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

HEALTH HAZARD EVALUATION DETERMINATION
REPORT NO. 76-75-340

ROCKY MOUNTAIN BANK NOTE
LAKEWOOD, COLORADO

NOVEMBER 1976

I. TOXICITY DETERMINATION

Based upon an environmental/medical evaluation conducted by NIOSH investigators on June 30-July 1, 1976, it has been determined that linotype operators, the lead melter, and pressman are not exposed to toxic concentration of lead (fume or dust) via inhalation or ingestion.

Recommendations:

Although the results of the biologic sampling do not indicate increased absorption of lead, the practice of eating and/or smoking at the worksite should be prohibited.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this hazard evaluation determination report are available upon request from NIOSH. Division of Technical Services, Information Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. Copies have been sent to:

a) Rocky Mountain Bank Note
b) Authorized Representative of Employees
c) U.S. Department of Labor - Region VIII
d) NIOSH - Region VIII

For the purpose of informing the approximate 57 "affected" employees, the employer shall "post" the Determination Report for a period of 30 calendar days in a prominent place(s) near where exposed employees work.

III. INTRODUCTION

Section 20 (a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669 (a)(6), authorizes the Secretary of Health, Education, and Welfare, following a written request by any employer or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

The National Institute for Occupational Safety and Health (NIOSH) received such a request from a representative of the employer regarding the possibility of a health hazard due to lead in the linotype operators', lead melter's, and pressmans' working environment and noise in the linotype operators working environment.

HEALTH HAZARD EVALUATION

A. Plant process - Conditions of use

Rocky Mountain Bank Note is a printing firm which employs close to 500 workers; of this number, approximately 300 are production workers and 8 are maintainance personnel. There are eleven linotype operators in the linotype room and one furnace man (lead melter) in a small room adjacent to the linotype room. There is one additional linotype operator in the make-up area who corrects errors made by other operators while setting type.

Of the eleven linotype machines housed in the linotype room, one is of the handset type while the others operate off of a computer tape. Each machine is equipped with a small melting pot held at 550°F. The local exhaust once present has been modified such that it is now a general room exhaust system with several exhaust points. This was accomplished by removing the lower portion of the individual branch ducts. Make-up air is provided through a unit located on the ceiling.

The furnace room (lead melt room) is purposely located adjacent to the linotype. Lead scraps collected from individual linotype machines, along with new bars of lead, are melted in one locally exhausted pot. Lead is melted and then poured in the shape of a small ingot which is convenient for use by each linotype machine. This operation is normally conducted during the second shift by one individual (furnace man) who is assisted, during the collection of lead scraps, by one other person.

The rest of the operations conducted by the production workers are done in the general workroom; this includes the make-up personnel, pressman, and composition personnel. These operations do not involve the application of heat; however, these employees come in contact with a lot of lead on a daily basis. The main concern was the possibility of lead intake via oral ingestion.

B. Evaluation Methods

The environmental evaluation consisted of collecting breathing zone (bz) samples, measuring noise levels, and observing work practices. Only linotype operators', the lead melters' and one "make-up mans" (who operated a saw) exposure to airborne lead was determined by collecting bz samples. These samples were collected at 1.7 liters per minute (after correcting for barometic pressure) for essentially the entire shift. These samples were collected on cellulose membrane filters and analyzed by atomic absorption.

Noise levels were measured by using a General Radio Sound Level meter and by using Dupont Noise Dosimeters.

In addition to the environmental evaluation, the Medical Technologist administered a directed questionnaire and collected blood samples from all employees in the linotype room. This included linotype operators, mechanics, foreman, and furnace man. In addition to these employees, a sample group from the make-up department and the pressing department was included in the study.

The questionnaire used included such information as smoking histories, eating habits on the job, outside the job exposures to lead, as well as symptomatology that the individuals thought may be job-related.

The blood samples for lead determination were obtained by standard vena puncture techniques and were collected in commerically available lead free tubes. In order to insure reliability of the lead determinations, the samples were split and analyzed both by the Utah Biomedical Test Laboratory (UBTL), Salt Lake City, Utah, as well as Medical Diagnostic Services in Cincinnati, Ohio. Both laboratories used the method of atomic absorption spectrophotometry in the measurement of the lead levels.

