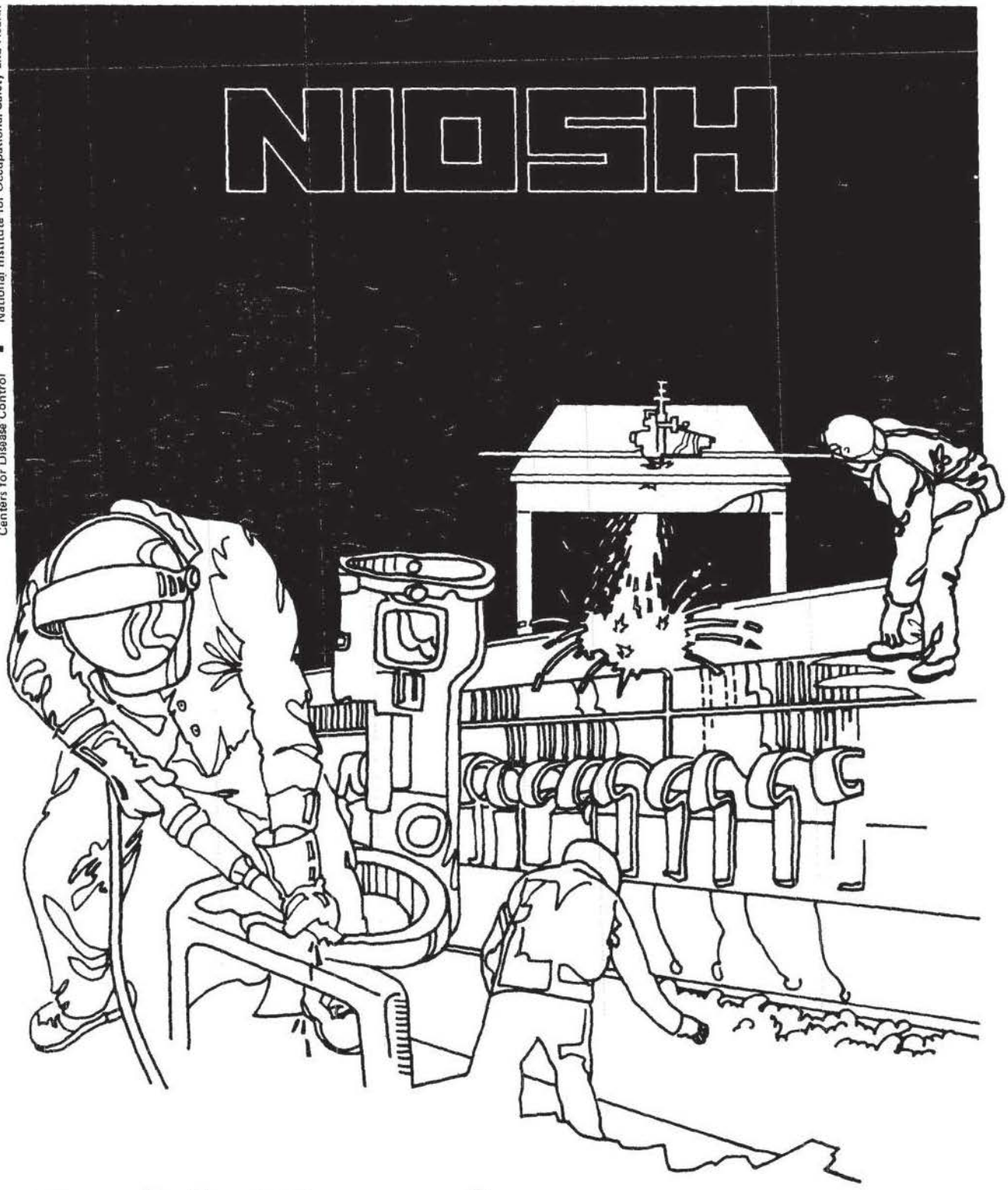
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
Centers for Disease Control ■ National Institute for Occupational Safety and Health

