U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
CENTER FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO

HEALTH HAZARD EVALUATION REPORT
HE 80-89-723

DENVER RADIATOR AND SHUTTER SERVICE
DENVER, COLORADO

JULY 1980

I. SUMMARY

In March 1980 the National Institute for Occupational Safety and Health (NIOSH) received a request to evaluate occupational exposures to lead (Pb) at Denver Radiator and Shutter Service, Denver, Colorado (Standard Industrial Classification 7540). All twelve workers were questioned about potential sources of lead exposure and about medical problems possibly associated with excessive lead exposures. Each worker was monitored for breathing zone lead and general room air samples for lead analysis were obtained. Venous blood samples were obtained for whole blood lead analysis.

Eight workers had lead levels above 40 micrograms of lead per 100 grams of whole blood (µg Pb/100 g). Three of these workers were above 60 µg Pb/100 g. Breathing zone and general room air samples for lead analysis were also obtained. Forty percent of the breathing zone and general room air samples exceeded the Occupational Safety and Health Administration (OSHA) standard of 50 micrograms of substance per cubic meter of air (µg/M^3). Values ranged from 10 to 570 µg/M^3.

On the basis of environmental and medical data, NIOSH concluded that a health hazard existed from overexposure to lead at Denver Radiator and Shutter Service. Recommendations on ventilation, work practices, and biological monitoring procedures necessary to control this hazard are included on page 4.

II. INTRODUCTION

NIOSH received a request in March 1980 from the owners and operators of Denver Radiator and Shutter Service at Denver, Colorado, to determine if there was a health hazard from lead during the repair of commercial and automobile radiators.[1] To evaluate lead exposures, an environmental survey was conducted on May 13, 1980, and a biological survey was conducted on May 19, 1980.

[1]Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 19 U.S.C. 669(a)(6), authorizes the Secretary of Health, Education, and Welfare, following a written request by any employer or authorized representative to employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

III. BACKGROUND

Commercial and automobile 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.

IV. METHODS AND MATERIALS

A. Environmental

Breathing zone air samples for lead analysis were collected on 37 mm AA filters using vacuum pumps operated at 1.5 liters per minute and analyzed according to NIOSH Physical and Chemical Analysis Method No. 173.

B. Medical

Venous blood samples were obtained in vacuum tubes containing EDTA for blood lead determination. Blood lead levels were analyzed by Delves' cup atomic absorption spectroscopy. (References 1, 2)

V. EVALUATION CRITERIA

A. Environmental

The source of criteria used to assess the workroom concentration of lead was the Occupational Safety and Health Administration (OSHA) standards (29 CFR 1910.1025), January 1978.

	Permissible Exposures 8-Hour Time-Weighted Exposure Basis ($\mu g/M^3$)
Lead.....	50 (OSHA)

$\mu g/M^3$ = micrograms of substance per cubic meter of air

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.

B. Toxicological

Lead -- Inhalation of lead dust and fumes is the major route of lead exposure in industry. A secondary source of exposure may be from lead dust contamination on food, cigarettes, or other objects. Once absorbed lead is excreted from the body very slowly. The absorbed lead can damage the kidneys, peripheral and central nervous systems, and the blood forming organs (bone marrow). These effects may be felt as weakness, tiredness, irritability, digestive disturbances, high blood pressure, kidney

damage, mental deficiency, or slowed reaction times. Chronic lead exposure is associated with infertility and with fetal damage in pregnant women.

Blood lead levels below 40 µg/100ml whole blood are considered to be normal levels which may result from daily environmental exposure. However, fetal damage in pregnant women may occur at blood lead levels as low as 30 µg/100ml. Lead levels between 40-60 µg/100ml in lead exposed workers indicate excessive absorption of lead and may result in some adverse health effects. Levels of 60 to 100 µg/100ml represent unacceptable elevations which may cause serious adverse health effects. Levels over 100 µg/100ml are considered dangerous and often require hospitalization and medical treatment.

The new OSHA standard for lead in air in most workplaces is 50 µg/M^3 on an eight-hour time-weighted average for daily exposure. For this particular industry the current standard is 50 µg/M^3. The new standard also dictates that in four years workers with blood lead levels greater than 50 µg/100ml must be immediately removed from further lead exposure and in some circumstances workers with lead levels less than 50 µg/100ml must also be removed. At present medical removal is necessary at blood lead levels of 70 µg/100 grams of whole blood or greater. Removed workers have protection for wage, benefits, and seniority until they can return to lead exposure areas.

VI. RESULTS

A. Environmental

Six of fourteen air samples taken for lead exceeded the OSHA standard. Values ranged from 10 to 570 µg/M^3. The radiator mechanics receive the highest exposure. Lowest levels were found in employees running the part shop; these workers were not in the radiator repair area. Results may be reviewed in Table 1.

B. Biological

Blood lead levels of all workers at this repair shop are summarized in Table 2. Blood lead levels were highest in the radiator mechanics. It should be emphasized that 8 of 13 workers had blood lead levels that exceeded 40 µg Pb/100 g, and three of these were above 60 µg Pb/100 g. These results indicate an increased lead absorption for the majority of workers at Denver Radiator.

Questionnaire data revealed no other potential sources of lead exposure and none of the employees had signs or symptoms of lead toxicity.

