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
HE 79-51-664

GATES ENERGY PRODUCTS, INC.
DENVER, COLORADO

FEBRUARY 1980

I. SUMMARY

In February 1979 the National Institute for Occupational Safety and Health (NIOSH) received a request to evaluate overexposures to lead (Pb) and methyl chloroform at Gates Energy Products, Inc., Denver, Colorado. Breathing zone air samples were taken on workers in all areas for lead determination. Methyl chloroform samples were taken in one area where perforated lead sheets were cleaned with methyl chloroform. Blood samples were taken on 217 workers. The workers were also administered a brief work history questionnaire. A comprehensive medical evaluation was not performed since Gates has an on-going medical monitoring program of all workers in this department.

Fifty-four percent (54%) of the lead air samples taken exceeded the Occupational Safety and Health Administration (OSHA) standard of 0.05 mg/M^3. None of the methyl chloroform samples exceeded the 1979 ACGIH Threshold Limit Value (TLV) of 1900 mg/M^3.

Lead was analyzed in 217 blood samples. Forty-four percent (44%) of these samples exceeded the OSHA standard of 40 micrograms Pb/100 grams of whole blood (40 ug Pb/100 g). Thirty-seven percent (37%) were between 40-60 ug Pb/100 grams of whole blood. Six percent (6%) were between 60-80 ug Pb/100 grams of whole blood and one percent (1%) exceeded 80 ug Pb/100 grams of whole blood.

On the basis of these environmental and medical data, it was concluded that a health hazard existed from overexposure to lead. Recommendations on ventilation, work practices, and biological monitoring procedures necessary to control these hazards are included on page 4.

II. INTRODUCTION

NIOSH received a request from workers at Gates Energy Products, Inc. in Denver, Colorado, to determine if there was a health hazard from lead and methyl chloroform exposures during the manufacture of acid lead batteries. An environmental and biological survey was conducted on March 13-15, 1979, to evaluate potential overexposures.

III. BACKGROUND

The Gates acid lead battery is a leak-proof system which has a long cycle life. This battery uses 100% recombination of gases during charging. It is composed of very thin and spirally-wound lead and then filled with sulfuric acid. See Figure 1.

IV. METHODS

A. Environmental Methods

Lead air samples were collected on 37 mm AA filters and analyzed by NIOSH Method P&CAM No. 173. Methyl chloroform samples were collected on organic solvent charcoal tubes and analyzed according to NIOSH Method P&CAM No. 127.

B. Biological Methods

A brief medical questionnaire was completed which included occupational history and symptoms of lead poisoning.

Venous blood samples were obtained in vacuum tubes containing EDTA. These blood samples were then refrigerated until analyzed. Blood lead levels were analyzed by the Delves' cup atomic absorption technique.

V. EVALUATION CRITERIA

Two sources of criteria were used to assess workroom concentrations of air contaminants: (1) recommended threshold limit values (TLVs) and their supporting documentation as set forth by the American Conference of Governmental Industrial Hygienists (ACGIH), 1979; (2) Occupational Safety and Health Administration (OSHA) standards (29 CFR 1910), January 1978.

	Permissible Exposures 8-Hour Time-Weighted Exposure Basis (mg/M^3)
Lead.....	0.05 (OSHA)
Methyl Chloroform.....	1900.0 (TLV)

mg/M^3 = milligrams 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.

Lead -- Although capable of causing acute toxicity when absorbed in large amounts, lead exposure is usually associated with chronic toxicity due to absorption of lesser amounts over prolonged periods of time. The major route of entry of lead into the body is the lung, although slight amounts may be ingested.

The early effects of lead toxicity are non-specific, and except for laboratory determination of lead in the blood, are difficult to distinquish from the symptoms of minor seasonal illness. The symptoms are decreased physical fitness, fatigue, sleep disturbance, headache, aching bones and muscles, digestive system symptoms (particularly constipation), abdominal pains and decreased appetite. These symptoms are reversible, and complete recovery is possible on removal from exposure.

The three systems most commonly affected are the bone marrow (producer of red blood cells), the nervous system, and the kidneys.

Because of more efficient material handling methods and biological monitoring, serious cases of lead poisoning are rare in industry today.

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 grams whole blood (60 ug Pb/100 g 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.

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 mg/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.