NIOSH



Health Hazard Evaluation Report

HETA 81-186-924
HAYES ALBION CORPORATION
SPENCERVILLE, OHIO

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 81-186-924
July 1981
Hayes Albion Corporation
Spencerville, Ohio

NIOSH INVESTIGATOR:
Cheryl Lucas, IH

I. SUMMARY

On February 19, 1981, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation from United Auto Workers Local Union 962 to investigate exposures of employees working on the Corvette Window Assembly Line in the Final Assembly Department at the Hayes Albion Corporation in Spencerville, Ohio. Potentially toxic substances of concern include the glass prep primer, naphtha, urethane adhesive, and their vapors.

Health effects reported in the request included dermatitis, dry nose and dry sore throats thought to be caused by the urethane adhesive. Burning in the nose throat; bronchial infections and dermatitis were attributed to the primer and naphtha. "Exposed" workers were assemblers, welders, and inspector-repair personnel totaling approximately 33 employees.

NIOSH made a site visit on February 25-27, 1981, to conduct an industrial hygiene evaluation. Analysis of bulk and area air sampling identified airborne contaminants. Worker exposures were determined by personal breathing zone sampling for methanol (35), naphtha (48), toluene (16), ethanol (1) and methylene bisphenyl, 4,4-diisocyanate (MDI), (38). Medical questionnaires were administered to nine first-shift employees.

Analysis of personal air samples showed that all contaminant levels were well below NIOSH recommended criteria and the OSHA standards. Toluene time weighted average (TWA) levels ranged from 13.0 to 53.0 milligrams per cubic meter of air (mg/M^3). Methanol TWA levels ranged from 4.0 to 12.0 mg/M^3. Naphtha TWA levels ranged from 32.0 to 191.0 mg/M^3. MDI samples analysed were below detectable limits. The work practice study revealed a need to change some work procedures which will reduce skin contact, and absorption of solvents into the body. Medical questionnaire results showed that all interviewees complained of nose and throat irritation, and some indicated problems of dermatitis on their hands and of headaches.

Based on the environmental data collected during the NIOSH survey there was no health hazard at the Hayes Albion Corporation due to atmospheric concentrations of methanol, ethanol, toluene, naphtha, and MDI in the corvette window assembly area. Time weighted average exposure concentrations were significantly below NIOSH recommended criteria for all contaminants measured. The prevalence of reported symptoms could possibly be due to individual short-term overexposures, absorption of solvents through worker skin, and/or lack of general ventilation in the building. Recommendations concerning work practice changes, and engineering controls included in this report should serve to eliminate symptoms being experienced by the workers.

KEYWORDS: SIC 3711 (Assembling complete automobiles, trucks, commercial cars, and buses). Hayes Albion Corporation, methanol, ethanol, toluene, naphtha and MDI.

II. INTRODUCTION

On February 18, 1981, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation from an authorized representative of UAW Local Union 962 to investigate exposures of employees working on the Corvette Window Assembly Line in the Final Assembly Department at the Hayes Albion Corporation in Spencerville, Ohio. Potentially toxic substances of concern include the glass prep primer, naphtha, urethane adhesive, and their vapors. The Corvette window line was started at the Hayes Albion plant on October 10, 1980.

Health effects reported in the request included dermatitis, dry nose and dry sore throats thought to be caused by the urethane adhesive. Burning in the nose and throat; bronchial infections and dermatitis were attributed to the primer and naphtha. "Exposed" workers were assemblers, welders, and inspector-repair personnel.

An interim report dated March 1981, covering the findings of the initial walk-through and industrial hygiene survey on February 25-27, 1981, was sent to the company and union.

Interim environmental sampling results were submitted to the company in a letter dated May 28, 1981.

III. BACKGROUND

A. Description of Process and Workforce

Hayes Albion's Corvette Window Assembly Line is devoted to assembling windows that will be used by General Motors on Corvette T-tops. Approximately 33 employees, covering three shifts, produce about 80 service package windows, and 250 regular windows per day. Regular windows are the same as the service pack windows except thay are without the service pack unit.

