U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
CENTER FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45226

HEALTH HAZARD EVALUATION DETERMINATION
HE 78-22-732

HERMETIC AIRCRAFT INSTRUMENT CORP.
200 MARINE AVENUE
FARMINGDALE, NEW YORK 11735

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I. SUMMARY

The National Institute for Occupational Safety and Health (NIOSH) conducted a Health Hazard Evaluation to evaluate the hazards from exposure to mercury vapor in the altimeter testing area and to solvent vapors (naphtha, consisting primarily of hexane and heptane) during parts cleaning at the Hermetic Aircraft Instrument Corporation (SIC 3728). No mercury vapor was detected in the altimeter testing area. Direct readings of solvent vapor concentrations were made in the operators' breathing zones using an MSA Combustible Gas Indicator. Airborne concentrations of the solvent vapors were determined to be approximately 130 to 275 parts per million (ppm). Because the operation is performed less than 1 hour per day, the time weighted average exposure would not exceed either the existing OSHA (Occupational Safety and Health Administration) Permissible Exposure Limit for petroleum naphtha of 500 ppm or the NIOSH Recommended Exposure Limit of 100 ppm.

No hazard from exposure to mercury or solvent vapors was determined to exist under conditions prevalent at the time of the survey. However, based on good industrial hygiene practice, and to assure that exposures to solvent vapors will not exceed existing or recommended limits, recommendations are made to improve on the method of operation and to limit the exposure time of any employee to less than 4 hours of spraying time in any one day. These recommendations are detailed in Section VII of this report.

II. INTRODUCTION

Under provisions of the Occupational Safety and Health Act of 1970*, NIOSH investigates the toxic effects of substances found in the workplace. In January, 1978, a representative of the International Association of Machinists and Aerospace Workers, District #15 requested such an investigation from NIOSH to determine exposure to chemicals used at Hermetic Aircraft Instrument Corporation.

*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 and Human Services, 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.

III. BACKGROUND

Hermetic Aircraft Instrument Corp. repairs small airplane instruments (altimeters, gyrocompasses, etc.). Employment at the plant had recently averaged about 25 workers. Work consists of light assembly and testing, including spray cleaning. The spray cleaning operations were performed by two employees.

Prior to NIOSH's first visit on March 15, 1978, the plant had been inspected by an industrial hygienist from the plant's insurance carrier. He had recommended substitution of various solvents used in the spray cleaning operation (methylene chloride, freon, methyl chloroform, trichloromethane and ethyl alcohol) with a single, less toxic solvent and the installation of additional exhaust ventilation equipment. A NIOSH walk-through inspection of the plant during the first visit indicated that the spray booth also was in the process of being up-graded. In addition, 3 mercury manometers were used at the plant to determine the accuracy of repaired altimeters. The mercury pumps were enclosed and exhausted. Plans were discussed with plant management and the shop steward to survey for mercury vapor and solvent vapors after the exhaust booth was completed. The survey was performed on October 24, 1978.

IV. EVALUATION CRITERIA AND SURVEY DESIGN

Mercury

A Bacharach Model MV-2 Mercury Vapor Meter was chosen to evaluate mercury vapor concentrations in the altimeter testing area. This instrument gives instantaneous readings of mercury vapor in air. It is capable of detecting mercury vapor concentrations of about 0.01 milligram per cubic meter of air. The following present the physical characteristics, symptoms of exposure and permissible limits for exposure to mercury:

Substance	Physical Appearance	Symptoms of Exposure
mercury	shiny, silvery, heavy odorless liquid	central nervous system, cough, headache, fatigue.

OSHA Permissible Exposure Limit	NIOSH Recommended Limit
0.1 milligram per cubic meter-ceiling	0.05 milligram per cubic meter, time weighted average; 10 hour work day, 40 hour work week

Solvents Vapors

The replacement solvent chosen for use in the spray booth was "Textile Spirits" manufactured by the Amsco Division, Union Oil Company. The material Safety Data Sheet supplied by the company identifies Textile Spirits as a mixture of petroleum hydrocarbons with the following physical parameters:

Boiling Point	145-190° F (60-90°C)
Vapor Pressure	152 millimeters of Mercury at 68°F
Vapor Density (Air=1)	3.0
Flash Point	20° F (-7° C)
Solubility in Water	negligible
Lower Explosive Limit (lel)	1.2%

According to information obtained from the manufacturer, the solvent is a mixture of aliphatic hydrocarbons of a type commonly referred to as "naphtha" or "petroleum naphtha". Textile spirits is a wide cut hexane, which is approximately 90% hexane, with most of the remainder heptane Small amounts of C_5 and C_8 aliphatics may be present. The product varies slightly from batch to batch, so that a more precise analysis is not available. It was further stated that the manufacturing process would not be expected to produce benzene or other aromatic hydrocarbons. The following table lists some important properties of naphtha, hexane and heptane.

