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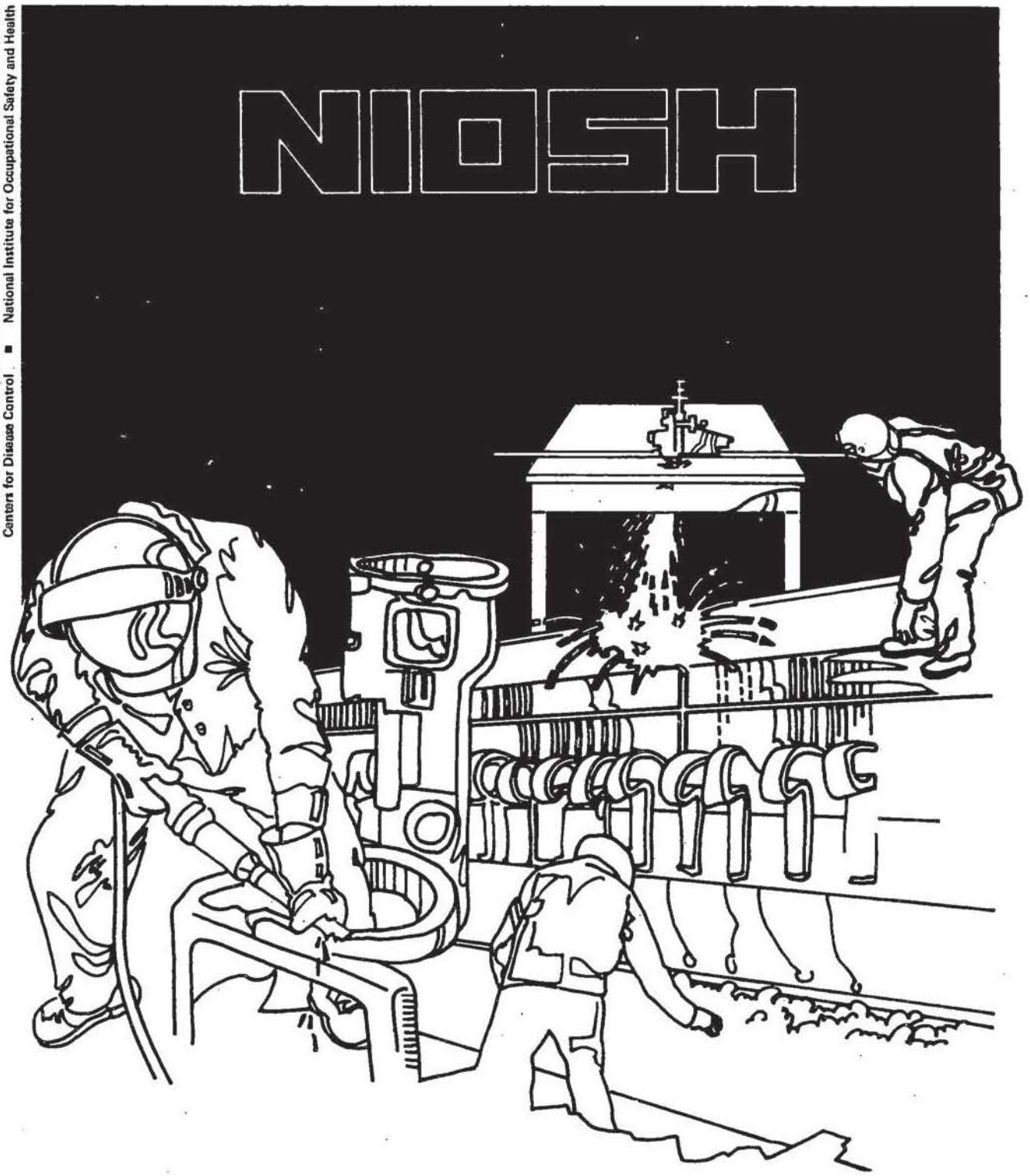

Health Hazard Evaluation Report

HETA 82-054-1194

LAUSON ENGINE DIVISION, TECUMSEH PRODUCTS
NEW HOLSTEIN, 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.

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LAUSON ENGINE DIVISION, TECUMSEH PRODUCTS
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I. SUMMARY

On November 23, 1981, the National Institute for Occupational Safety and Health (NIOSH) received a request to conduct a Health Hazard Evaluation at Lauson Engine Division, Tecumseh Products Company, New Holstein, Wisconsin. NIOSH was asked to evaluate the sporadic occurrence of an annoying odor which was associated with headaches, fatigue, and dizziness among employees in the starter assembly area of the plant.