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 with which to work.

Methyl Chloroform -- Methyl chloroform is an irritant to the eyes and upper respiratory system. It is also a central nervous system (CNS) depressant. There have been no permanent (chronic) effects reported. (Reference 1)

VI. RESULTS

A. Environmental Results

Fifty-four percent (54%) of the lead samples taken in the plant exceeded the evaluation criteria. None of the methyl chloroform samples exceeded the evaluation criteria. The results may be reviewed in Tables 1-2.

There was no local ventilation in the lead department. The acid fill area was adequately ventilated. The lead mix room and the paste area should have local ventilation installed. Work practices, cleanup, and poor hygiene habits accounted for environmental and biological overexposures. A meeting was held with management and workers when lead results were received from the laboratory to discuss means of decreasing airborne and blood lead levels.

B. Biological Results

Lead was analyzed in 217 blood samples. Forty-four percent (44%) of these samples exceeded the OSHA standard of 40 micrograms Pb/100 grams of whole blood (40 ug Pb/100). Thirty-seven percent (37%) were between 40-60 ug Pb/100 grams of whole blood. Six percent (6%) were between 60-80 ug Pb/100 grams of whole blood and one percent (1%) exceeded 80 ug Pb/100 grams of whole blood.

Gates has an on-going blood lead monitoring program and at present have employed consultants to install ventilation which will lower the air lead levels to a safe concentration. None of the workers had symptoms of lead toxicity. All workers are routinely given physical examinations by company doctors. Results of blood lead determinations may be reviewed in Table 3.

VII. RECOMMENDATIONS

1. Workers with blood lead levels greater than or equal to 60 ug Pb/100 ml should be re-tested, and if levels are still elevated, measures need to be taken to reduce their exposure.

2. No eating, drinking, smoking or snuff usage should be allowed in the work area.

3. All areas should be vacuum cleaned instead of swept; brooms should be eliminated.

4. A respirator program that meets all of OSHA's requirements under 1910.134 should be initiated until airborne lead levels are lowered to an acceptable level.

5. Aprons and smocks should be changed daily.

6. 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.

7. Every worker should shower before leaving work. Each worker should be provided with two lockers--one for street clothes and one for work clothes.

8. All dirty clothes bins should have a tight fitting cover.

VIII. REFERENCES

1. Plunkett, E.R., Handbook of Industrial Toxicology, Chemical Publishing Company, New York, 1976, p. 418.

IX. AUTHORSHIP AND ACKNOWLEDGMENTS

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X. 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. Gates Energy Products, Inc.
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

Mean and Range of Lead Concentrations by Departments

Gates Energy Products, Inc.
Denver, Colorado

March 14-16, 1979

Location	Mean	Range
Mix Room	0.62	0.04 - 1.71
Paste Area	0.17	0.002 - 0.54
Separator/Folder	0.24	0.09 - 1.04
Bodine	0.06	0.02 - 0.12

TABLE 2

Breathing Zone and General Room Air Concentrations of
Methyl Chloroform

Gates Energy Products, Inc.
Denver, Colorado

March 14, 1979

Sample Number	Job Classification	Location	Sampling Time	mg/M3 Methyl Chloroform
01	Operator	Cold Cast	7:05 AM - 1:55 PM	50.0
02	Operator	Cold Cast	7:05 AM - 1:55 PM	177.0
03	General Area	Cold Cast	8:05 AM - 12:30 PM	199.0
04	Operator	Cold Cast	8:05 AM - 12:30 PM	177.0
05	Operator	Cold Cast	8:05 AM - 12:45 PM	75.0
		EVALUATION CRITERIA		1900.0
		LABORATORY LIMIT OF DETECTION		0.05