Each of the three shifts has a welder, two regular window assemblers, four service pack window assemblers, two inspection-repair personnel, and two lift truck operators. The first step of the assembly process is called welding. Here a welder takes the glass window from a crate, places it on a welding machine, cleans the area of the window where the studs will be applied with Synolsol ethyl alcohol solvent, assembles the studs, places them on the window, and welds them into place. The welder then takes the window, places it in another rack where it is held until one of the two regular window assemblers takes it. The window assemblers apply primer around the edges of the window with a sponge, dry with a paper towel, wipe with a water soaked towel, apply urethane adhesive to a vinyl strip and then assemble the vinyl strip to the edge of the window. Last the window is moved to a small table about six feet away from the ventilation booth, where it is cleaned with naphtha. Next the windows move into a inspection area where they are inspected and repaired if necessary.

Approximately 80 of the 250 windows per shift go on to the service pack assembly area where a metal frame is assembled onto the window. A thick rubber piece is bolted onto the metal frame. A small vinyl strip is then applied with the urethane adhesive. Next the window is bolted onto the frame and primer is used to clean excess adhesive from the window.

The employees are potentially exposed to ethanol and methanol vapors in the welding area, and MDI, toluene, methanol and naphtha in all other jobs on the Corvette window line. These potential exposures result from the use of urethane adhesive, glass prep primer, naphtha, and Synolsol ethanol solvent.

B. Environmental Controls

In mid-December a double-booth dilution ventilation system was installed in the Corvette Window Assembly Line to reduce vapor concentrations in the work area (see Figure 1). The ventilation system included two booths, two 16" exhaust ducts, and a fan. One side of each booth is open allowing the worker to move in and out freely. Opposite to this open side, or at the back of the booth, there are two slots which have velocity ratings of 2100 FPM. These slots serve to draw vapors away from the worker who stands inside the booth assembling windows. Each booth has a rated flow of 2,725 CFM. The 16" exhaust ducts each have a velocity rating of 2200 FPM. The duct extends up about 16' above the working floor where the fan exhausts the vapors back into the inside environment. The static pressure and flow ratings from the fan are 1.75 and 5,450 CFM, respectfully. This ventilation system was designed for two workers, but in this area of the plant nine workers are exposed to potentially toxic materials in a similar fashion as the workers who will use the booths.

About one week prior to the NIOSH survey the company designed new sponges with handles to be used in the regular window assembly area for the application of the glass primer eliminating much skin contact. Also, plastic surgical gloves were ordered, but were being used only by the inspectors and the regular window assemblers. Employees indicated that the glass primer dissolved these plastic gloves exposing their hands. At the present time no ideal replacement glove is known to exist. In addition to these improvements, the company has begun using enclosed dispensing cans for the naphtha and the primer to cut down on vapor escape. However, there were not enough of these cans for all areas at the time of the survey.

IV. ENVIRONMENTAL EVALUATION DESIGN AND METHODS

Initial efforts went into determining what substances were present and could pose a potential health hazard to the workers in the Corvette Window Assembly Area. This was accomplished through correspondence with the Hayes Albion Company and the Essex Chemical Corporation, product supplier to Hayes Albion Company, and a review of the literature. In order to verify the information obtained through these initial efforts, five bulk solvent samples were collected, and two general area air samples were taken using charcoal tubes and low flow pumps operating at 100 cubic centimeters per minute (cc/min).

Personal breathing zone samples were taken for ethanol, methanol, toluene, naphtha, and MDI. Sampling was carried out during the first and second-shifts February 26, and the first-shift on February 27. Sampling for MDI was performed with constant flow personal sampling pumps operating at 1.0 or 2.0 liters per minute, and midget impingers with a nitro-adsorbing solution. Methanol sampling was done on silica gel tubes with low flow sampling pumps operating at 50 cubic centimeters per minute (cc/m). All other contaminants were collected on charcoal tubes with low flow pumps operating at 100 cc/m.

