U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45202

HEALTH HAZARD EVALUATION DETERMINATION
REPORT NO. 73-81-106

AEROJET GENERAL, INCORPORATED
SACRAMENTO, CALIFORNIA
JANUARY 1974

I. TOXICITY DETERMINATION

It has been determined that 10, 10'-Oxybisphenoxarsine (OBPA) is toxic at the concentrations experienced by workers in the Cordova Chemical plant. This determination is based upon the high incidence of dermatitis experienced by employees working with OBPA as described in the medical records of the Aerojet General Corporation. The environmental exposure of workers to OBPA could not be characterized by air sampling data since the production of this compound had been permanently discontinued prior to NIOSH's visit to the plant. It has been determined also that Trichloroethylene (TCE) and Methyl Ethyl Ketone (MEK) are not toxic in concentrations found at Aerojet. This determination is based upon the investigator's judgment after observing the quantities of these solvents being used by workers and their conditions of use. A toxicity determination for Acetylethylenimine (AEI) could not be made because the production of this compound had been permanently discontinued and little information could be found in medical records.

The occupational health program at Aerojet is very good, and the medical and environmental monitoring phases of this program are fairly complete. However, it is recommended that the occupational health program be expanded in reference to employee exposures to FEFO (bis-fluorodinitroethyl formal in methylene chloride) in the Cordova Chemical Plant and toluene diisocyanate (TDI) in the Solid Propulsion Division.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report are available upon request from the Hazard Evaluation Services Branch, NIOSH, U.S. Post Office Building, Room 508, 5th and Walnut Streets, Cincinnati, Ohio 45202. Copies have been sent to:

a) Aerojet General, Inc., Sacramento, California
b) Authorized Representative of Employees
c) U.S. Department of Labor - Region IX
d) NIOSH - Region IX

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.

The National Institute for Occupational Safety and Health (NIOSH) received such a request from an authorized representative of employees regarding exposure to "toxic chemicals" at the Aerojet General Corporation facilities in Sacramento, California.

IV. HEALTH HAZARD EVALUATION

Aerojet General, Inc., is made up of many buildings and facilities on a huge tract of land in Sacramento. With the recent acquisition of the Cordova Chemical Company, Aerojet is composed of a Solid Propulsion Division where rocket motors are assembled and the Chemical Division where specialty chemicals are manufactured.

An observational survey of Aerojet was conducted by NIOSH investigator Melvin T. Okawa on May 23, 1973 in response to an official request regarding exposure to "toxic chemicals." The observational survey was necessary to define which toxic chemicals were of concern to the requestor and to determine the need for any follow-up environmental and/or medical studies.

B. Initial Worksite Evaluation

On May 23, 1973, an opening conference was conducted with representatives of labor and management prior to the observational survey. The meeting was held in order to identify those substances which were of concern to the employee representative. It was determined that trichloroethylene and methyl ethyl ketone were of primary concern in several buildings in the Solid Propulsion Division and that 10, 10'-Oxybisphenoxarsine and acetylethylenimine were of major concern in the Chemical Division. It was decided upon their request to extend the walk-through survey to as many of the facilities as time permitted in order to elucidate other potential problem areas.

Solid Propulsion Division

The Solid Propulsion Division encompasses more than 6 buildings and 350 employees who are involved with different phases of the construction and testing of rocket motors. The following facilities were surveyed: 49-14, 49-15, 01-39, 01-84. 01-06 South, Cleaning Slab. Trichloroethylene (TCE) and methyl ethyl ketone (MEK) were not judged

to be a health hazard in any of the areas surveyed. These solvents were found in small safety cans for use by employees for intermittent hand cleaning operations. Large degreasing tanks containing TCE were located in Buildings 49-14 and 49-15. Each tank was equipped with a vapor condensing water jacket and slot ventilation. The effectiveness of these controls were judged to be excellent. It was noted, however, that TCE will remain on parts being removed from the tanks. If care is not taken to use the degreasing equipment properly, TCE can spill into the work area.

Cordova Chemical Plant

The Cordova Chemical Plant is an open structure made up of a complicated series of pipes, vessels, and reactors which are common to a chemical plant. There are about 30 workers at the plant who rotate on a continuous 24 hour shift. Management admits that the equipment is old and they are trying to replace worn parts as quickly as possible. There is leakage from the equipment and undoubtedly workers are receiving some exposure to chemicals being used or made.

The plant is involved in custom chemical production. Two compounds were initially singled out as being a cause of symptoms among the employees. These compounds were OBPA and AEI. OBPA was more prominent because it is irritating and a compound containing arsenic. OBPA is a fungicide and is made by combining arsenic trichloride and diphenyl oxide. AEI is made by acetylating ethyleneimine (a listed carcinogen in OSHA's Emergency Standard for carcinogens). Both of these compounds had been permanently discontinued from production prior to NIOSH's visit, and the environmental exposures of workers to these compounds could not be characterized. However, from questionning employees, it was determined that workers were being exposed to OBPA via contaminated protective clothing. OBPA is a powder and was being produced in an open system. Plans had been discussed to enclose the operation if OBPA was to be manufactured again. The current product is FEFO (bis-fluorodinitroethyl formal in methylene chloride). FEFO is a propellant and is formed by fluorinating nitroform into an intermediate which is reacted into the endproduct.

