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U.S. DEPARTMENT OF HEALTH, EDUCATION AND WELFARE
CENTER FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45202

HEALTH HAZARD EVALUATION DETERMINATION
REPORT NO. 77-6-465
ALLEN-BRADLEY COMPANY, MAGNETICS DIVISION
SHAWNEE, OKLAHOMA
FEBRUARY, 1978

I. TOXICITY DETERMINATION

It has been determined that employees performing duties in the powder house, as dry press operators and as wet press operators at the Allen-Bradley Company, Magnetic Division, Shawnee, Oklahoma, were not exposed to toxic concentrations of lead.

These determinations are based on data collected during fifteen (15) interviews conducted on March 10-11, 1977, as well as results of environmental sampling conducted on August 30, 1977.

II. DISTRIBUTION AND AVAILABILITY OF REPORT

Copies of this Determination Report are currently available upon request from NIOSH, Division of Technical Services, Information and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After ninety (90) days, the report will be available through the National Technical Information Service (NTIS), Springfield, Virginia. Information regarding its availability through NTIS can be obtained from NIOSH, Publications Office, at the Cincinnati, Ohio address. Copies have been sent to:

- A. Allen-Bradley Company, Magnetics Division
- B. U.S. Department of Labor, Region VI
- C. NIOSH, Region VI

For the purpose of informing the approximately thirty-six (36) "affected employees", the employer shall promptly "post" the Determination Report in a prominent place(s) near where exposed employees work, for a period of thirty (30) calendar days.

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 receipt of a written request from an 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 received such a request from an authorized representative of employees regarding the exposure of workers to lead in the powder house and wet/dry press areas.

IV. HEALTH HAZARD EVALUATION

A. Description of Process - Conditions of Use

This plant, commencing operations in October, 1973, currently employs a total of 374 persons, 246 of which are classified as production workers and thirty-six (36) of which perform duties in the specific area of the request. Specifically, the facility is involved in the production of ceramic permanent magnets.

B. Evaluation Design

1. Preliminary Survey

On March 10-11, 1977, an initial walk-through survey was conducted of the facility. No environmental sampling was performed at that time; considerable information was, however, gathered on the characterization of substances and conditions of their use. A thorough review and evaluation was also made of the location and degree of usage of lead in the work environment.

A total of fifteen (15) workers in the powder house, wet/dry press area were privately interviewed by the industrial hygienist in a non-directed manner concerning any health problems thought to be related to their specific jobs at the plant.

2. Follow-up Environmental-Medical Survey

In order to more fully evaluate employee exposure to lead, it was deemed necessary to collect personal air samples in the powder house and wet/dry press area(s). The NIOSH medical investigator visited the plant at the start of this survey, but no further medical investigation was conducted as a result of additional information obtained from plant officials relative to product/chemical usage.

C. Evaluation Methods

1. Lead

Twenty-four (24) breathing-zone air samples were collected by using Mine Safety Appliance, Model G, battery-operated vacuum pumps with 0.8 micron pore density cellulose membrane filters at a sampling rate of 1.7 liters per minute. Samples were analyzed for both total and respirable (by use of Dorr-Oliver cyclone pre-filter) portions of lead by direct aspiration atomic absorption at a lower limit of detection of five (5) micrograms per sample.

D. Evaluation Criteria

1. Environmental Standards or Criteria

The U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) standard currently in effect is $0.2\text{mg}/\text{M}^3$ (milligrams of lead per cubic meter of air sampled). The proposed

OSHA standard, and NIOSH supported level, has been set at 0.1 mg/M³.

Occupational health exposure limits for individual substances have generally been established at levels designed to protect workers occupationally exposed on an eight (8) hours per day, forty (40) hours per week basis over a normal working lifetime.

2. Toxic Effects

a) Lead

Prolonged absorption of lead or its inorganic compounds from inhalation of vapor, fume, or dust, and to a lesser degree from ingestion, results in severe gastrointestinal disturbances and anemia; with more serious intoxication, there is neuromuscular dysfunction, while the most severe lead exposure may result in encephalopathy. The onset of symptoms of lead poisoning or plumbism is often abrupt; presenting complaints are often weakness, weight loss, lassitude, insomnia and hypotension. Associated with these is a disturbance of the gastrointestinal tract which includes constipation, anorexia, and abdominal discomfort, or actual colic.

Physical signs are usually facial pallor, malnutrition, abdominal tenderness, and pallor of the eye grounds. The anemia associated with lead poisoning is of the hypochromic, normocytic type with reduction in mean corpuscular hemoglobin; stippling of erythrocytes and reticulocytosis is evident. On gingival tissues, a line or band of punctate blue or blue-black pigmentation (lead line) may appear; this is evidence of only lead absorption, rather than poisoning.

Occasionally, the alimentary symptoms are relatively slight and are overshadowed by neuromuscular dysfunction with signs of motor weakness which may progress to paralysis of the extensor muscles of the wrist, and less often of the ankles.

Following absorption, inorganic lead is distributed in the soft tissues and in the bones, with the highest soft tissue concentrations being in the kidneys and the liver. In the blood, nearly all circulating inorganic lead is associated with the erythrocytes. Over a period of time, the lead is redistributed, being deposited especially in bone and also in teeth and hair.