Bulk samples were qualitatively analyzed by gas chromatographic/mass spectroscopy using a 48M scotcarbowax 20 M column.

Charcoal tube area samples were desorbed with 1 mL carbon disulfide and analyzed by gas chromatography (GC) with a flame ionization detector (FID) using a 25 meter methyl silicone fused silica capillary column.

MDI samples were analyzed using NIOSH method P&CAM 240 with slight modifications. The nitro collecting solution was dryed using a rotary evaporator and then remaining residue was dissolved in 2 mL of methanol. Aliquots of the resulting solutions were injected into a high pressure liquid chromatography system.

Methanol samples were analyzed according to NIOSH method S-59 with minor modifications. The silica gel tubes were desorbed in 1 mL distilled water containing 1 µL/mL isopropanol as an internal standard. The resulting solution was analyzed on a GC equipped with a FID.

Ethyl Alcohol, Naphtha, and Toluene samples were analyzed according to NIOSH method P&CAM 127 with slight modifications, using a GC equipped with a FID.

Interviewer - administered medical questionnaires were completed on nine first-shift employees.

V. EVALUATION CRITERIA

OSHA standards and NIOSH recommended criteria, used to make a health hazard determination in this report, are levels of toxic substances which it is believed that nearly all workers may be repeatedly exposed to without adverse effects for a 40-hour work week in an occupational lifetime. Recommended criteria, OSHA standards, and comments on the known health effects for substances evaluated in this study are listed in Table I.

VI. RESULTS AND CONCLUSIONS

Bulk sample analysis results confirmed the contents of the primers and solvents in use on the Corvette Window Assembly Line, and are shown in table II. Bulk sample number five which was an unknown solvent thought not to be in use during the survey, but had been used, in the past on the corvette line contained primarily xylene. The health effects of xylene are very similar to those of naphtha and toluene, therefore similar precautions should be taken while using it. The OSHA standard for xylene is 435 mg/M^3.

Analytical results from the area charcoal tube samples showed toluene to be the major contaminant. Minor amounts of xylene and C_8-C_9 alkanes were also found in the area sample matching those found in the bulk #5 sample indicating that the unknown solvent was probably being used in the general area of the Corvette Window Assembly Line during the time of the survey.

All of the personal breathing zone sample results for methanol, naphtha, toluene, ethanol, and MDI showed that concentrations were below NIOSH recommended criteria and OSHA standard.

The ethanol sample taken on the welder resulted in an exposure concentration of 9.25 mg/M^3, which is below the OSHA standard of 1900 milligrams per cubic meter of air (mg/M^3). Toluene levels ranged from 13 to 53 (mg/M^3), which are much lower than the NIOSH recommended criteria of 375 mg/M^3, (8 hour time weighted average (TWA)) and the current OSHA standard of 750 mg/M^3 (8 hour TWA) NIOSH recommended that the OSHA standard be reduced to 375 mg/M^3 as a result of a complete review of investigations into the narcotic effects of toluene. This reduction in the standard NIOSH believed would prevent muscular weakness, incoordination, and mental confusion in exposed workers. Assembler #1 and #2 were exposed to lower toluene concentrations in general than the other exposed workers (see Table III). This is reasonable since the two assemblers were the only two workers protected by a ventilation booth (see section III part B).

Methanol levels ranged from 4 to 12 mg/M^3, which are much lower than the NIOSH recommended criteria of 260 mg/M^3 a 10 hour TWA and the OSHA standard of 260 mg/M^3 an 8 hour TWA. These results are shown in Table V. In general the service assembler exposure concentrations ranged slightly higher than the assemblers who were protected by a ventilation booth.