C. Evaluation Criteria

a. Environmental

The primary sources of environmental criteria considered in the report are: 1) the NIOSH Recommended Standard for Lead; 2) the American Conferene of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLV) for Lead; and 3) the Federal Standard (OSHA). The NIOSH Recommended Standard and ACGIH TLV are both 0.15 mg/m^3 determined as a time weighted average (TWA). The present OSHA Standard is 0.2 mg/m^3. However, it should be pointed out that OSHA is considering a standard of 0.1 mg/m^3.

Since the requester wanted plant noise levels compared to the present Federal Standard, only this standard (OSHA Standard) is presented below. However, it was pointed out that the ACGIH TLV and the NIOSH, recommended standard for noise is 85 dBA for an eight hour exposure.

Permissible Noise Exposure

Duration Per day hours	Sound Level dBA slow response
8	90
6	92
4	95
3	97
2	100
1 1/2	102
1	105

1/2	110
1/4 or less	115

b. Medical Criteria - Biological Norms

Prolonged absorption of lead or its inorganic compounds from inhalation of vapor, fume or dust, as well as from oral ingestion can result in severe gastro-intestinal disturbances and anemia. With more serious intoxication, neuromuscular dysfunction may occur, and with severe exposure may result in encephalopathy. Presenting symptoms are often weakness, weight loss, lassitude, insomnia, and hypotension. Usually associated with this, there is a disturbance of the gastro-intestinal tract, which includes constipation, anorexia, and abdominal pain described as colicky. The physical findings although occurring late usually consist of facial pallor, malnutrition, abdominal tenderness, and pallor of the eye grounds. The anemia associated with lead posioning is of the hypochromic, microcytic type with basophilic stippling of the red cells being present. A lead line may appear on gingival tissues, and in severe cases of poisoning paralysis of the extensor muscles of the wrist, and less often of the ankles, can occur. Encephalopathy while common in children is unusual in adults.[6]

Lead is teratogenic in mamalian animals, so it is advised that exposure of women in the child bearing age to lead should be carefully monitored. Health information related to lead suggests that blood lead levels in individual workers should be kept at values less than 60 micrograms per 100 ml. of whole blood. It also should be noted that persons with anemia existing or sickle cell trait may be at increased risk from exposure to lead. At this present time NIOSH recommends the levels of 0 to 40 micrograms per 100 ml. of whole blood to be in the normal range. The levels of 40 to 60 micrograms per 100 ml. of whole blood in the increased absorption range and increasing levels above 60 micrograms per 100 ml. of whole blood to be considered undesirable.[6]

D. Evaluation Results and Discussions

The highest concentration of lead measured in the breathing zone of the 13 employees samples was 0.02 mg per cubic meter of air and in ten of the twenty-two samples, lead was not detected.

Since lead was either not detected or else was determined to be present in very low concentrations in these environmental air samples, it was concluded the employees in question were not exposed to toxic concentrations of airborne lead.

The possibility of increased absorption of lead via oral ingestion was investigated as follows: As can be seen in Table I, a total of 20 workers, two females and 18 males, were interviewed and their blood sampled for lead during this evaluation. The age range was 19-55 years with a mean of 31.5 years, and years worked in each

particular occupation ranged from 2 months to 40 years, with a mean of 10.4 years. Ten of 20 workers have a history of symptomatology thought possibly related to work. However, on closer questioning a majority of these were felt to be related to some other cause and not to employment at Rocky Mountain Bank Note. It also can be seen by examining Table I that 13 of 20 workers interviewed, smoke on the job. Eight of 20 workers ate on the job; and that two of the 20 workers sampled has home exposure to lead, that is, outside the job situation.

Table II contains the lead values that were found as a result of this investigation. As stated before, the samples were analyzed at two different laboratories to insure validity of results. Of those analyzed at the UBTL lab, the mean value was 25.5 with a standard deviation of 9.6. The range of those leads done at the UBTL lab was 11 micrograms per 100 ml. to 46 micrograms per 100 ml. Of those leads analyzed at Medical Diagnostic Services the mean was 33.0 micrograms per 100 ml., with a standard deviation of 10.3 and a range of 16 micrograms per 100 ml. to 55 micrograms per 100 ml. As expected, those people who were involved in the study that were known to be in surrounding areas and support capacities as a whole were in their jobs a shorter period of time than the others tested, and had a mean lead lower than the workers actually in the lineotype operation. As seen in Table II, samples 19 through and including 26 are of surrounding and support personnel, whereas samples No. 1 through and including 18 are from those people directly involved in the lineotype and printing operations.

Results of four individual's exposure to noise, determined for one work shift, are presented in Table III. All are well within the Federal Standard. Also, instantaneous sound level measurements made with a General Radio Sound Level Meter ranged from 85-88 dBA throughout the linotype room.