Lead absorption is cumulative; elimination of lead from the body is slow, requiring considerably longer than the period of storage of toxic amounts. Asymptomatic lead workers, when subjected to a sudden increase in exposure to, and absorption of, lead, may respond with an episode of typical lead poisoning.

E. Evaluation Results and Discussion

1. Environmental

The results of twenty-four (24) air samples collected on August 30, 1977, are shown in Table 1. All samples were well below both the proposed and the current OSHA standard.

2. Medical

Results of employee interviews/medical questionnaires conducted by the industrial hygienist revealed no job-related health problems to be apparent, with the possible exception of the skin "itching/irritation" as reported by five (5) of the fifteen (15) employees interviewed. It is judged that the irritation factor was due mainly to the employees' use of an abrasive skin cleanser both during and after working hours.

No excessive absenteeism existed because of sickness, etc. resulting from exposure to chemicals/contaminants utilized within the work area(s).

Because of one elevated air lead level on an OSHA inspection prior to the NIOSH study, numerous questions arose both prior to and during the evaluation as to potential hazards and/or medical problems based on the solubility/insolubility of the lead products being used within the plant. If, as the company had presented to OSHA the highly insoluble forms of lead do not cause problems (similar) to those of the more soluble forms, it would be appropriate to consider only the respirable fraction of lead in air as being hazardous. This, of course, assumes that swallowing the insoluble form should make very little difference, as ingested lead is not well absorbed, and an insoluble form should be absorbed to even a lesser extent.

This information would have been important in setting the lead standard, in that the proposed standard might have more appropriately been applied to the respirable fraction for insoluble lead compounds as opposed to the total air-borne lead.

During the August 30, 1977, visit to the plant, it was determined that the plant had modified their formulation to eliminate lead from all products. Thus this problem could not be studied.

F. Conclusions

The following conclusions are based upon the previously-discussed environmental and medical findings:

1. No excessive concentrations of lead were found to exist in the work atmosphere of the plant in question. Concentrations of air-borne lead were, in fact, found to be below the lower limit of detection of the analytical method utilized.
2. "Complaints" mentioned on the administered employee questionnaires suggest a process which occasionally becomes dusty, but otherwise is not causing problems. No evidence was produced which would

indicate the presence of medical problems related to or resulting from the prior use of lead in the manufacturing process.

3. Emphasis is again placed on the fact that lead has recently been eliminated from the company's formulations. Further concern for employee exposure to lead is now, therefore, inappropriate.

V. RECOMMENDATIONS

Considering that: (a) all air-borne lead concentrations of lead were found to be below both the proposed and the current OSHA standard, and (b) no improper work practices were observed, no specific recommendations will be made to improve existing conditions in the applicable work area(s)

VI. AUTHORSHIP AND ACKNOWLEDGEMENT

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Table 1

Lead Concentrations
 Allen-Bradley Company, Magnetics Division
 Shawnee, Oklahoma
 August 30, 1977

Sample Number	Operation	*Type of Sample	Sampling Period	**Concentration (mg/M ³)
T-1	Filter Press & Dryer Line	P(T)	10:09AM - 11:25AM	< 0.04
R-1	"	P(R)	"	"
T-2	Make-up Red Mix & Ball Mills	P(T)	10:12AM - 11:25AM	< 0.04
R-2	"	P(R)	"	"
T-3	Wet Press 02	P(T)	10:19AM - 11:30AM	< 0.04
R-3	"	P(R)	"	"
T-4	Wet Presses #21 & #22	P(T)	10:21AM - 11:34AM	< 0.04
R-4	"	P(R)	"	"
T-5	Dry Presses #15 & #16	P(T)	10:25AM - 11:30AM	< 0.05
R-5	"	P(R)	"	"
T-6	Dry Presses #1 & #2	P(T)	10:29AM - 11:35AM	< 0.04
R-6	"	P(R)	"	"
T-7	Filter Press & Dryer Line	P(T)	12:04PM - 1:24PM	< 0.04
R-7	"	P(R)	"	"
T-8	Make-up Red Mix & Ball Mills	P(T)	12:05PM - 1:22PM	< 0.04
R-8	"	P(R)	"	"
T-9	Wet Press #02	P(T)	12:06PM - 1:39PM	< 0.03
R-9	"	P(R)	"	"
T-10	Dry Presses #15 & #16	P(T)	12:08PM - 1:15PM	< 0.04
R-10	"	P(R)	"	:
T-11	Grinder #22	P(T)	12:12PM - 1:42PM	< 0.03
R-11	"	P(R)	"	"
T-12	Dry Presses #1 & #2	P(T)	12:03PM - 1:15PM	< 0.04
R-12	"	P(R)	"	"

U. S. Department of Labor, Occupational Safety and Health
 Administration (OSHA), Current Standard..... 0.20

U. S. Department of Labor, Occupational Safety and Health
 Administration (OSHA), Proposed Standard..... 0.10

* P(T) = Personal, Total Lead; P(R) = Personal, Respirable Fraction
 **mg/M³ = milligrams of lead per cubic meters of air sampled