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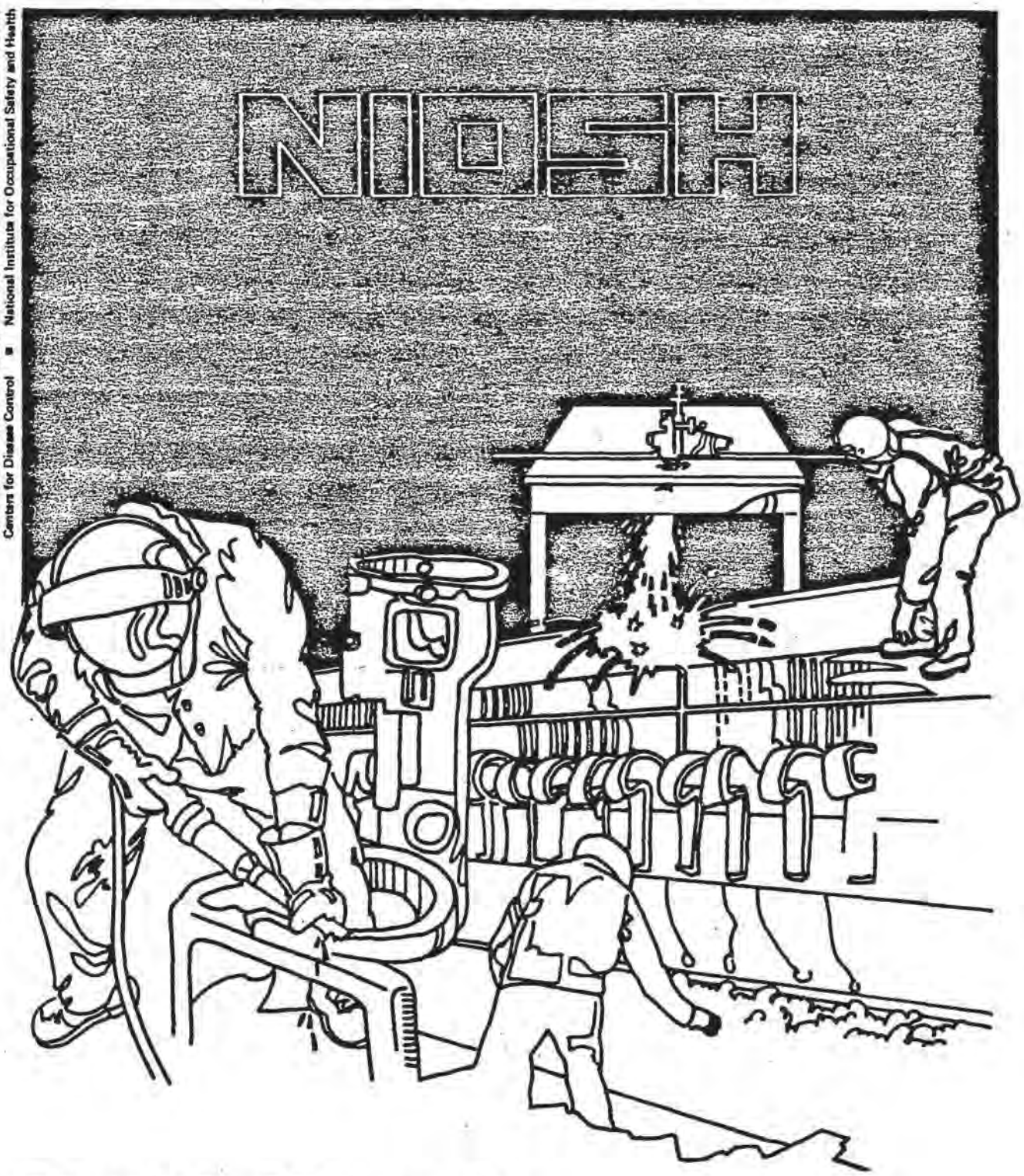

Health Hazard Evaluation Report

HETA 81-317-1202
HARLEY DAVIDSON MOTOR COMPANY
MILWAUKEE, WISCONSIN

PREFACE

The Hazard Evaluations and Technical Assistance Branch of NIOSH conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from 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 Hazard Evaluations and Technical Assistance Branch also provides, upon request, medical, nursing, and industrial hygiene technical and consultative assistance (TA) to Federal, state, and local agencies; labor; industry and other groups or individuals to control occupational health hazards and to prevent related trauma and disease.

