U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
CENTER FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45226

SUPPLEMENT TO HAZARD EVALUATION AND TECHNICAL ASSISTANCE COMPOSITE REPORT ON LEAD STUDIES FOR TA 76-107

N. L. BEARINGS
FREMONT, NEBRASKA

JULY 1978

Study Requested By:
OSHA
Washington, D.C.

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16. Abstract (Limit: 200 words)

In July 1973 OSHA cited this plant for violations of the air-borne lead standard. At OSHA's request, NIOSH arranged for a medical evaluation of the worker's current health status. Medical examinations were carried out on workers in this railroad bearing foundry in November 1976. There were 95 workers screened using a ZPP test. Fifty-two men who worked at high-risk jobs or had a ZPP value equal to or greater than 90 ug% were examined by history, physical and laboratory tests. Eighty-five percent (85%) of these had lead levels greater than 40 ug per 100 ml of blood, and over 20% had levels greater than 60 ug. Thirty-five percent (35%) had abnormally elevated blood pressures and a significant number had abnormalities of the urine and other parameters of renal function including BUN.

In summary, this railroad bearing foundry, under abatement, and with a program apparently aimed at decreasing the risk to workers of lead intoxication was found to have a number of workers with blood lead over 60 ug/100 ml, zinc protoporphyrin over 90 ug FEP/100 ml, abnormalities of renal function as shown by abnormal urinalyses or BUN's over 21 mg%, or elevated blood pressures. It appeared on the walk-through that lead and dust possibly containing lead were present in excessive quantities in the work area.

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I. SUMMARY

In July 1973 OSHA cited this plant for violations of the air-borne lead standard. At OSHA's request, NIOSH arranged for a medical evaluation of the worker's current health status. Medical examinations were carried out on workers in this railroad bearing foundry in November 1976. There were 95 workers screened using a ZPP test. Fifty-two men who worked at high-risk jobs or had a ZPP value equal to or greater than 90 ug% were examined by history, physical and laboratory tests. Eighty-five percent (85%) of these had lead levels greater than 40 ug per 100 ml of blood, and over 20% had levels greater than 60 ug. Thirty-five percent (35%) had abnormally elevated blood pressures, and a significant number had abnormalities of the urine and other parameters of renal function including BUN.

In summary, this railroad bearing foundry, under abatement, and with a program apparently aimed at decreasing the risk to workers of lead intoxication was found to have a number of workers with blood lead over 60 ug/100 ml, zinc protoporphyrin over 90 ug FEP/100 ml, abnormalities of renal function as shown by abnormal urinalyses or BUN's over 21 mg%, or elevated blood pressures. It appeared on the walk-through that lead and dust possibly containing lead were present in excessive quantities in the work area.

II. INTRODUCTION

In July of 1973 this plant was cited by OSHA for violating the OSHA Standard for airborne lead. Since that time, the plant has been under abatement while attempting to correct these violations. NIOSH was asked by OSHA to assess the general health of the workers during this time of the abatement period.

The plant in Fremont, Nebraska, consists of a lead recovery area and a foundry. Both are housed in one large building which used to be a grain elevator. Raw materials consisting of railroad car bearings made of 80% bronze and 20% babbit metal and various other types of scrap metal that contain lead are brought to the plant by rail. The finished products are bearings for journal boxes of railroad cars. The lining of these bearings is composed of 87% lead, 3% tin, and 9% antimony and is known as babbit. The rest of the bearing is bronze (15-22% lead content). Four electric furnaces are used to melt down the scrap metal and reclaim the lead. The metal is then alloyed and cast into bearings. The usual shake-out, grinding, and finishing operations are present.

III. EVALUATION

A. Study Design and Analytical Methods

This plant was one of three plants that were investigated by NIOSH and its medical contractor, Cook County Hospital. The protocol followed in all three studied is described in the Composite Report.