Substance	Composition	Physical Appearance	Symptoms of Exposure
Naphtha, Petroleum naphtha	hexane, heptane, octane, pentane	usually clear, colorless liquid, mild "gasoline or kerosene odor".	eye and nose irritation, dizziness, confusion, dermatitis (defatting of skin)
Hexane	—	same	same
Heptane	—	same	same

OSHA Permissible Limit	NIOSH Recommended Standard for alkanes (C_5-C_8 compounds)
500 parts per million parts or air (ppm), time weighted exposure for an 8-hour day, 40 hour work week.	350 milligrams per cubic meter of air (mg/M^3) = about 100 ppm, time weighted exposure for 10 hour day, 40 hour work week.

OSHA Permissible Limit (cont'd)	NIOSH Recommended Standard (cont'd)
500 ppm (for hexane)	350 mg/M^3 = about 100 ppm; 510 ppm ceiling for 15 min (for hexane).
500 ppm (for heptane)	350 mg/M^3 = about 85 ppm; 450 ppm ceiling (for heptane).

Exposures to the solvent vapors are intermittent and sporadic. An MSA Model 40 Combustible Gas Indicator was chosen as the sampling instrument since it provides instantaneous readings of airborne solvent concentrations. The following chart, developed from response curves provided by MSA, lists solvent concentrations at several meter readings of the Model 40 instrument.

Concentration of Solvent
(parts per million parts of air)

Solvent	Lower Explosive Limit (lel)	Meter Reading (% lel)			
		1	2	3	4
Hexane	1.2	130	300	450	600
Heptane	1.2	130	270	400	540

Since the naphtha used in this operation is composed mostly of these two compounds, a meter reading of 4% of the lower explosive limit (lel) would indicate a concentration of solvent vapors of 540 to 600 parts per million parts of air. A reading of 1% would indicate 130 ppm. The instrument's sensitivity and precision are questionable to concentrations less than 0.5% of the lel (i.e., at concentrations less than about 65 ppm) and determinations of concentrations at 65 ppm or less are not reliable.

V. RESULTS

No mercury vapor was detected in the operators' breathing zones in the altimeter testing area. No visual evidence of mercury spills was observed nor was mercury vapor detected on the floor, near cracks, etc.

Difficulty was experienced in "zeroing" the mercury vapor meter while positioned on some old work-benches in the rear work room away from the altimeter testing area. After the meter had been purged and "zeroed" outdoors, concentrations of mercury vapor of about 0.01 to 0.02 milligrams per cubic meter were detected immediately above the work bench surface and near cracks in the bench surfaces. The benches had been purchased years before, reportedly from a firm which had made thermometers and barometers. No mercury vapor concentration could be detected at regular breathing level heights.

Readings taken with the MSA Combustible Gas Indicator while operators were spraying parts indicated a solvent concentration in the operators' breathing zone of approximately 1 to 2% of the lower explosive limit, or 130 to 275 parts per million parts of air. Since the operation is intermittent and requires exposures of about ½ hour once or twice daily, neither the OSHA Permissible Exposure Limit of 500 ppm nor the NIOSH Recommended Limit of 100 ppm was exceeded, as these limits are applicable to a time weighted daily exposure. For example, a one hour daily exposure at 400 ppm during an 8 hour work day would be equivalent to 50 ppm. The NIOSH ceiling limits were not exceeded.

VI. DISCUSSION AND RECOMMENDATIONS

Concentrations of airborne solvent vapor in the operators' breathing zone while spraying parts in the exhaust booth average 130-275 parts per million parts of air. Because this operation requires approximately ½ to one hour per day, neither the OSHA limit (500 ppm) time weighted average (TWA) nor the NIOSH limit (100 ppm) TWA for an average daily exposure 40 hour week, nor the ceiling limits was exceeded. Nevertheless, based on good industrial hygiene practice, the following recommendations are made:

1. Care should be taken while spraying parts. The operator should stand back from the parts being sprayed, directing the over spray toward the exhaust slots. The operator should exit from the spray booth and leave the cleaned parts on the drain board while excess solvent drains and evaporates. The exhaust fans should be in operation while this process takes place. After at least five or ten minutes, the operator can reenter the booth and remove the dried parts.

2. The exposure time of spraying operations should be limited to less than 4 hours per day for any individual. When increased production or rush orders require increased spray-cleaning of parts, the work should be divided between several employees so that no one individual is exposed to solvent vapors for more than 4 hours. Ideally the spraying operation should be scheduled as it is currently. Small batches should be sprayed sporadically throughout the day to avoid any build-up of solvent vapors.

3. The work benches should be treated with a mercury absorption compound to remove all vestiges of mercury contamination.

VII. DISTRIBUTION AND AVAILABILITY

For purposes of informing the affected employees, the employer shall post this report for 30 days in a prominent place near where employees work.

Copies of this report are currently available, upon request, from NIOSH, Division of Technical Services, Pulications Dissemination, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days, the report will be available through the National Technical Information Service (NTIS), Springfield, Virginia 22161. Information regarding its availability from NTIS can be obtained from NIOSH's Publication Office at the Cincinnati address. Copies of this report have been sent to:

1. Hermetic Aircraft Instrument Corp.
2. International Association of Machinists and Aerospace Workers, District #15.
3. OSHA Office, Region II
4. NIOSH Office, Region II
5. N.Y. State Dept. of Health

VIII. AUTHORSHIP AND ACKNOWLEDGEMENT

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