In February 1982, NIOSH investigators conducted an initial survey. Confidential employee questionnaires were administered to eight employees who were currently working or had recently worked in the starter assembly area. These employees reported a variety of nonspecific central nervous system complaints suggestive of low-dose hydrocarbon exposure. Detector tube samples for measurement of potential contaminants in air revealed no detectable traces of either toluene or carbon monoxide. Additionally, environmental data collected previously by the company and/or the Occupational Safety and Health Administration revealed no significant quantities of hydrocarbon solvents or carbon monoxide.

In April 1982, a follow-up survey was conducted. Exhaust stacks and make-up air intakes on the roof were inspected. It was noted that stack heights were low and that weather caps were in place. Visible emissions from the paint exhaust stacks were noted to be settling toward the make-up air intakes. That finding indicates potential for reentry of emissions into the plant during certain weather conditions.

Following this survey a supply of charcoal tubes and air sampling pumps were left with representatives of management and the union for the collection of environmental air samples at the starter assembly table. Subsequent qualitative analysis by gas chromatography/mass spectrometry identified the presence in these samples of toluene, xylene, and a naphtha consisting mainly of C_9 - C_{15} alkanes, all used in the paint booth area. However, due to the dilution of emissions with outside air these reentrant substances would not be expected to be present in quantities which would represent a health hazard, yet could well have accounted for the odor detected by employees in the starter assembly area.

On the basis of the data obtained in this investigation, NIOSH has determined that no health hazard existed in the starter assembly area of the Lauson Engine plant. Employee complaints of intermittent odors and of nonspecific central nervous system symptoms were most probably due to reentry into the plant of small quantities of solvent exhaust from the paint booths. Recommendations for improvement of the existing ventilation system are incorporated in the body of this report.

KEYWORDS: SIC 3519 (Internal Combustion Engines), Toluene, Xylene, Naphthas.

II. INTRODUCTION

On November 23, 1981, an authorized representative of employees requested a National Institute for Occupational Safety and Health (NIOSH) health hazard evaluation at the Lauson Engine Division of Tecumseh Products, Company, New Holstein, Wisconsin. The requestor was concerned with complaints of unusual odors and headaches, fatigue and dizziness among the employees working in the starter assembly area of the plant. These complaints had been occurring for about three years.

On February 4, 1982, NIOSH investigators responded to the request by conducting an intial survey. This survey included an opening conference with representatives of the management and local union officials, followed by a walk-through inspection of the plant. Detector tube samples were collected for toluene and carbon monoxide. Confidential medical questionnaires were administered to eight employees who were currently working or had recently worked in the area. Additionally, environmental data collected by the company and the Occupational Safety and Health Administration (OSHA) were reviewed.

On April 20, 1982, NIOSH investigators returned to the plant to inspect the ventilation system. Smoke tubes were used to test the effectiveness of the ventilation system and trace air movement paterns. The exhaust stacks and air make-up units on the roof of the building also were inspected.

III. BACKGROUND

The plant has been in operation for 26 years and employs approximately 200 administrative, 1200 production, and 50 maintenance personnel. The plant was operating two shifts a day at the time of the study. The company is involved in the manufacture of four cycle internal combustion engines of the type and size used for garden tractors, lawn mowers, and snow blowers. The plant contains numerous machining and assembling processes along with injection molding of plastics, painting, and engine testing.

The starter assembly area, where the employee complaints had been centered, is approximately 300 square feet in size and is situated in the center of an open production floor of approximately 40,000 square feet. The bulk of the activity on this floor consists of assembling motors on multiple lines surrounding the starter assembly area.

The starter assembly process consists of assembling the plastic pull rope, rewind mechanism, and other components into an operating unit which is added to the engine at another point in the assembly. There are no liquid or gaseous chemicals used in this operation. At the time of the study 4 people were employed in the starter assembly area which was operating one shift per day.

The starter assembly area receives its ventilation from the general make up air supplied to the assembly floor. A large duct blows air at a high velocity directly on this area, with other ducts contributing a lesser amount of air from other directions.

Thirty feet west of the starter assembly is a fastening operation using an adhesive/sealant containing methacrylate esters and are applied to bolts and nuts. No local exhaust ventilation is present in this area.