The inital walk-through of this plant was made on October 22, 1976. Present at this meeting were Doctors Carnow and Conibear from Cook County Hospital. Doctor Ted Thoburn from NIOSH, and Mr. Ray Hervin representing NIOSH Region 7. November 10 through 12, 1976 a team of health professionals went to the plant and carried out the survey.

All of the workers in this plant were exposed to varying concentrations of lead. Therefore, a screening exam consisting of ZPP (Zinc Protoporphyrin test determined by Hematofluromether) was done on all of the employees. A total of 95 persons had this examination, and there was one refusal. Three were absent from work during the screening visit.

On the basis of the results of the screening examination, everyone with a ZPP test greater than or equal to 90 was asked to participate in a brief neurological exam, a work history, past medical history, and history of symptoms (see figure 1 of Composite Report). In addition it was requested that employees presently working in or who had worked for a least 6 months in one of the areas cited by OSHA come in for this more extensive examination. Laboratory work consisted of a urine specimen collected for dip stick analysis and microscopic exam, and three samples collected by venepuncture for complete blood count without differential, a chem-24 (an automated screen including BUN, uric acid, and creatinine) and a blood analysis. Fifty-two (52) persons received the more extensive work up. Five others met the criteria for this more extensive work up, but could not be included in the study.

Questionnaires and laboratory data were put on IBM cards, validated and a computer was used to generate tables, calculate chi squared values, means, frequency tables and "t" test analyses.

B. Toxic Substance Medical Data and Evaluation Criteria

These are discussed in the Composite Report.

IV. RESULTS

Overall results from the three lead studies are discussed in the Composite Report. This section will deal with results at this specific plant.

A. Demographic Data

Of the 95 workers screened, fifty-two were examined beyond the ZPP screening phase either because they worked at high-risk jobs or had ZPP levels equal to or greater than 90 micrograms per cent. Their ages ranged from 19 to 60 years with a mean of 37.8 years. (Table 1) All were white males.

B. Risk and Exposure

More than 50 per cent worked at high-risk jobs as judged by management or the labor union (Table 2) and more than 35 per cent were exposed to lead for ten or more years (Table 3). The number of workers in high-risk operations and the fact that almost half of the work force had been there for ten or more years suggest the potential for developing serious health problems if poor industrial hygiene practice exists.

Data regarding lead exposure and intoxication as well as treatment for intoxication are detailed in Table 5. It can be seen that 11 have histories of elevated blood lead, 4 were treated and 1 was hospitalized. While the number of workers noting a history of elevated blood lead is considerable, some of the workers stated that they were never told about what their blood levels were after blood was taken so that their knowledge regarding this does not necessarily correlate with the numbers with elevated lead levels.

Three workers had possible outside exposure to lead although they were not ones with a past history of elevated blood leads.

C. Past History of Illness

A history of symptoms of disease is noted in Table 4. More than half answered in the affirmative to having 3 or more symptoms possibly related to lead exposure but, few of these appeared to be on-going for long periods of time.

Fifteen per cent of the workers did report 6 or more days of illness in the previous year. (Table 4) A significant number (14%) reported a history of hypertension. (Table 5)

D. Physical Findings

Approximately half of the workers had one or more abnormalities of reflexes or muscle strength. (Table 6) (The same caveat must be noted here as with the other studies, namely that the test depends on the physician's determination of strength or weakness and is quite subjective except in those cases where gross foot or wrist drop is present or reflexes are absent). These findings do not seem to relate to either ZPP or blood lead levels. While only 15% gave a history of elevated blood pressure, in fact, thirty-five percent were found with abnormal values - with 15% of the total workers examined having grossly abnormal blood pressures. Considering that these are normal, white, healthy, working males, this would appear to be an inordinate number of individuals with such an abnormality.

