	.040	2.5	
225	10/3/61	.232	.076	3.0	
	9/25/63	.116	.047	2.5	
	8/24/65	.210	.038	5.5	
	12/1/65	.148	.066	2.2	
	6/8/66	.150	.049	3.1	
360	7/13/59	.064	.037	1.7	
	6/8/61	.052	.088	0.6	
	7/27/61	.088	.055	1.6	
	2/20/63	.097	.048	2.0	
	7/7/64	.069	.032	2.2	
416	3/13/61	.118	.059	2.0	
	10/11/62	.125	.046	2.7	
	1/5/65	.152	.037	4.1	
414	5/12/65	.083	.051	1.6	
290	4/7/58	.097	.038	2.6	
	8/11/61	.121	.037	3.3	
	9/25/62	.174	.057	3.0	
	8/28/63	.120	.049	2.4	
	5/10/67	.185	.061	3.0	
353	5/19/58	.076	.036	2.1	
406	4/24/58	.050	.020	2.5	
	4/29/60	.065	.047	1.4	
	9/20/61	.057	.160	0.4	
	10/9/61	.051	.045	1.1	
305	10/23/59	.146	.054	2.7	
	9/20/61	.136	.046	3.0	
	4/5/62	.132	.048	2.8	
	5/14/62	.125	.050	2.5	
	10/30/67	.234	.069	3.4	
	11/20/67	.283	.085	3.3	
73	9/19/58	.104	.052	2.0	
	5/24/61	.166	.017	9.8	
	5/30/61	.168	.046	3.6	
	8/14/61	.089	.052	1.7	
	7/2/64	.150	.041	3.6	
77	8/2/65	.081	.062	1.3	
8	5/31/60	.247	.076	3.2	
	3/1/61	.078	.054	1.4	
	7/11/66	.161	.054	3.0	
86	3/12/58	.034	.040	0.8	
	1/13/60	.086	.056	1.5	

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Edge #	Date	Urine, mg./l.	Blood, mg./100 gm.	Ratio	Comments
94	5/15/57	0.120	0.046	2.6	
	11/25/57	.125	.045	2.8	
	8/22/58	.148	.054	2.7	
	6/1/59	.118	.050	2.4	
	9/20/61	.059	.054	1.1	
	11/3/61	.118	.042	2.8	
	9/3/64	.189	.053	3.6	
	2/1/65	.073	.046	1.6	
	10/14/65	.103	.049	2.1	
219	8/24/61	.096	.025	3.8	
282	11/20/64	.045	.036	1.2	



heavy term (>20 yr.) lead workers
 40 individuals
 114 paired urine - blood determinations

Possibly inorganic component
 in lead exposure - worked furnace
 alloy or melt pot

mean 2.6
 Std. Dev. 1.25
 $P \leq 0.05$ ("t-test")

PUNCHED
VERIFIED

I.

DETERMINATIONS OF LEAD IN COUPLED
URINE AND BLOOD SAMPLES

OCT 22 1968

TEL Operators with 20 or more years of continuous service---not working in furnaces, alloy or melt pot at time samples taken (i.e., exposure presumably primarily to organic lead compounds. Records from 1955 through 1967. Sixty-six individuals. One hundred thirty-nine pairs of urine-blood determinations.

Badge #	Date	Urine, mg./l.	Blood, mg./100 gm.	Ratio	Comments
286	1/7/66	0.074	0.030	2.5	Acute exposure.
333	4/12/67	.142	.034	4.2	
401	1/12/66	.126	.043	2.9	Acute exposure.
164	3/9/61	.033	.035	0.9	
	3/14/61	.234	.039	6.0	
	3/16/61	.065	.025	2.6	
	3/20/61	.061	.030	2.0	
	3/22/61	.016	.030	0.5	
	4/6/61	.054	.029	1.9	
	5/24/61	.045	.028	1.6	
	6/10/66	.151	.042	3.6	
51	9/28/61	.028	.029	1.0	
46	9/20/61	.046	.038	1.2	
	2/20/64	.136	.042	3.2	
	1/7/65	.091	.025	3.6	
159	8/19/64	.127	.027	4.7	
28	1/11/67	.042	.025	1.7	
157	9/20/61	.101	.043	2.3	
3	10/23/64	.102	.037	2.8	
	7/20/66	.118	.054	2.2	
	2/20/67	.090	.058	1.6	
	12/19/67	.201	.056	3.6	
63	1/31/66	.052	.031	1.7	
509	10/20/64	.164	.042	3.9	
	1/20/67	.145	.032	4.5	
215	10/17/61	.078	.036	2.2	
	6/4/64	.175	.042	4.2	
	11/12/65	.186	.045	4.1	
	7/11/66	.182	.047	3.9	
148	9/13/61	.074	.037	2.0	
243	6/1/60	.050	.044	1.1	
	10/16/62	.261	.066	4.0	
	10/24/62	.097	.016	6.1	
	10/29/64	.098	.045	2.2	
334	4/28/65	.122	.026	4.7	
185	7/30/62	.113	.054	2.1	
	2/5/64	.185	.039	4.7	
	10/1/64	.084	.051	1.6	
202	9/19/61	.088	.047	1.9	
443	12/29/58	.035	.041	0.8	
	5/27/59	.077	.037	2.1	
	10/23/61	.095	.039	2.4	
4	10/11/61	.062	.042	1.5	
278	10/18/61	.084	.034	2.5	

