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. 79-53-625



EMPIRE RADIATOR, INC.
LITTLETON, COLORADO

OCTOBER 1979

## I. TOXICITY DETERMINATION

A health hazard evaluation was conducted by the National Institute for Occupational Safety and Health (NIOSH) at Empire Radiator, Inc., Littleton, Colorado, on March 9 and 15, 1979. At the time of this evaluation, breathing zone air samples were taken for lead. Biological monitoring of all workers was also conducted. The biological monitoring consisted of whole blood lead determinations.

It has been determined on the basis of biological and environmental evidence that a potential health hazard existed during this evaluation to workers exposed to lead.

## II. DISTRIBUTION AND AVAILABILITY

Copies of this determination report are currently available upon request from NIOSH, Division of Technical Service, 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. Information regarding its availability through NTIS can be obtained from NIOSH, Publications Office, at the Cincinnati address.

Copies of this report have been sent to:

1. Empire Radiator, Inc.
2. U.S. Department of Labor/OSHA - Region VIII
3. NIOSH - Region VIII.

For the purpose of informing the 4 affected employees, a copy of this report shall be posted in a prominent place accessible to the employees for a period of 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 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.

NIOSH received such a request from the owner of Empire Radiator, Inc., Littleton, Colorado, to evaluate the potential exposures to lead during the repair of automobile radiators.

## IV. HEALTH HAZARD EVALUATION

### A. Process Evaluated

Automobile, truck, and commercial radiators are repaired in this shop. During the repair, radiators are disassembled using oxygen acetylene torches. After the radiators are cleaned, they are reassembled using soldering wire composed of lead and tin. During these processes lead fumes become airborne. Workers are also exposed to lead by handling the soldering wire and the lead contaminated radiators.

B. Environmental Design and Methods

Breathing zone air samples were taken on all four workers. These samples were collected on AA filters using vacuum pumps operated at 1.5 liters per minute. Samples were collected during the entire time workers were repairing radiators. This is often less than eight hours.

C. Biological Monitoring Design and Methods

This radiator repair shop employs four workers, including the owner. All four workers were interviewed. Questions were directed at work history, symptoms of lead toxicity, personal hygiene, and potential extra occupation lead exposures. None of the four workers had either complaints or symptoms consistent with lead toxicity. One worker stated that he occasionally got dizzy during the winter months when all doors were closed. The possibility of carbon monoxide exposures should be investigated during cold weather. All workers were very careful to practice good hygiene and were very aware of the biological effects that may be caused by lead.

Breathing zone air samples indicated elevated exposures; therefore, all workers volunteered to submit blood for whole blood lead determinations.

Venous blood samples were obtained in vacuum tubes containing EDTA by a NIOSH laboratory technician. These blood samples were then refrigerated until analyzed.

Blood lead levels were analyzed by Delves' cup atomic absorption technique.

D. Criteria for Assessing Workroom Concentrations of Air Contaminants

Three sources of criteria are generally used to assess workroom concentrations of air contaminants: (1) NIOSH criteria for recommended standards; (2) recommended Threshold Limit Values (TLVs) and their supporting documentation as set forth by the American Conference of Governmental Industrial Hygienists (ACGIH), 1978; (3) Occupational Safety and Health Administration (OSHA) standards (29 CFR 1910.1025), February 1979.

| | Permissible Exposures 8-Hour Time-Weighted Exposure Basis ($mg/M^3$) | | |
|---|---|---|---|
| Substance | NIOSH Criteria for Recommended Standard | TLV | Current OSHA Standard |
| Lead..... | 0.10 | 0.15 | 0.05* |

$mg/M^3$ = milligrams of substance per cubic meter of air

* The OSHA lead standard, Title 29 CFR Part 1910.1025, was effective February 1, 1979, and the Implementation Schedule is given below.

| Industry | Years to Meet Standard | |
|---|---|---|
| | 100 $ug/M^3$ | 50 $ug/M^3$ |
| Primary Lead Production | 3 | 10 |
| Secondary Lead Production | 3 | 5 |
| Battery Manufacturers | 2 | 5 |
| Nonferrous Foundries | 1 | 5 |
| Pigment Manufacturers | 3 | 5 |
| All Other Industries | 0 | 1 |

Occupational health standards are established at levels designed to protect individuals occupationally exposed to toxic substances on an 8-hour per day, 40-hour per week basis over a normal working lifetime.

E. Toxicology

Inorganic lead, a heavy metal, can be absorbed into the body by either inhalation or ingestion. After absorption the lead becomes bound primarily with the red blood cells and is distributed throughout the body into the soft tissues, particularly the liver and kidneys. Over a period of time the lead is redistributed and deposited into hard tissues such as bone, teeth, and hair. Lead absorption is accumulative and the elimination from the body is slow. Absorbed lead affects each body system it comes in contact with, particularly red blood cells, kidney and the central and peripheral nervous systems.