E. Laboratory Tests

Results are noted in Table 6. Abnormal urinalysis were shown by 15% of those examined and 13-1/2% had abnormally elevated BUN's. In contrast to this, only 4% revealed abnormally low hemaglobin. This would strongly suggest that the kidney is a, if not the, major target organ with evidence of abnormality expressed by abnormal urinalysis, elevated BUN and a finding of high blood pressure. The possibility exists that rotation of workers in and out of high-risk areas may be a factor leading to chronic renal disease. This deserves serious scrutiny since any kind of administrative control would tend to maintain an abnormally high level which may not be enough to produce acute toxic symptoms. In addition, a few workers reported treatment with "iron pills" which may have been Versenate. Chronic use of this drug may cause renal abnormality. (Routine use of chelating agents is said not to be a part of company policy.

F. Lead and ZPP Levels

ZPP levels were determined on 95 workers. Values and frequency distribution were noted in Table 7 and ranged from 6 to 319 ug percent with a mean of 77 ug percent. Blood lead levels were determined on 52 workers (Table 8). Eighty-five percent of those examined had blood lead levels equal to or greater than 40 ug, 54% had levels greater than 50 ug and over 20% had levels greater than 60 ug.

G. Conclusion

There were 95 workers screened using a ZPP test. Fifty-two men who worked at high-risk jobs or had a ZPP value equal to or greater than 90 ug% were examined by history, physical and laboratory tests. Eighty-five percent (85%) of these had lead levels greater than 40 ug per 100 ml of blood, and over 20% had levels greater than 60 ug.

Thirty-five percent (35%) had abnormally elevated blood pressures, and a number had abnormalities of the urine and other parameters of renal function including BUN.

In summary, this railroad bearing foundry, under abatement for more than three years, and with a program apparently aimed at decreasing the risk to workers of lead intoxication was found to have large numbers of workers with blood lead over 60 ug/100 ml, zinc protoporphyrin over 90 ug FEP/100 ml, abnormalities of renal function as shown by abnormal urinalyses or BUNs over 21 mg%, or elevated blood pressures. It appeared, based on the walk-through, that lead or dust possibly containing lead was noted in abundance on the floors, worktables, and clothing of workers.

V. RECOMMENDATIONS

1. Housekeeping needs improvement.

2. The incidence of workers with unacceptably high blood lead levels demonstrates the need for a more vigorous lead monitoring and control program.

NIOSH is currently recommending that both air levels and blood levels of lead should be monitored; that air levels be maintained below 100 ug cubic meter and that blood levels be maintained at or below 60 ug/100 ml whole blood. Those workers with blood lead levels above 60 ug/100 ml should have a repeat blood lead determination done promptly and, if still elevated, be removed from further exposure until their blood leads have returned to within the acceptable range. Questions of persistently elevated blood leads, extremely high blood leads or possible lead intoxication should be promptly referred for care by a physician. The ZPP test may prove of value in helping to assess the individual's reaction to lead exposure. Chelating agents should not be a part of routine care, but be reserved for use by a physician when a particular patient needs this treatment.

3. The abatement program needs to be reviewed to see if workers can be afforded additional protection.

4. The abnormalities of kidney function and blood pressure should be followed up, both on an individual basis and in relation to an ongoing medical program at the plant.

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Table 1

Age Distribution - Study Cohort

NL Bearings
Fremont, Nebraska

November 10-12, 1976

Age	Number	(Percent)	Cumulative (Percent)
19	1	2.0	2.0
20	2	3.9	5.9
22	2	3.9	9.8
24	2	3.9	13.7
25	4	7.8	21.6
26	2	3.9	25.5
27	1	2.0	27.5
28	1	2.0	29.4
29	1	2.0	31.4
31	1	2.0	33.3
32	1	2.0	35.3
33	3	5.9	41.2
34	2	3.9	45.1
35	1	2.0	47.1
39	4	7.8	54.9
40	1	2.0	56.9
41	2	3.9	60.8
44	1	2.0	62.7
45	3	5.9	68.8
46	1	2.0	70.6
47	3	5.9	76.5
48	2	3.9	80.4
51	2	3.9	84.3
52	4	7.8	92.2
53	1	2.0	94.1
54	1	2.0	96.1
58	1	2.0	98.0
60	1	2.0	100.0