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Badge #	Date	Urine, mg./l.	Blood, mg./100 gm.	Ratio	Comments
47	10/9/61	0.038	0.029	1.3	
311	6/8/60	.014	✓.018	0.8	
41	10/9/61	.096	.096	1.0	
355	5/27/59	.106	.032	3.3	
	10/2/61	.090	.034	2.6	
429	10/28/61	✓.101	✓.035	2.9	
	3/2/66	✓.086	✓.036	2.4	
	9/25/67	✓.137	✓.047	2.9	
56	10/18/61	✓.090	✓.030	3.0	
67	9/21/61	✓.132	✓.057	2.3	
109	9/22/61	✓.118	✓.040	3.0	
420	5/27/59	✓.039	✓.037	1.0	
	8/25/61	✓.086	✓.113	0.8	
	10/4/61	✓.060	✓.097	0.6	
	1/23/67	✓.091	✓.047	1.9	
20	10/17/61	✓.132	✓.061	2.2	
	10/23/64	✓.195	✓.042	4.6	
138	10/16/61	✓.095	✓.040	2.4	
174	9/16/66	✓.070	✓.094	0.7	
	10/26/66	✓.124	✓.052	2.4	
304	12/16/60	✓.116	✓.053	2.2	
	8/21/63	✓.095	✓.049	1.9	
	8/16/66	✓.150	✓.052	2.9	
366	9/29/61	✓.093	✓.078	1.2	
	10/10/61	✓.112	✓.041	2.7	
	1/11/62	✓.055	✓.046	1.2	Acute exposure.
371	10/30/61	✓.117	✓.046	2.5	
	10/12/64	✓.058	✓.037	1.6	
146	5/28/59	✓.033	✓.039	0.8	
385	5/31/60	✓.326	✓.057	5.7	Acute exposure.
	7/25/61	✓.170	✓.063	2.7	
	9/21/61	✓.141	✓.062	2.3	
	7/30/62	✓.194	✓.040	4.8	
	9/17/64	✓.077	✓.042	1.8	
	5/2/66	✓.084	✓.027	3.1	
256	10/3/61	✓.074	✓.040 *	1.8	
393	8/25/61	✓.102	✓.026	3.9	
	9/11/61	✓.159	✓.092	1.7	
	10/3/61	✓.106	✓.049	2.2	
	10/8/65	✓.168	✓.037	4.5	
396	9/18/61	✓.065	✓.040	1.6	
332	9/21/61	✓.126	✓.034	3.7	
	2/26/64	✓.163	✓.035	4.6	
	10/1/64	✓.165	✓.041	4.0	
	8/22/67	✓.118	✓.040	3.0	
216	9/12/61	✓.119	✓.029	4.1	
254	12/22/65	✓.176	✓.062	2.8	
	1/11/66	✓.226	✓.066	3.4	
389	10/9/61	✓.123	✓.040	3.1	
405	10/18/61	✓.117	✓.023	5.1	
	10/14/64	✓.065	✓.027	2.4	
	10/11/65	✓.100	✓.030	3.3	
280	9/29/61	✓.056	✓.036	1.6	
452	9/28/61	✓.071	✓.051	1.4	

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Badge #	Date	Urine, mg./l.	Blood, mg./100 gm.	Ratio	Comments
460	6/4/59	✓.057	✓.032	1.8	
	10/18/61	✓.047	✓.042	1.1	
	11/5/62	✓.064	✓.031	2.1	
199	7/19/60	✓.083	✓.068	1.2	
	9/2/60	✓.073	✓.044	1.7	
43	8/25/61	✓.113	✓.059	1.9	
	10/30/61	✓.089	✓.040	2.2	
462	10/9/61	✓.026	✓.051	0.5	
	9/19/61	✓.057	✓.097	0.6	
277	10/2/61	✓.150	✓.038	3.9	
848	9/19/61	✓.088	✓.162	0.5	
	10/9/61	✓.113	✓.036	3.1	
	3/17/64	✓.147	✓.024	6.1	
375	9/17/64	✓.150	✓.060	2.5	
	11/6/64	✓.144	✓.047	3.1	
	5/19/65	✓.127	✓.035	3.6	
430	8/23/61	✓.162	✓.039	4.2	
	10/2/61	✓.124	✓.034	3.6	
	9/25/62	✓.127	✓.052	2.4	
	8/19/64	✓.127	✓.030	4.2	
106	4/26/60	✓.124	✓.037	3.4	
	8/15/66	✓.140	✓.037	3.8	
6	10/17/61	✓.165	✓.043	3.8	
33	8/25/61	✓.120	✓.057	2.1	
	11/1/61	✓.078	✓.044	1.8	
108	7/22/60	✓.103	✓.040	2.6	
149	9/12/61	✓.142	✓.061	2.3	
226	10/18/61	✓.133	✓.039	3.4	
230	9/20/61	✓.080	✓.038	2.1	
284	2/22/61	✓.073	✓.043	1.7	
	9/20/61	✓.119	✓.036	3.3	
	11/6/61	✓.064	✓.035	1.8	
	11/19/64	✓.112	✓.029	3.9	
	1/27/67	✓.094	✓.045	2.1	
	2/3/67	✓.098	✓.049	2.0	
258	10/26/66	✓.172	✓.039	4.4	
346	9/28/61	✓.084	✓.047	1.8	
	12/16/64	✓.117	✓.029	4.0	
	5/24/66	✓.142	✓.063	2.2	
226(contd)	12/16/65	✓.203	✓.058	3.5	
	1/3/66	✓.090	✓.046	2.0	

Long term (> 20 yrs) lead workers

66 Individuals

139 Paired urine - blood
determinations

Primarily
Organic Exposure
(i.e. not fumaces, alloy
or melt pot)

mean 2.4

std. dev. 1.3

$p \leq 0.07$ "t-test"

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KF

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0

Ratio of urine/blood (ug/l/mg %) in
long term Organic lead workers