Medical Questionnaires

Seven employees in the Chemical Plant and five in Building 49-15 of the Solid Propulsion Division were asked non-directed questions regarding work related and non-work related health problems.

C. Evaluation Criteria

After completion of the observational survey, it was concluded that the compounds OBPA and AEI in the Chemical Plant were the

cause of most of the concern among employees interviewed. Trichloroethylene and methyl ethyl ketone were determined to be nontoxic under present conditions of use. OBPA and AEI had been permanently discontinued and an environmental evaluation of these compounds was not possible. For the purposes of making any conclusions about these chemicals, the investigator felt that medical records dealing with employees exposed to OBPA and/or AEI would have to be reviewed by a NIOSH physician.

D. Evaluation Results

On August 7, 1973, Dr. Arnold Bodner of NIOSH conducted an interview with the company physician and reviewed selected medical records of employees working in the Chemical Plant and with solvents in the Solid Propulsion Division. Additionally, Dr. Bodner reviewed two union complaints involving chemicals being used in the Chemical Division.

1. Introduction

According to a complaint initiated by the International Association of Machinist and Aerospace Workers, AFL-CIO, a maintenance mechanic, J.K., was exposed to FEFO on May 21 and 22, 1973 and was given some medication on May 23 and became ill on May 29. He saw the company physician, and was hospitalized that day. He returned to work on June 6 and was told that he had been treated for a kidney infection. On March 8, 1973, the same union had complained that OBPA, an organic arsenical, was hazardous to the health of workers because it was contaminating the breathing air of the airline respirators and causing skin rashes..

2. Results

According to company records, J.K. was exposed to FTM (fluorotrinitromethane, an intermediate in the production of FEFO) and not to FEFO itself, and was seen by a private physician complaining of eye and chest irritation. He was administered a steroid compound intramuscularly and given some steroid pills to take. The next day J.K. felt well except for weakness; by May 30, he complained of sweating and weakness. The physical examination and laboratory tests were normal except for an elevated white blood count and a moderately high number of white blood cells in his urine. The company physician felt that this infection was not related to any chemical exposure at the plant. No other records showed any evidence of toxic effects relating to FEFO.

According to company records, there have been 29 incidents of dermatitis caused by exposure to OBPA. There were a total of

30 employees working with this material at any one time, and an incidence of approximately 50% of workers developing dermatitis at any given time. Aside from this high incidence of skin reactions, there is no indication of toxicity to arsenic as judged by accepted[1] parameters for heavy metal toxicity: all levels of bilirubin, white blood cell counts, BUN, SGOT, and hemoglobin have been within normal limits. Also, every 2 to 6 weeks the company has been monitoring arsenic levels in scalp and pubic hair as well as urinary arsenic excretion on workers exposed to OBPA. All these levels were below those values judged to be toxic.

Records were reviewed for evidence of toxicity among employees working with solvents or other chemicals in the Solid Propulsion Division. Not much evidence of toxicity was discovered, although some employees were under health restrictions from working with specific chemicals.

3. Conclusions

According to medical records and professional experience, J.K. appears to have no permanent effects from exposure to FEFO or FTM. His kidney infection occurred incidental to his exposure. It is possible that an infection which already existed was exacerbated by his steroid therapy for the above chemical exposure.

OBPA, as was produced by Aerojet, is a very fine dust which disperses readily, contaminating both the inside and outside surfaces of protective clothing and equipment. All cases of dermatitis appear to be allergic reactions and not systemic ones because all parameters of systemic arsenic poisoning, such as hair, blood, and urine arsenic levels, as well as hemotological and enzymatic levels, have been within normal limits in these workers. However, it is felt that the incidence of dermitiis is excessive and can be avoided by the proper control measures.

Evidence of toxicity resulting from exposures to AEI, TCE and MEK was sparse.

Aerojet has an excellent environmental and medical monitoring program. It is recommended that monitoring for chemicals not noted in the opening conference but were found in use throughout various areas be expanded or improved. These compounds were toluene, toluene diisocyanate, and benzene.

IV. REFERENCES

1. Wintrobe, et al: Harrison's Principles of Internal Medicine, pp 664-5, 1970.

V. AUTHORSHIP

Report Prepared By;

Melvin T. Okawa
Principal Industrial Hygienist
Region IX, San Francisco, California

Arnold Bodner, M.D.
Principal Medical Officer
Division of Technical Services
Salt Lake City, Utah

Originating Office:

Jerome P. Flesch, Chief
Hazard Evaluation Services Branch
Cincinnati, Ohio