Naphtha levels ranged from 32 to 191 mg/M^3 which is below NIOSH recommended criteria of 350 mg/M^3 a 10-hour TWA and the OSHA standard of 400 mg/M^3 an 8-hour TWA. Naphtha exposure concentrations are listed in Table IV. Even though the assemblers are under a ventilation booth they received the highest naphtha exposure. This is probably because they move the window out from under the ventilation booth to apply the naphtha. In fact during naphtha application the assemblers are standing between the naphtha and the ventilation booth which would mean that air movement toward the ventilation booth would carry the naphtha vapor into their breathing zone, therefore, giving the assemblers higher exposures even higher than those which would be incurred in the absence of a ventilation booth. This seems to be supported by the inspectors' naphtha exposure concentrations because their exposures are somewhat lower than assemblers exposures and are without ventilation booth protection. Service assemblers showed much lower naphtha concentrations because they primarily use the primer and very little naphtha.

MDI sample results are listed in Table VI of this report. They were all below detectable limits.

Measurements made in the ventilation control booths on the Corvette Window Assembly line showed that slot velocities range from 1900 to 2000 feet per minute (FPM) which is just slightly below the design specifications of 2100 FPM.

Even though it seems that all workers sampled are not overexposed to solvent vapors and therefore should not be experiencing any health problems, when reviewing the environmental sampling results, it must be noted that it is very difficult to estimate or measure the amount of a solvent which enters into the body by absorption through the skin. In fact according to Patty some substances enter the body by skin absorption with efficiencies equal to those which would occur if the substance was inhaled. Therefore, before concluding, on the basis of environmental data, that there should be no health problems for workers in the Corvette window assembly area, skin contact with the solvent being used must be minimized.

Medical questionnaires showed that all interviewees complained of dry sore noses and throats, and some indicated problems of dermatitis on their hands, and headaches. All agreed that these health problems started after the company begun operating the Corvette Window Line on October 10, 1980.

VII. RECOMMENDATIONS

In view of the complaints from workers in the Corvette Window Area about nose and throat irritation, headaches, and dermatitis, the following recommendations are made to further reduce employee exposure to contaminants and help eliminate symptoms experienced by the workers causing these complaints.

1. Since gloves alone do not offer effective protection from the solvents being used, engineering controls such as long handled sponges should be implemented on all solvent exposed jobs.

2. Exposed employees should be educated about the proper use and problems associated with the solvents they are using especially the need for personal cleanliness to eliminate skin absorption.

3. Work practices followed by the assemblers should be altered so that naphtha is applied to the windows under the ventilation hood instead of on the adjacent table.

4. During the survey it was recommended to management that the existing ventilation booths' exhaust be vented outside the building. Subsequently, management indicated that this measure had been taken.

5. Performance checks and proper maintenance should be carried out regularly on the ventilation system.

6. The various open top containers filled with solvents should all be replaced with the new enclosed dispensing cans which were being used by only a few workers during the survey.

7. A medical surveillance program should be implemented for exposed employees including urine excretion analysis.

8. Future environmental sampling should be conducted according to NIOSH approved methods and analysis of samples should be done by an Industrial Hygiene accredited laboratory.

VIII. REFERENCE

1. Occupational Safety and Health Standards for General Industry. U.S. Department of Labor (OSHA) Sec. 1910.1000 (January 1978).

2. NIOSH Manual of Analytical Methods, 2nd Ed. Vol. 1. DHEW (NIOSH) Pub. No. 77-157A. April 1977.

3. Occupational Diseases, A Guide to Their Recognition, U.S. DHEW (NIOSH) Pub. No. 77-181. June 1977.

4. NIOSH Recommended Standard, for Occupational Exposure to Methyl Alcohol, U.S. DHEW (NIOSH). U.S. Government Printing Office: 1979-657-012/319.

5. A Recommended Standard for Occupational Exposure to Diisocyanates. Reprinted 1979, U.S. DHEW (NIOSH) Pub. No. 78-125.

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7. A Recommended Standard for Occupational Exposure to Toluene, U.S. DHEW (NIOSH), U.S. Government Printing Office: 1977-757-009/40.

8. Precautions for the Proper Usage of Polyurethanes, Polyisocyanurates, and Related Materials, Upjohn Chemical Division. Tech. Bulletin 107, 1973.