HETA 81-317-1202
OCTOBER 1982
HARLEY DAVIDSON MOTOR COMPANY
MILWAUKEE, WISCONSIN

NIOSH INVESTIGATORS:
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I. SUMMARY

On May 7, 1981, the National Institute for Occupational Safety and Health (NIOSH) received a request for a Health Hazard Evaluation from the Allied Industrial Workers International Union, to evaluate exposure to cutting fluids at Harley Davidson Motor Company, Incorporated, Milwaukee, Wisconsin. The requestor was concerned with the incidence of dermatitis and cancer among employees at this plant.

In September 1981, NIOSH investigators conducted an initial survey. In March 1982, a combined environmental and medical survey was conducted during which personal breathing zone samples for oil mist exposure were collected, medical information related to dermatitis and cancer was obtained, and workers with skin rashes were examined. In addition, environmental data collected in June 1980, by the Occupational Safety and Health Administration (OSHA) were examined.

All six personal breathing zone air samples collected for oil mist were well below the current OSHA standard of 5 milligrams of contaminant per cubic meter of air (mg/M^3). These values ranged from below the limit of detection (0.01 mg per sample) to 1.01 mg/M^3. A review of the OSHA environmental data indicated no detectable amounts of polynuclear aromatic hydrocarbons in 3 bulk samples, and no detectable amounts of N-Nitrosodiethanolamine in 14 bulk samples of the various cutting fluids collected throughout the machining area. N-Nitrosodiethanolamine was detected in 1 of 10 wipe samples collected throughout the plant.

Both irritant and hypersensitivity dermatitis were present in the plant as a persistent problem among a minority of the working population (less than 2% of the exposed workers in 1981). Numerous causes of the problem have been identified and are being eliminated by labor and management; these include, lack of good personal hygiene, improper mixing and handling of the fluids, lack of fluid maintenance, increased individual sensitivity, and failure to use proper protective equipment.

Given the distribution of cancer in the general population, the list of cancer deaths among employees at this plant over a five year period did not appear excessive. A standard mortality ratio study was determined unnecessary due to the small chance of demonstrating an excess risk of cancer in this population of approximately 500 workers.

On the basis of the data obtained in this investigation, NIOSH has determined that no inhalation hazard from oil mist exposure existed at the time of this survey. However, the continued occurrence of dermatitis indicates a hazard from skin exposure to the cutting fluids does exist. No excess cancer mortality was evidenced by the data collected in this study. Recommendations related to this evaluation are contained in the full body of the report.

KEYWORDS: SIC 3751, Cutting Fluids, Oil Mist, N-Nitrosodiethanolamine, Trim®Sol, Kool Cut 100, Mobil Vacmul #281, Dermatitis, Cancer

II. INTRODUCTION

On May 7, 1981, a representative of the Allied Industrial Workers International Union requested a NIOSH health hazard evaluation at the Harley Davidson Motor Company, Incorporated, Milwaukee, Wisconsin. The requestor was concerned with the toxicity of cutting fluids used in machining operations throughout the plant, and the possible role of exposures to these substances in the incidence of cancer and dermatitis among employees.

Following the completion of a general schedule inspection by the Occupational Safety and Health Administration (OSHA) and an annual shutdown by the plant, NIOSH investigators conducted an initial survey on September 19, 1981. This included an opening conference with representatives of the management and local union followed by a walk-through inspection of the plant. On March 9, 1982, a combined environmental and medical survey was conducted during which personal breathing zone samples for oil mist exposure were collected, medical information was obtained, and symptomatic workers were examined. Results of the environmental survey were provided by letter to the requestor and company on June 15, 1982.

III. BACKGROUND

Since 1950, the plant has been engaged in the production of engines and transmissions for motorcycles and golf carts, and employs approximately 200 administrative and 900 production workers. The plant is divided into two major areas, parts machining and assembly. Use of the cutting fluids occurs in the machining area where 300 - 500 workers are employed, over 3 shifts. The workforce is approximately 80% male, with an average age of 41, and an average length of employment of 18 years.