TABLE 3

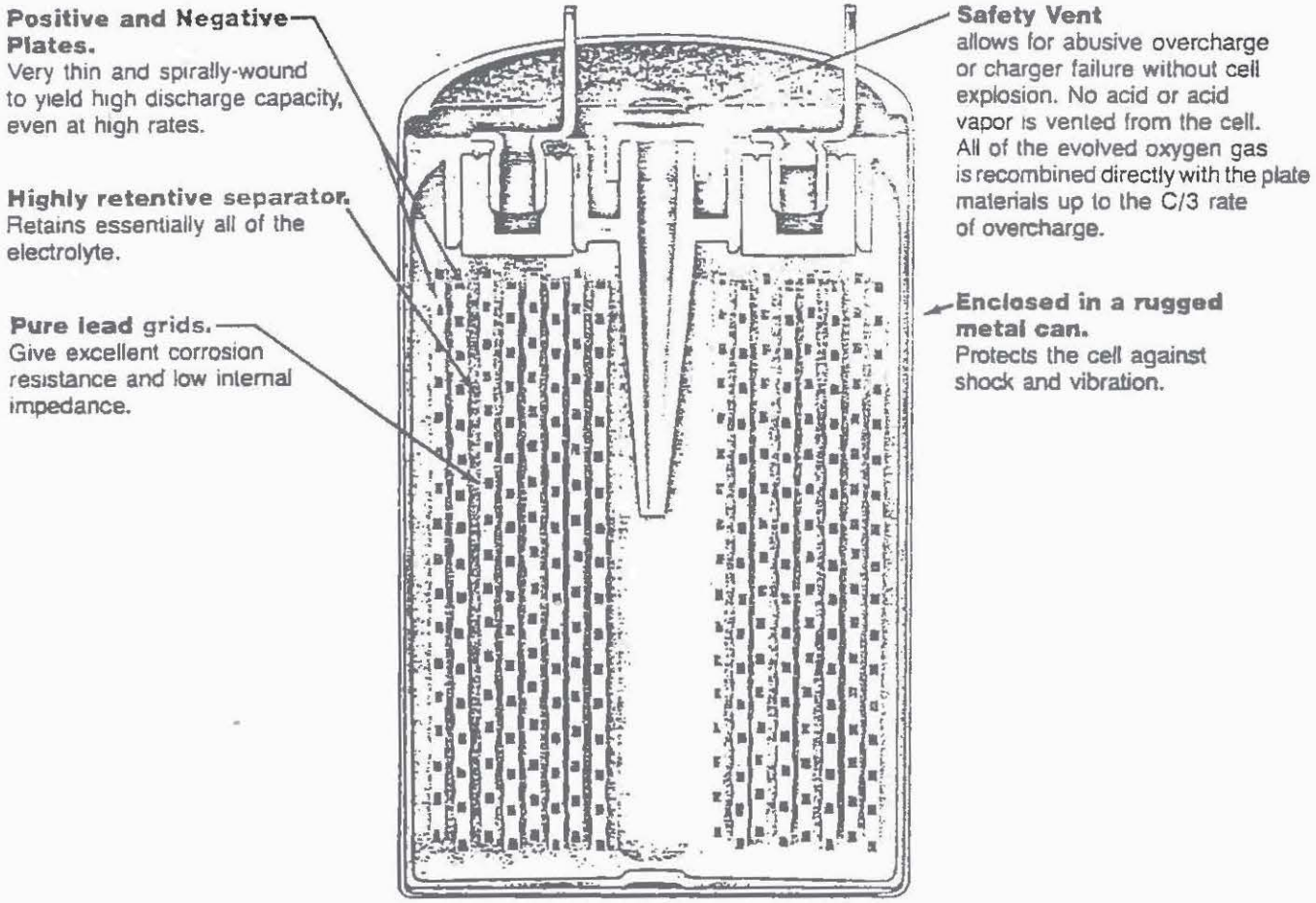
Mean and Range of Lead Concentrations by Departments

Gates Energy Products, Inc.
Denver, Colorado

March 14-16, 1979

Location	Mean	Range
Paste Area	47	23 - 72
Mix Room	51	35 - 82
Production	36	19 - 58
Bodine	39	21 - 71
Fill & Form	38	24 - 66
Beer Can	42	39 - 48
Battery Assembly	30	14 - 62

FIGURE 1


Positive and Negative Plates.
Very thin and spirally-wound to yield high discharge capacity, even at high rates.
Highly retentive separator.
Retains essentially all of the electrolyte.
Pure lead grids.
Give excellent corrosion resistance and low internal impedance.
Safety Vent
allows for abusive overcharge or charger failure without cell explosion. No acid or acid vapor is vented from the cell. All of the evolved oxygen gas is recombined directly with the plate materials up to the C/3 rate of overcharge.
Enclosed in a rugged metal can.
Protects the cell against shock and vibration.