VII. DISCUSSION AND CONCLUSIONS

A health hazard exists at this work place. This conclusion is based on the elevated whole blood lead levels and overexposures to airborne lead. Forty percent of the air samples taken exceeded the OSHA standard of 50 µg/M^3. Sixty-seven percent of the blood samples exceeded 40 µg Pb/100 g.

VIII. RECOMMENDATIONS

1. Approved respirators should be worn by employees until engineering controls decrease the blood lead levels.

2. 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.

3. Smoking, eating, and drinking must be prohibited in the work area.

4. Workers should wash hands thoroughly before eating, smoking, and snuff usage.

5. Workers should be given clean clothes at the beginning of each shift. These clothes should be removed and left at the facility at the end of the work tour.

6. All radiator mechanics must have their blood lead levels checked every six months until levels fall below 30 µg/100 gram of whole blood.

IX. REFERENCES

1. Delves, H.T. Analyst, 95:431, 1970.

2. Barthel, W.F. J.A.O.A.C., 56, No. 5, 1973.

X. AUTHORSHIP AND ACKNOWLEDGMENTS

Report Prepared By:
Bobby J. Gunter, Ph.D.
Regional Industrial Hygienist
NIOSH - Region VIII
Denver, Colorado

Evaluation Assistance:
Paul D. Pryor
Industrial Hygienist
NIOSH - Region VIII
Denver, Colorado

Originating Office:
Hazard Evaluation and Technical Assistance Branch (HETAB)
Division of Surveillance, Hazard Evaluations, and Field Studies (DSHEFS)
NIOSH, Cincinnati, Ohio

Report Typed By:
Marilyn K. Schulenberg
NIOSH - Region VIII
Denver, Colorado

XI. DISTRIBUTION AND AVAILABILITY

Copies of this determination 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. 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. Denver Radiator and Shutter Service.
2. U.S. Department of Labor/OSHA - Region VIII.
3. NIOSH - Region VIII.
4. Colorado Department of Health
5. State Designated Agency

For the purpose of informing all employees, a copy of this report shall be posted in a prominent place accessible to the employees for a period of 30 calendar days.

TABLE 1

Breathing Zone and General Room Air Concentrations of Lead

Denver Radiator and Shutter Service
Denver, Colorado

May 13, 1980

Sample Number	Job Classification	Sampling Time	µg/M3 Lead
113	Radiator Mechanic	8:00 AM - 3:03 PM	40
9	Radiator Mechanic	8:00 AM - 3:03 PM	60
8	Radiator Mechanic	8:01 AM - 3:02 PM	570
106	Radiator Foreman	8:02 AM - 3:03 PM	40
10	Lead Man	8:02 AM - 3:03 PM	30
11	Radiator Foreman	8:02 AM - 3:03 PM	50
6	Radiator Mechanic	8:03 AM - 3:03 PM	190
7	Shutter Repair	8:04 AM - 3:03 PM	70
105	Shutter Repair	8:06 AM - 2:00 PM	90
1	Cleaning	8:07 AM - 3:10 PM	10
2	Service Manager	8:10 AM - 3:06 PM	10
3	Parts Manager	8:12 AM - 3:00 PM	10
109	Parts Man	8:13 AM - 3:05 PM	10
112	General Room	8:25 AM - 3:10 PM	80
	EVALUATION CRITERIA		50
	LABORATORY LIMIT OF DETECTION		3

TABLE 2

Blood Lead Values

Denver Radiator and Shutter Service
Denver, Colorado

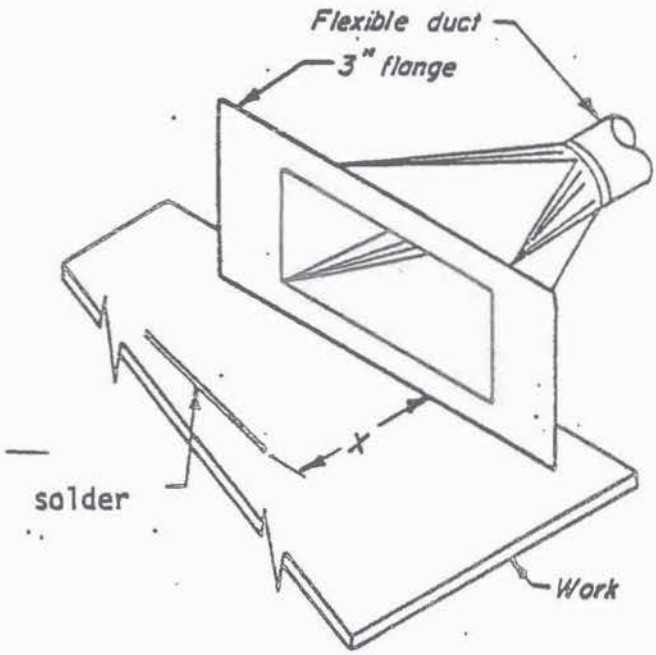
May 19, 1980

Sample Number	µg Pb/100 g
1	61**
2	39
3	63**
4	20
5	41*
6	66**
7	56*
8	38
9	50*
10	45*
11	22
12	41*
13	38

* Samples with values above 40 µg Pb/100 grams of whole blood
** Samples with values above 60 µg Pb/100 grams of whole blood

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