9. Pattys' Industrial Hygiene and Toxicology. 1979, Vol. III, Page 226.

IX. AUTHORSHIP/ACKNOWLEDGEMENTS

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X. DISTRIBUTION AND AVAILABILITY OF REPORT

Copies of this Determination Report are currently available upon request from NIOSH, Division of Technical Services, 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), 5285 Port Royal Road, Springfield, Virginia 22151. Information regarding its availability through NTIS can be obtained from the NIOSH Publications Office at the Cincinnati address.

Copies of this report have been sent to:

a) Hayes Albion Corporation, Spencerville, Ohio.
b) United Auto Workers, Local Union 962.
c) NIOSH, Region V
d) OSHA, Region V

For the purpose of informing the exposed 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 I

RECOMMENDED EXPOSURE CRITERIA FOR HAZARDOUS SUBSTANCES

HAYES ALBION CORPORATION
SPENCERVILLE, OHIO

HETA 81-168

Substance	Recommended Levels	OSHA Standard	Health Effects
Methylene bisphenyl, 4,4-diisocyanate (MDI)	0.05 mg/M^3, TWA 0.20 mg/M^3, 20-min. ceiling	0.05 mg/M^3, 10-hr TWA 0.20 mg/M^3, 10-min. ceiling	MDI has been associated with irritation of the eyes, respiratory tract, and skin. In severe cases pulmonary adema, nausea, vomiting, and abdominal pains may occur. Sensitization to MDI can occur which may cause an asthmatic reaction with wheezing, and cough.
Toluene	375 mg/M^3, 8-hr TWA 750 mg/M^3, 10-min. ceiling (NIOSH)	750 mg/M^3, 8-hr TWA 1125 mg/M^3, 15-min ceiling 1875 mg/M^3, 10-min ceiling	Toluene has been associated with irritation of the eyes, respiratory tract, and skin. Prolonged contact with the liquid may cause removal of natural liquids from the skin, resulting in dry, fissured dermatitis. Acute exposure can result in central nervous system (CNS) depression. Symptoms include headache, dizziness, fatigue, muscular weakness, drowsiness, incoordination, skin paresthesias, and collapse.
Methyl Alcohol	260 mg/M^3 10-hr TWA (NIOSH)	260 mg/M^3 , 8-hr TWA	Methyl Alcohol liquid contact may cause defatting and mild dermatitis. It has also been associated with optic nerve damage and general CNS depression with symptoms including blindness, headache, nausea, giddiness and loss of consciousness.
Ethyl Alcohol		1900 mg/M^3, 8-hr TWA	Ethyl Alcohol may produce mild irritation of eyes and nose. Prolonged inhalation of high concentrations can cause CNS depression producing symptoms including headaches, drowsiness, tremors, and fatigue.
Naphtha	350 mg/M^3, 10-hr TWA (NIOSH)	400 mg/M^3, 8-hr TWA	Naphtha has been associated with irritation of the skin, conjunctiva, and the nose. Repeated contact can cause chapping and photo sensitivity. Acute exposure to the vapor may cause CNS depression, with symptoms including inebriation, headache, and nausea.

TABLE II

BULK SOLVENT SAMPLES

HAYES ALBION CORPORATION
SPENCERVILLE, OHIO

HETA 81-168

Location	Sample Number	Results
Assembly	1	Methanol and toluene
Service Assembly	2	Methanol and toluene
Inspection	3	Methanol and toluene
Welding	4	Ethanol minor amounts of MIBK, ethyl acetate hexane
Unknown	5	Xylene plus C_8-C_9 alkanes

TABLE III

PERSONAL AIR SAMPLES FOR TOLUENE

HAYES ALBION CORPORATION
SPENCERVILLE, OHIO

HETA 81-168

2/26/81 - 2nd Shift

Job	Sample Time	Toluene TWA Concentration (mg/M^3)
Assembler #1	1420-2200	13
Assembler #2	1623-2345	14
Inspector #1	1628-2345	53
Inspector #2	1645-2200	14
Service Assembler #1 (right)	1626-2348	18
Service Assembler #2 (right)	1631-2347	23
Service Assembler #1 (left)	1645-2343	18
Service Assembler #2 (left)	1645-2348	15