Classic signs and symptoms of chronic lead poisoning are: (1) lead colic characterized by poorly localized abdominal cramps; (2) constipation; (3) anemia; (4) "lead line" along gum margins; and (5) peripheral neuropathy. Other lead-related illnesses include encephalopathy and nephropathy. (Reference 1) Inorganic lead has been shown to be mutagenic and teratogenic. It can cross the placental barrier and can affect embryological and fetal development. Lead is eliminated from the body via urine and feces. NIOSH recommends that a blood lead value of 60 micrograms per 100 milliters whole blood (60ug Pb/100 ml blood) be the maximum occupational blood lead level. When this value is exceeded, the employee should be removed from the lead exposure to allow his body to reduce its lead burden.

Lead is a highly toxic metal, but long experience in industry has shown that good engineering controls in the workplace and good personal hygiene among employees can make lead a safe material to work with.

The OSHA lead standard (29 CFR 1910.1025) states: The employer shall make available medical examinations for all workers that are exposed to inorganic lead at levels exceeding 30 ug/$M^3$ over an 8-hour work period. This level (30 ug/$M^3$) is called the action level. Each worker at or above 40 ug/100 grams shall also have an annual physical according to OSHA 1910.1025.

F. Environmental Results and Discussion

All workers were monitored for breathing zone lead. Workers were only repairing radiators for about four hours this particular day which is about normal. Five out of seven breathing zone samples taken exceeded the evaluation criteria even when averaged over an 8-hour day.

The ventilation at this facility consist of one large exhaust fan in the upper part of wall. There was some air movement across the work area--about 50 linear feet per minute. Additional ventilation will be needed to lower the air lead levels.

G. Biological Results and Discussion

According to OSHA's lead standard effective February 1, 1979, workers must be removed from exposures at 80 ug/100 grams effective February 1, 1980, at 70 ug/100 grams February 1, 1981, at 60 ug/100 grams February 1, 1982, and at 50 ug/100 grams averaged over a six month period.

NIOSH recommends that a blood lead value of 60 ug/100 grams whole blood be the maximum tolerated occupational blood 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 has set an average blood level of 50 ug/100 grams whole blood as requiring removal until blood levels are normal. OSHA's aim is to maintain workers' blood lead levels below 40 ug/100 grams whole blood, the upper limit of blood lead in unexposed individuals.

Blood lead results of the four workers were 40, 40, 51, and 32 ug/100 grams whole blood. Only one of these samples exceeded the evaluation criteria of 50 ug/100 grams whole blood established in the OSHA Standard 1910.1025.

A potential health hazard existed at this work place. This conclusion is based on excessive lead exposures and slightly elevated whole blood lead levels.

H. Conclusions

The environmental and biological data indicates that a potential health hazard exists at this facility. None of the workers had symptoms of lead exposure. This would be expected since their blood lead levels were on the borderline of overexposure. Improvement of the ventilation system and better personal hygiene would certainly lower the worker's total exposure to lead and prevent the accumulation of lead in the blood.

## V. RECOMMENDATIONS

1. Additional local ventilation in the area where the radiators are repaired and more general ventilation throughout the shop.

2. No eating, drinking, or smoking in the repair shop.

3. Employee education as to the hazards and toxicology of lead should be given by the employer.

## VI. REFERENCES

1. Patty, F.A. Industrial Hygiene and Toxicology, Second Revised Edition, Interscience Publishers, New York, 1963.

## VII. AUTHORSHIP AND ACKNOWLEDGMENTS

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TABLE 1

Breathing Zone and General Room Air Concentrations of Lead (Pb)

Empire Radiator Company
Littleton, Colorado

March 9, 1979

| Sample Number | Job Classification | Time of Sampling | Pb $mg/M^3$ | TWA* |
|---|---|---|---|---|
| 01 | Radiator Mechanic | 8:23 AM - 12:00 N | 0.15 | .06 |
| 02 | Radiator Mechanic | 8:25 AM - 12:00 N | 0.15 | .06 |
| 03 | Radiator Mechanic | 8:26 AM - 12:00 N | 0.13 | .06 |
| 50 | Radiator Mechanic | 8:30 AM - 12:00 N | 0.09 | .04 |
| 05 | General Room | 8:35 AM - 12:00 N | 0.15 | .06 |
| 06 | General Room | 8:32 AM - 12:00 N | 0.16 | .07 |
| 07 | Radiator & Car Mechanic | 8:35 AM - 12:00 N | 0.10 | .04 |
| | OSHA STANDARD 8-HOUR AVERAGE | | 0.05 | |
| | LABORATORY LIMIT OF DETECTION mg/sample | | 0.002 | |

* 8-hour Time Weighted Average

TABLE 2

Whole Blood Lead Levels of Radiator Mechanics

Empire Radiator, Inc.
Littleton, Colorado

March 15, 1979

| Worker | Job Classification | Whole Blood Lead ug/100 gram |
|---|---|---|
| A | Radiator Mechanic | 40 |
| B | Radiator Mechanic | 51 |
| C | Radiator Mechanic | 32 |
| D | Radiator Mechanic | 40 |