Mean 37.8 Median 39

NL Bearings
Fremont, Nebraska

November 10-12, 1976

Table 2

Work In High Risk Area

	All Workers		Study Cohort	
	Number	Percent	Number	Percent
Yes	49	51.6	44	84.6
No	46	48.4	8	15.4
Total	95	100	52	100

Table 3

Years Worked In The Plant

Years	Number	Percent
Up to 1.0	4	7.7
More than 1.0 but less than 5.0	7	13.5
5.0 or more but less than 10.0	22	42.3
10.0 or more but less than 15.0	12	23.1
15.0 or more	7	13.5
Total	52	100

Table 4

Sick Days in Last 1 Year

	Number	Percent
0	29	60.4
1-5	12	25.0
6-19	6	12.5
> 20	1	2.1
Total	48	100

Table 5

Positive Findings On History

NL Bearings
Fremont, Nebraska

November 10-12, 1976

Finding	Number with Finding	Percent with Finding	Total number Responding
Elevated Blood Lead Level	11	21.2	52
Treatment for Lead Poisoning	4	7.7	52
Pills	2	66.7	3
Intravenous (IV)	1	33.3	3
Having Received Oral Medication for Elevated Blood Lead Levels	3	5.8	52
Hospitalization for Lead Poisoning	1	1.9	52
Non-Occupational Lead Exposure	3	5.8	52
Kidney Disease	2	3.8	52
Anemia Since Working in Plant	0	0	52
Gout	1	1.9	52
Seizures	0	0	52
Hypertension	7	13.7	51
Three or More Symptoms within the Past Year Related to Lead Intoxication	29	55.8	52

Table 6

Positive Findings On Physical Examination
And Laboratory Work

NL Bearings
Fremont, Nebraska

November 10-12, 1976

Finding	Number with Finding	Percent with Finding	Total number Responding
Abnormal Neurologic Findings	24	46.2	52
Blood Pressure			
Possibly Elevated (Systolic 140-149 and/or Diastolic 90-94)	10	19.2	52
Elevated (Systolic 150+ and/or Diastolic 95+)	8	15.4	52
Abnormally Low Hematocrit (Less than 42%)	1	1.9	52
Abnormally Low Hemoglobin (Less than 14 gm/100 ml)	2	3.8	52
Abnormally High Uric Acid (Greater than 8.5 mg%)	1	1.9	52
Abnormal Urinalysis	8	15.4	52
Abnormally High BUN (Greater than 21 mg%)	7	13.5	52
Abnormally High Creatinine (Greater than 1.4 mg%)	1	1.9	52

Table 7

ZPP Values
(ug FEP/100 ml whole blood)

NL Bearings
Fremont, Nebraska

November 10-12, 1976

ZPP (ug %)	Frequency - All Workers			Frequency - Study Cohort		
	Number	Percent	Cum. Percent	Number	Percent	Cum. Percent
6	1	1.1	1.1	0	0.0	0.0
8	1	1.1	2.1	1	1.9	1.9
12	3	3.2	5.3	1	1.9	3.8
14	3	3.2	8.4	1	1.9	5.8
15	2	2.1	10.5	0	0.0	5.8
17	2	2.1	12.6	2	3.8	9.6
18	2	2.1	14.7	0	0.0	9.6
20	1	1.1	15.8	1	1.9	11.5
21	1	1.1	16.8	0	0.0	11.5
22	3	3.2	20.0	1	1.9	13.5
23	3	3.2	23.2	0	0.0	13.5
24	3	3.2	26.3	1	1.9	15.4
25	3	3.2	29.5	0	0.0	15.4
26	2	2.1	31.6	0	0.0	15.4
27	1	1.1	32.6	0	0.0	15.4
28	2	2.1	34.7	0	0.0	15.4
29	2	2.1	36.8	1	1.9	17.3
33	1	1.1	37.9	0	0.0	17.3
34	2	2.1	40.0	0	0.0	17.3
35	1	1.1	41.1	1	1.9	19.2
39	1	1.1	42.1	0	0.0	19.2
43	1	1.1	43.2	0	0.0	19.2
44	1	1.1	44.2	0	0.0	19.2
48	2	2.1	46.3	1	1.9	21.2
49	1	1.1	47.4	0	0.0	21.2
53	1	1.1	48.4	1	1.9	23.1
54	1	1.1	49.5	0	0.0	23.1
59	1	1.1	50.5	1	1.9	25.0
65	3	3.2	51.6	1	1.9	26.9
72	1	1.1	54.7	0	0.0	26.9
73	1	1.1	55.8	0	0.0	26.9
75	1	1.1	56.8	0	0.0	26.9
76	2	2.1	57.9	2	3.8	30.8
81	2	2.1	60.0	2	3.8	34.6
86	1	1.1	62.1	1	1.9	36.5
87	2	2.1	63.2	2	3.8	40.4