E. Conclusions

Based on the results of the blood lead determination, as well as the questionnaire it is apparent that no current lead toxicity problems were present at the time of this study. Seventeen of the 20 workers tested had blood lead levels less than 40 micrograms per 100 ml. It is apparent from the results that those people who are directly involved in the lineotype and printing operations are more likely to be exposed to lead than those who are in the surrounding areas or who are in the support categories. However, it must be stated again that no toxic blood levels of lead were discovered on this survey.

RECOMMENDATIONS

1. Despite the fact that no definite abnormal blood lead levels were detected on this survey, it must be noted that lead and its inorganic compounds are capable of causing potentially serious disease. It is because of this fact that certain surveillance practices be taken purely as a precautionary measure. This should include periodic biological monitoring on an annual basis. If on annual monitoring a blood lead level of 60 micrograms per 100 ml. or greater is found a repeat sample should be taken approximately 2 weeks from the original to confirm an elevated blood lead level. If this is indeed documented, certain steps should be taken to reduce the employees absorption of lead as soon as possible. This may include change of work area, or job, or others.

2. Workers should be educated as to the potential dangers of over-exposure to lead, especially those resulting from poor work practices.

3. Employees should be prohibited from eating, drinking or smoking in the work area.

4. Employees should be instructed not to carry their cigarettes into the work area since they may become contaminated.

5. Employees should be instructed to wash their hands prior to eating, drinking, or smoking.

6. Although the concentration of lead in the saw operator's breathing zone (make-up department) was found to be quite low (<0.01 mg/m^3), it is suggested that the already present exhaust system be tapped in order to provide local exhaust at the sawing and brushing station.

VI. REFERENCES

1. Carl Zenx, MD., Occupational Medicine, Yearbook Medical Publishers.

2. F.A. Patty, editor, Industrial Hygiene and Toxicology, 2nd edition, New York Interscience Press.

3. NIOSH Criteria Document - Occupational Exposure to Inorganic Lead.

4. NIOSH Research Report - Behavioral Effects of Occupational Exposure to Lead.

5. BNA Occupational Safety and Health Reporter - Guidelines for controlling Occupational Exposure to Lead. pp. 1300-1303, Feb. 26, 1976.

6. NIOSH Standard completions project; appendix C - Medical Surveillance Guidelines.

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TABLE I

Rocky Mountain Bank-Note

June 29-July 1, 1976

SYMPTOMS BY HISTORY

TOTAL WORKERS INTERVIEWED 20
2 Females 18 Males

10 workers gave a history of symptomatology possibly related to work (50%)

Dry or sore throat	2
Burning or itching of eyes	2
Stiffness of joints	3
Headache	3
Fatigue	3
Difficulty sleeping	2
Metalic taste in mouth	1

More than a total of ten symptoms are reported because of some individuals reporting more than one symptom.

13 of 20 smoked on the job

8 of 20 eat on the job

2 of 20 have home exposure (auto body work) (moonshine whiskey)

Age Range 19 - 55 Mean of 31.5 years

Years worked in this occupation:

Range 2 months - 40 years

Mean 10.4 years

TABLE II

Rocky Mountain Bank-Note

June 29-July 1, 1976

BLOOD LEAD VALUES

SPECIMAN NUMBER	MICROGRAMS OF LEAD PER 100 ML OF WHOLE BLOOD NIOSH LAB	MEDICAL DIAGNOSTICS LAB
1	38	45
2	22	34]
3		37]
4	26]	35
5	27]	
6	27	43]
7		46]
8	26]	34
9	27]	
10	46	55
11	38	44]
12		44]
13	15]	23
14	36]	
15	42	32
16	31	21
17	36	38
18	17	26
19	19	26
20	24	26
21	16	16
22	22	25
23	14	23
24	24	26
25	11	17
26	20	-

] Brackets indicate split samples to same laboratory to check variation and reliability.

TABLE III

Individual's Noise Exposure Determined July 1, 1976

Rocky Mountain Bank Note

	Elapsed time	Sound Level of 115 dBA exceeded	% of permissible exposure*
Linotype operator (A) (handset)	7.8 hours	No	45
Linotype operator (B) (Tape Type)	7.78 hours	No	25
Linotype operator (C) (Tape Type)	7.75 hours	No	17
Mechanic	7.07 hours	No	60

*determined with Dupont noise dosimeters