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

HEALTH HAZARD EVALUATION DETERMINATION
REPORT HE 79-115-650

BAUMER RADIATOR WORKS
DENVER, COLORADO

January 1980

I. SUMMARY

A health hazard evaluation was conducted by the National Institute for Occupational Safety and Health (NIOSH) at the Baumer Radiator Works in Denver, Colorado, on August 7, 1979, to evaluate possible hazards from lead and nuisance dust in the work environment. Environmental samples were taken for airborne particulate and lead. Blood samples were drawn and analyzed for lead and free erythrocyte protoporphyrin (FEP).

Results of this evaluation indicate that, on the day of sampling, two employees were exposed to airborne lead concentrations of 50 and 100 $\mu g/M^3$ (micrograms of lead per cubic meter of air). The recommended maximum level is 50 $\mu g/M^3$. The same employees had blood lead levels of 43 and 65 $\mu g/100$ ml (micrograms of lead per 100 milliliters of blood). The normal maximum is 40 $\mu g/100$ ml. The FEP concentration ranged from 926 to 2212 $\mu g/l$ RBC (micrograms FEP per liter red blood cells). The normal range is 220 to 870 $\mu g/l$ RBC. Other values were within normal limits.

The data obtained in this investigation indicate that a health hazard due to overexposure to lead existed at the Baumer Radiator Works, and had existed as a prolonged exposure over the past several months. The overexposures were due to a combination of inhalation and ingestion. Recommendations on improved housekeeping, personal hygiene, and local exhaust ventilation are presented on page 3.

II. INTRODUCTION

Under the Occupational Safety and Health Act of 1970*, NIOSH investigates the toxic effects of substances found in the workplace. The owner and manager of Baumer Radiator Works requested such an investigation from NIOSH to determine the hazards presented by lead fume and nuisance dust in his shop.

Subsequent to the on-site portion of this investigation, employees were individually notified by letter of the results of their blood sample analysis. On October 24, a preliminary report was sent to the employer with the results of the environmental testing as well as a summary of the blood sample results.

III. BACKGROUND

Automobile, truck and commercial radiators are repaired in this shop. During the repair, these radiators are disassembled using oxygen acetylene torches to melt solder which holds the radiator together. The radiator cores are then cleaned, repaired, or replaced as necessary, and the unit is reassembled. New solder is then applied. The solder being used in this process is 60% lead and 40% tin. During the process, lead fume becomes airborne. Workers are also exposed to lead by handeling the soldering wire and the radiators, and to lead dust from waste solder which has fallen to the floor.

IV. EVALUATION DESIGN AND METHODS

Personal breathing zone air samples were taken on all employees repairing radiators. These samples were collected on mixed cellulose ester filters using battery powered sampling pumps operated at 1.5 liters per minute and worn by the workers through most of their 8-hour shift. Analysis was by atomic absorption spectroscopy.

Blood specimens were collected by venipuncture for analysis for lead and free erythrocyte protoporphyrin (FEP). Employees were interviewed regarding work histories and general physical condition.

V. EVALUATION CRITERIA

Lead

Lead exhibits toxic effects on the kidneys, the peripheral and central nervous systems, and the hematopoietic system. These effects are felt as weakness, tiredness, irratability, digestive disturbances, high blood pressure, premature aging, nephritis, mental deficiencies, and other changes detected by testing. The OSHA standard for lead in workplace air (effective February 1, 1980, for industries such as this) is 50 $\mu g/M^3$.

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* 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 concen-

NIOSH has recommended that a blood lead value of 60 micrograms per 100 grams whole blood (60 µg/100 g blood) be the maximum tolerated occupational blood lead level. The new OSHA standard has dictated that by the end of four years this will become the level at which a worker must be removed from further lead exposure until his blood lead level has dropped to normal values. OSHA's aim is to keep as many workers' blood lead levels as possible below 40 µg/100 g, the upper limit of blood leads in unexposed individuals.

The normal range for FEP in unexposed individuals is from 220 to 870 micrograms per liter of red blood cells (220 - 870 µg/l RBC).

Nuisance Dust

The evaluation criteria for airborne particulate or "nuisance dust" is based on its ability to reduce workshop visibility, create unpleasant deposits in the eyes, ears and nasal passages, or cause injury to the skin or mucous membranes by chemical or mechanical action per se or by the rigorous cleansing procedures necessary for its removal. The American Conference of Governmental Industrial Hygienists has recommended a concentration of 10 mg/M^3 as a maximum acceptable level for particulate in air. OSHA enforces a standard of 15 mg/M^3.

VI. EVALUATION RESULTS

Samples taken for airborne lead and particulate indicate, as shown in Table I, that both the bench man and the manager were exposed to airborne lead at levels equal to or greater than the evaluation criteria. Other lead samples and particulate samples were within safe limits.

Table II shows the results of blood tests for lead and free erythrocyte protoporphyrin (FEP). The same two employees who were exposed to the highest levels of airborne lead also have the highest concentrations of blood lead, the manager's level being slightly elevated and the bench man's level being significantly elevated. FEP concentrations range from slightly to significantly elevated for all employees, with the bench man again having the highest level. Both blood lead and FEP concentrations range from slightly to significantly elevated for all employees, with the bench man again having the highest level. Both blood lead and FEP concentrations reflect total intake of lead, that is, from ingestion with food, drink, and smoking as well as by inhalation. Blood lead levels are an indicator of exposure over the previous few days, while FEP levels are an indicator of exposure over several months.

