U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Center for Disease Control
National Institute for Occupational Safety and Health
Cincinnati, Ohio 45226

HEALTH HAZARD EVALUATION DETERMINATION REPORT
HE 79-116-652

AERO RADIATOR SERVICE
DENVER, COLORADO

January 1980

I. SUMMARY

A health hazard evaluation was conducted by the National Institute for Occupational Safety and Health (NIOSH) at the Aero Radiator Service in Denver, Colorado, on August 9, 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 protoporphrin (FEP).

Results of this evaluation indicate that, on the day of sampling, three employees were overexposed to airborne lead in concentrations ranging from 50 to 70 ug/M^3 (micrograms of lead per cubic meter of air). The recommended maximum level is 50 ug/M^3. These same three employees had blood levels ranging from 44 to 62 ug/100 ml (micrograms of lead per 100 milliliters of blood). The normal maximum is 40 ug/100 ml.

Two of these three employees showed FEP values of 2427 and 3790 ug/liter RBC (micrograms FEP per liter of red blood cells). One other employee showed a FEP level slightly above the normal maximum of 870 ug/liter RBC. Other environmental and blood analyses were within safe limits.

The data obtained in this investigation indicate that a health hazard due to overexposure to lead did exist at Aero Radiator Service, 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 Aero Radiator Service 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 handling 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, irritability, 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 ug/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 concentrations as used or found.

NIOSH has recommended that a blood lead value of 60 micrograms per 100 grams whole blood (60 ug/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 ug/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 ug/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 all three bench men were exposed to airborne lead 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 protoporphrin (FEP). The bench men who experienced high airborne exposures to lead also exibited high blood lead levels. Two of these three bench men had markedly elevated FEP values. The mechanic, who works occasionally in the bench area, had a slightly elevated FEP concentration. 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 indication 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 two bench men having highest blood lead levels contact their personal physicians for an evaluation and repeat blood lead level determination. These men have been individually informed by letter of this recommendation.

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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TABLE I

AIRBORNE LEAD AND PARTICULATE CONCENTRATIONS

AERO RADIATOR SERVICE, INC.
LAKEWOOD, COLORADO

HE 79-116

August 9, 1979

DESCRIPTION	DURATION	CONCENTRATION LEAD	CONCENTRATION PARTICULATE
Bench Man	8:30 a.m. - 4:25 p.m.*	70 ug/M^3	--
Bench Man	8:35 a.m. - 4:25 p.m.*	50	--
Area Sample, on Bench in Mechanic Area	10:45 a.m. - 4:10 p.m.	10	--
Bench Man	8:35 a.m. - 4:25 p.m.	70	1.9 mg/M^3
Manager	8:40 a.m. - 4:25 p.m.	10	0.7
Area Sample, in Center of Repair Shop, Behind Repairmen	8:45 a.m. - 4:10 p.m.	10	0.3
Recommended Maximum Concentration		50	10

* Sampler removed ½ hour for lunch.

TABLE II

BLOOD LEAD AND FEP CONCENTRATIONS

AERO RADIATOR WORKS
DENVER, COLORADO

HE 79-116

August 9, 1979

Description	Blood Lead Level	FEP
Manager	35 ug Pb/100 ml	600 ug FEP/liter RBC
Bench Man	44 ug Pb/100 ml	700 ug FEP/liter RBC
Mechanic	37 ug Pb/100 ml	910 ug FEP/liter RBC
Bench Man	62 ug Pb/100 ml	3790 ug FEP/liter RBC
Bench Man	59 ug Pb/100 ml	2430 ug FEP/liter RBC
Driver	21 ug Pb/100 ml	690 ug FEP/liter RBC
Officer Person	14 ug Pb/100 ml	630 ug FEP/liter RBC
Normal	Below 40 ug Pb/100 ml	220-870 ug FEP/liter RBC

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.

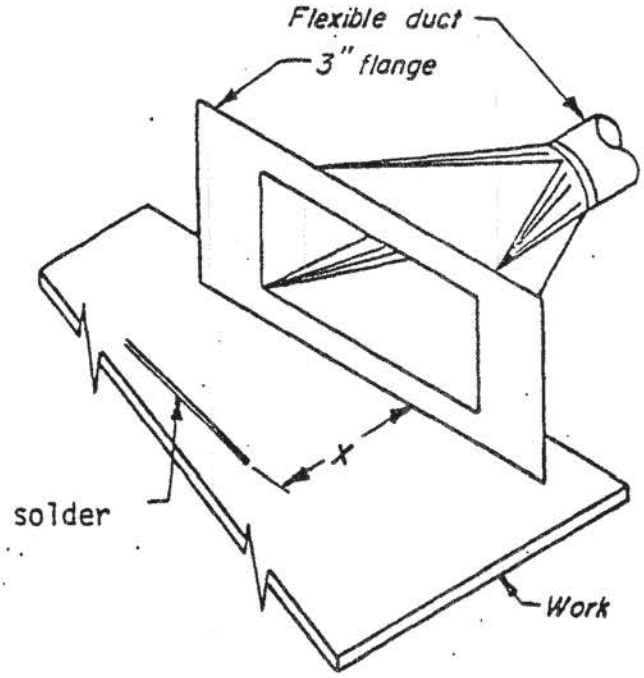
Copies of this report have been sent to:

1. Aero Radiator Service
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