An equal distance northwest of the starter assembly is the rear wall of the spray painting booths for assembled engines. Aromatic hydrocarbons, primarily toluene and xylene, are used as paint solvents in this area. A local exhaust ventilation system is provided at this operation.

The bake ovens for the paint spraying operations are located to the west of the paint booths over 100 feet from the starter area. The engines travel by monorail conveyor from the paint booth to the drying ovens. These ovens are exhausted locally from the roof of the plant.

Located north of the starter assembly area is the parts washer which uses water soluble cleaners. These cleaners consist of caustic alkalies and hydrochloric acid. The parts washer is separated from the starter assembly area by several assembly lines, in a room that is under negative pressure.

Finally, the engine test rooms exhaust to the roof as well. They are are substantially removed from the starter assembly area. Engines under test are connected to local exhaust ventilation systems.

The employees are required to wear ear, eye, and foot protection at all times while in the plant. The company also provides audiometric examinations for its employees at least once annually. A first aid station is located within the plant and is staffed by a nurse. The services of a hospital located seven miles from the plant are obtained in the event of more serious accident.

IV. EVALUATION DESIGN AND METHODS

Manufacturers' data were collected and related to the composition of the various materials used throughout the plant, and records of previous OSHA investigations were obtained and reviewed. A hazardous material audit of the processes in the vicinity of the starter assembly area was conducted; however, since no chemicals are used in the immediate area of the starter assembly area, the audit focused on the adjacent operations.

Detector tube samples were collected for hydrocarbons and carbon monoxide airborne contaminants suspected of being present due to their use in adjacent operations. The exhaust ventilation system at the spray painting operation was inspected and air patterns were traced with smoke detector tubes to estimate the effectiveness of the system.

Due to the transient nature of the complaints, a supply of charcoal tubes for organics and air sampling pumps were left at the plant. Company officials and a union representative were instructed to place a battery powered air sampling pump, operating at 1.4 liters per minute (lpm) attached via tygon tubing to a charcoal tube, in the area every morning for the three week period, and remove them in the afternoon following the shift. Additional instructions included recording the

appropriate information, as well as, indicating employee comments on the air quality for the time period sampled. Only those charcoal tubes from days when employee complaints were registered were analyzed. All samples were analyzed by gas chromatography/mass spectrometry. Analyses of the samples were qualitative (identification) rather than quantitative (absolute amounts) in nature.

Confidential questionnaires were administered to eight employees currently working or who had recently worked in the starter assembly area. The questionaires solicited information as to health history, smoking and drinking habits, as well as the nature and frequency of a group of symptoms commonly associated with low dose hydrocarbon exposure.

V. EVALUATION CRITERIA

The following exposure limits are derived from existing human and animal data, and industrial experience to which it is believed that nearly all workers may be exposed for an 8-10 hour day, 40-hour work week, over a working lifetime with no adverse effects. However, due to variations in individual susceptability, a small percentage of workers may experience effects at levels at or below the recommended exposure limit; a smaller percentage may be more seriously affected by aggravation of a pre-existing condition or by development of a occupational illness.

A. Toluene

Toluene vapor causes narcosis in humans at low doses producing mild fatigue, weakness, confusion, lacrimation, and paresthesia and at higher doses causing euphoria, headache, dizziness, dialated pupils, and nausea. Severe but reversible liver and kidney injury has been reported in an individual with extrodinary high dose chronic exposure. Prolonged contact with the skin will produce drying irritation and rash and eye contact may produce corneal damage.[1]

The current OSHA standard for toluene is 200 parts of toluene per million parts of air (ppm) averaged over an eight-hour work shift, and during any such workshift, 300 ppm toluene may not be exceeded except that a peak of 500 ppm toluene is permitted for 10 minutes during the eight-hour work shift. NIOSH has recommended that the permissible exposure limit be reduced to 100 ppm toluene averaged over an eight-hour work shift with a ceiling level of 200 ppm averaged over a ten-minute period. The NIOSH Criteria Document for Toluene should be consulted for more detailed information.[1]

B. Xylene

Xylene causes irritation to the eyes, skin, and mucous membranes. At high doses it may cause narcosis, pulmonary edema, and liver damage. The current OSHA standard for xylene is 100 parts of xylene per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 435 milligrams of xylene per cubic meter of air (mg/m^3). NIOSH has recommended that the permissible exposure limit be changed to 100 ppm averaged over a work shift of up to ten hours per

day, forty hours per week, with an acceptable ceiling level of 200 ppm averaged over a 10-minute period. The NIOSH Criteria Document for xylene should be consulted for more detailed information.[1].