Table 7 Continued

ZPP (ug %)	Frequency - All Workers Number	Percent	Cum. Percent	Frequency - Study Cohort Number	Percent	Cum. Percent
90	1	1.1	65.3	1	1.9	42.3
91	1	1.1	66.3	1	1.9	44.3
94	1	1.1	67.4	1	1.9	46.2
96	2	2.1	69.5	2	3.8	50.0
100	2	2.1	71.6	2	3.8	53.8
102	3	3.2	74.7	3	5.8	59.6
108	1	1.1	75.8	1	1.9	61.5
109	1	1.1	76.8	1	1.9	63.5
110	1	1.1	77.9	1	1.9	65.4
116	1	1.1	78.9	1	1.9	67.3
118	1	1.1	80.0	1	1.9	69.2
125	1	1.1	81.1	1	1.9	71.2
129	1	1.1	82.1	1	1.9	73.1
131	1	1.1	83.2	1	1.9	75.0
138	1	1.1	84.2	1	1.9	76.9
139	1	1.1	85.3	1	1.9	78.8
140	1	1.1	86.3	1	1.9	80.8
142	1	1.1	87.4	0	0.0	80.8
143	1	1.1	88.4	1	1.9	82.7
162	1	1.1	89.5	1	1.9	84.6
181	1	1.1	90.5	1	1.9	86.5
185	1	1.1	91.6	1	1.9	88.5
189	1	1.1	92.6	1	1.9	90.4
202	1	1.1	93.7	1	1.9	92.3
213	1	1.1	94.7	1	1.9	94.2
219	1	1.1	95.8	0	0.0	94.2
226	1	1.1	96.8	1	1.9	96.2
233	1	1.1	97.9	1	1.9	98.1
272	1	1.1	98.9	0	0.0	98.1
319	1	1.1	100.0	1	1.9	100.0
Total	95	100.0		52	100.0	

Mean 103.6 Median 98
Std. Dev. 64.9

Table 8

Lead Values
(ug/100 ml whole blood)

NL Bearings
Fremont, Nebraska

November 10-12, 1976

Lead (ug %)	Number	Percent	Cum. Percent
28	1	1.9	2.0
31	1	1.9	3.8
34	1	1.9	5.8
37	1	1.9	7.7
38	2	3.8	11.5
40	2	3.8	15.4
42	1	1.9	17.3
43	3	5.8	23.1
44	2	3.8	26.9
45	2	3.8	30.8
46	2	3.8	34.6
47	1	1.9	36.5
48	1	1.9	38.5
49	1	1.9	40.4
50	3	5.8	46.2
51	2	3.8	50.0
52	1	1.9	51.9
53	1	1.9	53.8
54	4	7.7	61.5
55	1	1.9	63.5
56	2	3.8	67.3
58	3	5.8	73.1
60	1	1.9	75.0
61	1	1.9	76.9
64	2	3.8	80.8
67	3	5.8	86.5
69	2	3.8	90.4
77	2	3.8	94.2
84	1	1.9	96.2
86	1	1.9	98.1
99	1	1.9	100.0
Total	52	100.0	

Mean 53.8 Median 51.5
Std. Dev 14.2