NIOSH Recommended Criteria: (Time-weighted average 8-hour exposure)	375 mg/M^3
OSHA Standard: (Time-weighted average 8-hour exposure)	750 mg/M^3

TABLE IV

PERSONAL AIR SAMPLES FOR NAPHTHA

HAYES ALBION CORPORATION
SPENCERVILLE, OHIO

HETA 81-168

Job	Sample Time	Naphtha TWA Concentration (mg/M^3)
	2/26/81 - 1st Shift	
Assembler #1	0713-1457	142
Assembler #2	0716-1500	179
Inspector #1	0722-1450	60
Inspector #2	0726-1446	107
Welder	0728-1122	44
	2/26/81 - 2nd Shift	
Assembler #1	1420-2200	48
Assembler #2	1623-2345	41
Inspector #1	1628-2343	76
Inspector #2	1645-2200	38
Service Assembler #1 (right)	1626-2348	28
Service Assembler #2 (right)	1631-2347	42
Service Assembler #1 (left)	1645-2343	32
Service Assembler #2 (left)	1645-2348	38
	2/27/81 - 1st Shift	
Assembler #1	0728-1514	191
Assembler #2	0727-1514	118
Inspector #1	0722-1513	118
Inspector #2	0743-1515	88
Service Assembler #1 (left)	0735-1510	73
Service Assembler #2 (left)	0735-1510	64
Welder	0740-1514	44

NIOSH Recommended Criteria: (Time-weighted average 10-hour exposure)	350 mg/M^3
OSHA Standard: (Time-weighted average 8-hour exposure)	400 mg/M^3

TABLE V

PERSONAL AIR SAMPLES FOR METHYL ALCOHOL

HAYES ALBION CORPORATION
SPENCERVILLE, OHIO

HETA 81-168

Job	Sample Time	Methyl Alcohol TWA Concentration (mg/M^3)
	2/26/81 - 1st Shift	
Assembler #1	0713-1457	10
Assembler #2	0716-1500	7
Inspector #1	0722-1450	6
Inspector #2	0726-1450	5
Service Assembler #1 (right)	0734-1455	11
Service Assembler #2 (right)	0737-1453	12
	2/26/81 - 2nd Shift	
Assembler #1	1623-2345	9
Assembler #2	1620-2345	8
Service Assembler #1 (right)	1757-2210	12
Service Assembler #2 (right)	1626-2110	10
	2/27/81 - 1st Shift	
Assembler #1	0727-1514	9
Assembler #2	0723-1514	9
Inspector #2	0722-1513	4
Service Assembler #1 (left)	0735-1510	8

NIOSH Recommended Criteria: (Time-weighted average 10-hour exposure)	260 mg/M^3
OSHA Standard: (Time-weighted average 8-hour exposure)	260 mg/M^3

TABLE VI

PERSONAL AIR SAMPLES FOR MDI

HAYES ALBION CORPORATION
SPENCERVILLE, OHIO

HETA 81-168

February 26, 1981

Job	Sample Time	MDI (mg/M^3)
Assembler #1	0713-0945	***<0.0007
" #2	0716-0950	<0.0007
Inspector #2	0726-1015	<0.0018
Service Assembler #1 (R)*	0734-0920	<0.0014
" " #2 (R)	0737-1305	<0.0009
" " #2 (L)**	0739-1125	<0.0013
" " #1 (L)	0740-0925	<0.0010
" " #2 (R)	0920-0935	<0.0100
" " #1 (L)	0925-0940	<0.0067
Assembler #1	0945-1000	<0.0071
" #2	0950-1005	<0.0067
Service Assembler #2 (R)	0935-1310	<0.0007
" " #1 (L)	0940-1320	<0.0010
Assembler #1	1000-1315	<0.0006
" #2	1005-1320	<0.0005
Inspector #2	1015-1330	<0.0067
" #2	1030-1325	<0.0017
Service Assembler #2 (R)	1305-1514	<0.0023
" " #1 (R)	1310-1515	<0.0011
Assembler #1	1315-1511	<0.0009
" #2	1320-1509	<0.0008
Inspector #2	1335-1505	<0.0011

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* Right Side
** Left Side
*** The less than sign indicated that the result is below the limit of detection of the analytical method. The limit of detection changes with various size air volumes.