C. Naphthas

There have been few toxicological studies with petroleum distillates either on animals or man. The liquid is a defatting agent, and repeated or prolonged skin contact results in drying and cracking. Petroleum naphtha distillates vapor is a central nervous system depressant with severe exposure causing irritation of the respiratory tract. The current OSHA standard for occupational exposure to pertroleum naphthas is 500 parts per million.[2]

VI. RESULTS AND DISCUSSION

All eight employees who were currently working or had recently worked in the starter assembly area reported frequent headaches at work. Seven noted eye irritation at work, six complained of sinus congestion, dry throat, and unusual tiredness. Four noted frequent nausea, heart palpitations, light headedness, irritablity, and a bad taste in their mouths. No individuals indicated having hepatitis, jaundice, or unusual change in weight.

These symptoms were suggestive of low dose solvent exposure yet due to the transient nature of the complaints, it was nearly impossible to identify any one contaminant as the causative agent. However, qualitative analysis of the charcoal tubes sent to the laboratory for analysis revealed that the major components identified were toluene, xylene, and a naphtha consisting mainly of C_9-C_{15} alkanes.

The spray-painting booths, northwest of the starter assembly area use aromatic hydrocarbons, primarily toluene and xylene, as paint solvents. Yet there appeared to be no overspray escaping from the paint booths. The air velocity at the spray-paint booth was not measured, however, the ventilation smoke tubes indicated that an adequate capture velocity was being maintained. Therefore, the solvent airborne contaminants were not directly crossing from the booths to the assembly area.

Directly west of the starter assembly is a fastening operation using an adhesive/sealant containing methacrylate esters. The quantity of material, infrequent use, and distance from the starter assembly area is sufficiently large to rule out the possiblity of this operation causing the employee complaints.

In the engine test rooms internal plant airflows would cause any contaminants escaping to travel away from starter assembly in such a way to preclude the contamination of the starter assembly area.

Inspection of the exhaust and make up air intake system on the roof of the plant revealed the possiblity of the re-entry of the spray paint booth exhaust air into the air make-up system. Emissions from the exhaust ventilation systems could be seen settling toward the roof.

Weather caps used on the exhaust stacks resulted in a loss of velocity pressure and directing the discharged contaminants back down toward the roof. The main intake duct for the assembly area was the duct located closest to the paint exhaust stacks on the roof. However, due to the dilution of emissions with the outside air these reentrant substances would not be expected to be present in quantities which would represent a health hazard, yet could well have accounted for the odor detected by employees.

Further, it is possible that a combination of environmental conditions (wind velocity, and direction) and plant conditions (ventilation) could result in the by-products of the paint drying ovens entering the plant. The main plant airflow is from west to east, and if these by-products were forced down through the conveyor openings, they would probably move through the starter assembly area. While this is a possibility, it is far more likely that the complaints are produced by the intake of the paint solvents from the exhaust of the paint booths themselves.

VII. RECOMMENDATIONS

1. The company should raise the height of all exhaust stacks so as to discharge the contaminated air high enough to preclude re-entry of the contaminated air back into the building.

2. Weather caps should be replaced by stackheads, weather caps are not recommended as good ventilation design. The use of stackheads should help eliminate the re-entry of contaminated air into the building.

3. After modifications in the ventilation system have been completed the company should conduct personal monitoring of the employees in the starter assembly area for exposure to solvent vapors and mists.

4. If employee complaints continue further investigation would be deemed necessary.

VIII. REFERENCES

1. NIOSH/OSHA Occupational Health Guidelines for Chemical Hazards, U.S. Dept. of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, Publication No. 81-123, Cincinnati, Ohio, January 1981

2. Proctor, N.H. and Hughes, J.P., Chemical Hazards of the Workplace, J.P. Lippincott Company, Philadelphia, 1978, pp. 336.

3. Industrial Ventilation - A Manual of Recommended Pratice, American Conference of Governmental Industrial Hygienists, Cincinnati, Ohio.

IX. AUTHORSHIP AND ACKNOWLEDGEMENTS

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X. DISTRIBUTION AND AVAILABILITY OF REPORT

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1. International Association of Machinists, Local #1259
2. Lauson Engine Division of Tecumseh Products
3. NIOSH, Region V
4. OSHA, Region V

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