Three major cutting fluids are currently used throughout the various departments where parts machining occurs. Trim®Sol, a water soluble emulsion, is the most commonly used cutting fluid in the plant. Kool Cut 100, a synthetic cutting fluid, has been used for the past two years on a limited basis throughout the various departments. Mobil Vacmul #281 is a petroleum oil used primarily in one department. Standardization of cutting fluids was undertaken in January 1981 to limit the number of fluids to the three listed above. Prior to this date, a wide variety of fluids were used in the plant.

In most instances cutting fluids are applied by the continuous flood principle in which a low pressure pump is used to deliver and dispense the fluid through a nozzle located directly above the cutting tool and the part. At some machines, the fluids are manually applied by hand brushing directly onto the parts. In some instances, parts are required to be hand or basket dipped in a kerosene solvent prior to machining.

There are three central reservoir systems for filtering and cleaning of the various fluids. In addition, many machines have built-in fluid reservoirs which independently filter and recycle the fluids. Routine checks are conducted by plant personnel to determine concentration and

pH of the fluids, and in addition, samples are periodically submitted to the manufacturers for detailed lab analysis which includes measurements of bacteria, fungi, and tramp oil. All fluid systems are usually drained, cleaned, and replaced during the semi-annual plant shutdown. During this period, individual machines are also cleaned.

The company provides gloves and barrier creams for use by employees who are in regular contact with the coolant or cutting oils. Employees that develop cutaneous reactions to these oils that are not controlled by the above methods are transferred from the area.

IV. EVALUATION DESIGN AND METHODS

A. Environmental

Following the initial survey, manufacturers data was collected related to the composition of the various cutting fluids in use, and records of OSHA investigations were obtained. An environmental survey was conducted on March 9, 1982 to assess employee exposures to oil mist. Personal samples were collected near the employees' breathing zone using battery powered pumps operating at 1.5 liters per minute (lpm) attached via tygon tubing to AA mixed cellulose ester membrane filters. The filters were analyzed for oil mist according to NIOSH Method No. P&CAM 159.[1] Other information pertinent to sample collection is provided in Table 1.

B. Medical

1. Dermatitis

During the initial survey, information was collected from union and management concerning the extent of the dermatitis problem, as well as the company's policy for its prevention and treatment. Several employees with rashes felt to be due to oil exposure were examined on the job by the NIOSH medical officer.

2. Cancer

Information was solicited from both union and management as to the number of cancer cases over the last five years, the types of cancer, the age of these employees, number of years in the plant, and their job categories and departments. These data were analyzed by the investigators with respect to the incidence rates for the particular types of cancer in the U.S. population for the same years and age groups.

V. EVALUATION CRITERIA

A. Environmental Criteria

The current OSHA standard for oil mist is 5.0 milligrams per cubic meter of air (mg/m^3) for an 8 hour time weighted average (TWA). This standard was designed to represent the airborne concentration of oil

mist to which workers may be exposed for eight hours a day, 40 hours per week for a working lifetime without adverse health effects.[2]

B. Toxicity

There are conflicting reports in the literature concerning the pulmonary effects of the inhalation of mineral oil mist. In high concentrations it appears to cause pulmonary effects.[2] A review published in 1962 of oil mist exposures of all types found a lack of reported cases of illness at concentrations below 15 mg/m^3.[3] A 1970 study reported no excess mortality due to oil mist exposures at an average concentration of 3.7 mg/m^3, nor an increase in respiratory symptoms at an average concentration of 5.2 mg/m^3.[4] A recent study of male grinders, turners, and hardeners in machine shops exposed at concentrations of 0.3 to 18.0 mg/m^3 showed that while there was no decrement in pulmonary function, a significant increase in respiratory symptoms was evident that varied with concentration.[5]

Current evidence indicates that oil mist is not associated with the induction of respiratory cancers. Exposure to oil mist did not appear to accelerate lung tumors in a lung tumor-susceptible strain of mice[2]. Furthermore, Decoufle reported in 1978 that there was no excess of respiratory cancers in a cohort of white males exposed to oil mists for five or more years.[6] Additionally, a case controlled study of sinonasal cancer in Connecticut in 1978 did demonstrate an association with cutting oil mist exposure and this respiratory cancer.[7]