VII. RECOMMENDATIONS

Since employee exposure to lead appeared to be due to a combination of ingestion and inhalation (eating and breathing), both methods of intake should be reduced. The easiest and cheapest way to do this is through improved housekeeping and personal hygiene. Dust and old solder should

be removed from floors, walls, rafters, work areas, and any place it may collect. Clean-up will reduce the amount of lead-containing dust that otherwise might become airborne by the movement of people, equipment, wind or use of compressed air. It will also decrease the amount of lead which is ingested by transfer from the work area to hands to mouth via cigarettes, food, or drink. Ingestion, however, can be more adequately controlled by the elimination of all smoking, eating, and drinking in the work area.

Clean-up should be with vacuum, wet mop, water spray or some other method that does not create an additional exposure by throwing dust into the air. This procedure should be repeated frequently so that dust does not accumulate.

NIOSH recommends that the bench man contact his personal physician for an evaluation and repeat blood lead level, and has so stated in a letter to that individual.

The installation of local exhaust ventilation appears to be the most practical method of removing from the air any lead fume which is created during the soldering process. Either a soldering hood with a flexible duct as pictured in Figure 1, or a hood built around the tank would be acceptable. The soldering hood is less expensive to install and needs less makeup air and therefore is less expensive to operate. It must be repositioned frequently, however, and needs to be close (within a foot) to the workpiece to be effective. Repeat blood lead levels and, if desired, repeat air sampling, subsequent to cleanup and hygiene improvements should help determine if the installation of ventilation is necessary.

VIII. AUTHORSHIP AND ACKNOWLEDGEMENTS

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IX. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this report are currently available, upon request, from NIOSH, Division of Technical Services, Information Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days, the report will be available through the National Technical Information Service (NTIS), Springfield, Virginia 22161.

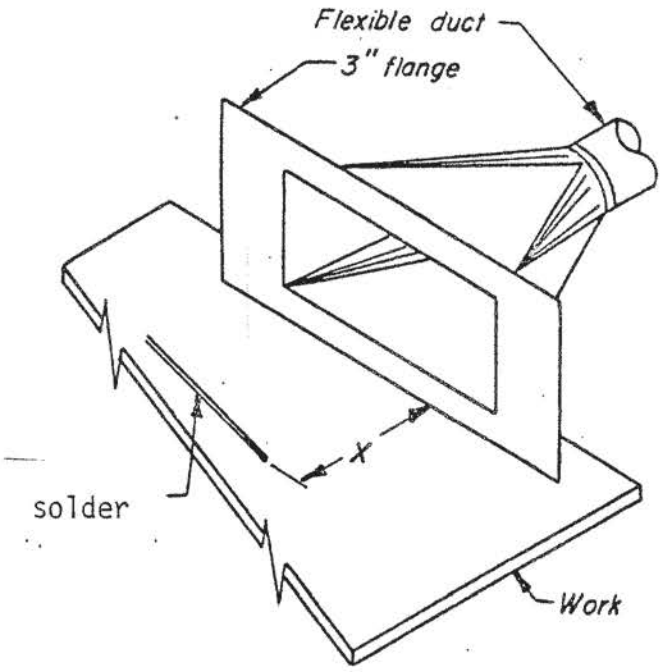
Copies of this report have been sent to:

1. Baumer Radiator Works
2. U.S. Department of Labor, Region VIII
3. NIOSH, Region VIII

For the purpose of informing the "affected employees," the employer shall promptly "post" the determination report for a period of 30 days in a prominent place near where exposed employees work.

Figure I

Soldering Hood with Flexible Duct:



PORTABLE EXHAUST

X, inches	Plain duct cfm	Flange or cone cfm
up to 6	335	250
6 - 9	755	560
9 -12	1335	1000

Face velocity = 1500 fpm
Duct velocity = 3000 fpm minimum
Entry loss = 0.25 duct VP

TABLE I

AIRBORNE LEAD AND PARTICULATE CONCENTRATIONS

BAUMER RADIATOR WORKS
DENVER, COLORADO

HE 79-115

August 7, 1979

DESCRIPTION	DURATION	CONCENTRATION LEAD	CONCENTRATION PARTICULATE
Outside Person	8:20 a.m. - 12:00 n 3:05 p.m. - 4:45 p.m.	20 $\mu g/M^3$	----
Bench Person	8:20 a.m. - 12:25 p.m. 2:25 p.m. - 4:45 p.m.	100	----
On Desk in Office	9:30 a.m. - 4:20 p.m.	10	----
Manager	8:25 a.m. - 12:25 p.m. 2:30 p.m. - 4:45 p.m.	50	1.4 mg/M^3
In Center of Workshop	8:40 a.m. - 4:25 p.m.	20	0.2
Recommended Maximum Concentration		50	10

TABLE II

BLOOD LEAD AND FEP CONCENTRATIONS

BAUMER RADIATOR WORKS
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Description	Blood Lead Concentration	FEP Concentration
Office Person	29 µg/100 ml	1222 µg/liter RBC
Manager	43	926
Bench Person	65	2212
Outside Person	30	1889
Normal Range	Below 40	220 - 870