TABLE VII

PERSONAL AIR SAMPLES FOR MDI

HAYES ALBION CORPORATION
SPENCERVILLE, OHIO

HETA 81-168

February 27, 1981

Job	Sample Time	MDI (mg/M^3)
Inspector #2	0708-1110	<0.0004
Assembler #1	0711-1000	<0.0006
" #2	9713-0936	<0.0021
Service Assembler #1 (L)*	0716-0810	<0.0056
Inspector #2	0719-0940	<0.0007
Service Assembler #2 (L)	0820-1005	<0.0028
Assembler #2	0936-0950	<0.0125
Inspector #1	0940-0955	<0.0067
" #1	0955-1505	<0.0003
Assembler #1	1000-1015	<0.0100
" #1	1015-1509	<0.0005
Service Assembler #1 (L)	1005-1020	<0.0100
" " #1 (L)	1020-1507	<0.0010
Inspector #2	1110-1125	<0.0071
" #2	1125-1508	<0.0004
Assembler #2	0950-1501	<0.0009

* Left Side

FIGURE 1

HAYES ALBION CORPORATION
SPENCERVILLE, OHIO

HETA 81-168

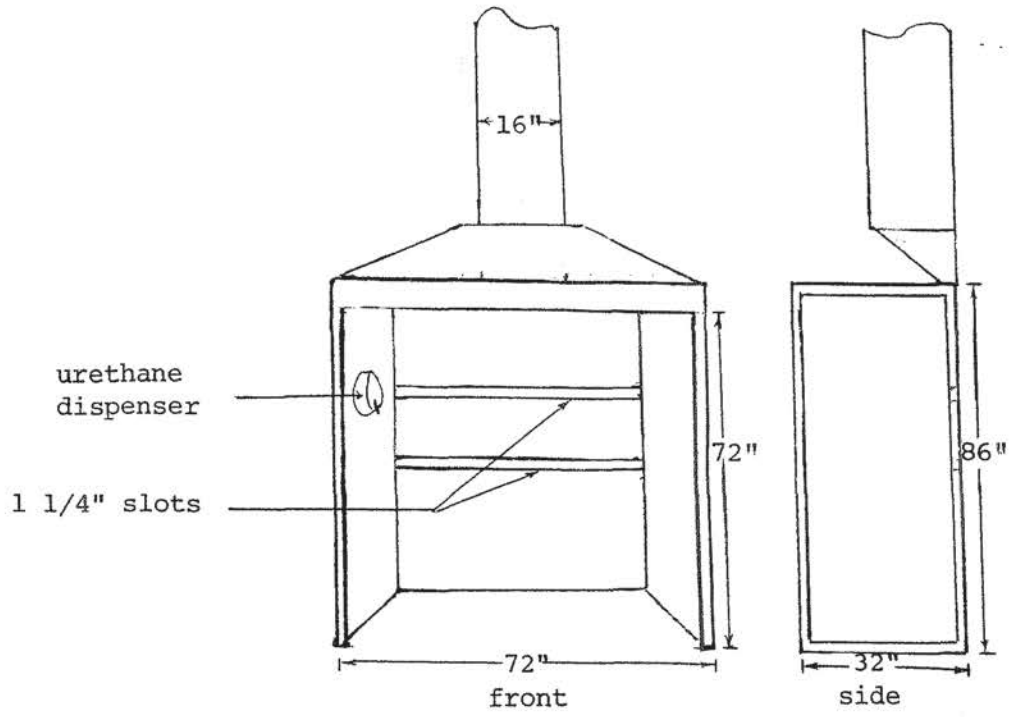

Figure 1 Diagram of the ventilation booth on the Corvette Assembly Line.

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