Decoufle's study did document an apparently significant two fold increase in stomach and large intestinal cancers in these exposed workers. Further, in the past, skin and scrotal cancers have been linked with exposure to mineral oil mist. It is suggested by some investigators that these cancers may have been induced by the presence of polycyclic aromatic hydrocarbons in the oil, which are now substantially reduced through extensive refining in oils produced in the United States.[8]

No data is available indicating that a health threat is posed through the inhalation of synthetic oil mist.[9] However, recent concern has been centered on the discovery of N-Nitrosodiethanolamine, a suspected carcinogen, as a product of the reaction of amines with nitrites, both of which are common in commercially available fluids. No environmental limits exist for airborne concentrations of synthetic fluids, although standards may exist for specific additives or components which may exert a specific toxicity.

Cutting fluids as a whole are among the leading causes of industrial dermatitis, causing both follicular inflammation and irritative or hypersensitivity skin reactions. These reactions may be stimulated by the fluid itself, metal parts or other impurities in dirty oil, or additives, such as biocides, used to prevent fluid decomposition and odor formation.[9] Basic principles of control, personal protection, good housekeeping, and personal hygiene should be implemented when working with these fluids.

VI. RESULTS

A. Environmental

All six personal breathing zone samples collected for oil mist were well below the current OSHA standard of 5 mg/M^3. These values ranged from below the limit of detection (0.01 mg per sample) at operations where manual application of the fluid occurred, to 1.01 mg/M^3 where flood application was used. A complete listing of the results is provided in Table 1.

A review of environmental data collected by OSHA in June 1981 indicated no detectable amounts of polynuclear aromatic hydrocarbons in 3 bulk samples, and no detectable amounts of N-Nitrosodiethanolamine in 14 bulk samples of the various cutting fluids collected throughout the machining area. A small amount of N-Nitrosodiethanolamine (104 micrograms) was detected in 1 of 10 wipe samples collected throughout the plant. This sample was collected at an electrical box in an automated machining operation which was not in operation during the NIOSH survey visits.

B. Medical

1. Dermatitis

A review of the company medical records, information supplied by the union, and the dermatologic examinations performed by the NIOSH medical officer, confirmed the presence of both irritant and hypersensitivity dermatitis present in the plant. Both union and management acknowledged that skin problems associated with exposure to these fluids was a persistent problem among a minority of the working population (less than 2% of the exposed workers). Numerous causes of the problem were identified, including lack of good personal hygiene, improper mixing and handling of the fluids, lack of fluid maintenance, increased individual sensitivity, and failure to use proper protective equipment.

2. Cancer:

A review of the data supplied to the NIOSH investigators by both union and management sources revealed the following cancer deaths over the past five years:

Number	Type of Cancer	Age at Death
1	Adenocarcinoma of the Cecum	51
1	Chronic Lymphocytic Leukemia	35
1	Acute Leukemia	65
3	Lung Cancer	56,53,35
2	Bladder Cancer	65,61
1	Colonic Cancer	62
1	Anaplastic-Primary Unknown	63

VII. DISCUSSION AND CONCLUSIONS

Analysis of the environmental data indicated that levels of airborne oil mist collected during this survey were well below the OSHA standard. Providing that assurances are taken to prevent the introduction or formation of carcinogenic or otherwise hazardous agents into the cutting fluids, inhalation of the mist would not be expected to pose a health hazard at the current exposure levels.

The problem of dermatitis and its causes are recognized by both management and labor at this plant. An aggressive approach to individual protection and removal from exposure is presently being pursued. Only through continued efforts and employee education will this problem be reduced.

Given the distribution of cancer in the general population, the list of cancer deaths among employees at this plant over a five year period does not appear excessive. The presence of two deaths of individuals in their thirties is suspicious, yet due to the differing types of cancer in these individuals, this would not be considered highly improbable. Furthermore, the existence of two bladder cancer deaths in five years is not particularly suspicious as one death might be expected every three years from this cause among any group of males over sixty in the general population.

An accurate mortality study would require the securing of a list of all workers with oil mist exposure in 1960, their dates of birth, race and sex, date of hire into the job with the exposure, length of exposure, and the names of the individuals that have died and their cause of death. However, after a review of Decoufle's data, it would appear that to have an 80% chance of demonstrating a two-fold elevation in cancer of the stomach or large intestine in a group of workers employed over this period of time, more than 2,000 exposed subjects and 2,000 controls would be needed. If a standard mortality ratio study was undertaken with the same security of demonstrating a positive outcome, and assuming that less than 25% of the U.S. population are below working age, at least fourteen hundred workers would have to be included in the exposed group. Therefore, the chances of demonstrating an excess risk of cancer in this population of approximately 500 workers would not be expected to be good.[10] In addition, when one considers the large number of different cutting fluids and additives used by the plant over the years, and the various contaminants which may have been present in these fluids during any given time, the chances of identifying a specific causative agent for an excess of cancer would be particularly difficult.

VIII. RECOMMENDATIONS

It is recognized that the company currently has in place a comprehensive program for dermatitis prevention and treatment. However, in order to further emphasize the need for ongoing efforts to effectively reduce the incidence of dermatitis, the following recommendations are made:

A. Employee Education - Each worker must be made aware through regular training of the importance of the following:

1. Avoiding sustained contact between the cutting fluid and the skin.
2. Using protective clothing, gloves, splash guards, and any other devices required for the work operation.
3. Frequently practicing personal hygiene including regular washing of hands, laundering of work clothes, and prompt removal of fluid soaked gloves and clothing.
4. Avoiding contamination of cutting fluids with any type of waste matter.
5. Immediately reporting any skin irritation or disorder to the plant medical department.

B. Fluid Maintenance - The company should adhere to the following guidelines for maintaining the coolant supplies:

1. Regular inspection of central coolant systems and individual machines for contamination, and replacement when necessary.
2. Restriction of the addition of cutting fluids and additives to those employees trained in their proper handling and mixing.
3. The toxicity of any fluid additive should be examined prior to introduction into the system.

C. Personal Protective Equipment - Adequate gloves, aprons, and other necessary personal protective equipment should be made easily available to the employees.

D. Medical Program - Besides the approach to treating individual employees' rashes, the medical department should continue to pursue an aggressive program designed to decrease the incidence of dermatitis, including the following:

1. Log of cases, noting time, machine, department, oil used, and type of dermatitis.
2. Follow-up by plant medical personnel to determine the cause of this problem, and recommendations for its correction.
3. Discussions with the employee involved as to recommendations for the correction of the problem.
4. Should the problem be outside of the realm of individual work practices, there should be a system for reporting the problem and the recommendations for its correction to the production supervisors.

IX. REFERENCES

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IX. AUTHORSHIP AND ACKNOWLEDGEMENTS

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X. DISTRIBUTION AND AVAILABILITY OF REPORT

Copies of this report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days, the report will be available through the National Technical Information Service (NTIS), 5285 Port Royal, Springfield, Virginia 22161. 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. Allied Industrial Workers of America International Union
2. Harley Davidson Motor Company, Inc.
3. Allied Industrial Workers of America, Local Union 209
4. NIOSH, Region V
5. OSHA, Region V

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

TABLE 1

RESULTS OF PERSONAL BREATHING-ZONE SAMPLES FOR OIL MIST
at the HARLEY DAVIDSON MOTOR COMPANY
March 9, 1982

Department	Machine Number(s)	Fluid Type(s)	Sampling Period (minutes)	Sample Volume (liters)	Concentration Oil Mist (mg/M3)
906	4501	Trim®Sol	360	540	0.44
906	4316	Trim®Sol	369	554	0.42
922	1501	Mobil	369	554	0.90
922	1515, 1321, 1328	Mobil	370	555	1.01
904	3302	Kool Cut	366	549	ND†
904	3358, 4202,	Mobil, Kool Cut	365	548	ND†

† ND = None Detected (Limit of Detection is 0.01 mg/sample).

Evaluation Criteria: 5.0 milligrams per cubic meter of air (mg/M^3) - OSHA

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