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

HEALTH HAZARD EVALUATION DETERMINATION
REPORT NO. 76-17-395

THE HAYES & ALBION COMPANY
SPENCERVILLE, OHIO

MAY 1977

I. TOXICITY DETERMINATION

A Health Hazard Evaluation was conducted by the National Institute for Occupational Safety and Health (NIOSH) on April 1-2, 1976, July 27-29, 1976 at the Hayes & Albion Company, Spencerville, Ohio. It has been determined on the basis of environmental sampling that exposure to chromic acid, sulfuric acid, nitric acid, methylene chloride, ethanol, sodium hydroxide, methyl ethyl ketone, toluene, acetone, carbon monoxide and vinyl chloride did not exceed recommended environmental criteria within the worksite areas.

However, it is our opinion that workers in the spray painting, and stripping areas may occasionally be exposed to excessive concentrations of methylene chloride, methyl ethyl, ketone, and toluene. These substances are known to produce nose, throat and skin irritation, nausea and headaches - symptoms which were reported by workers on confidential health questionnaires during this survey.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report are currently available upon request from NIOSH, Division of Technical Services, Information and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days the report will be available through the National Technical Information Service (NTIS), Springfield, Virginia. 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:

a) Hayes & Albion Company, Spencerville, Ohio
b) Authorized Representative of United Automobile Workers of America (UAW) Local Union #962
c) U.S. Department of Labor - Region V
d) NIOSH - Region V

For the purpose of informing the approximately 100 "affected employees" the employer shall promptly "post" for a period of 30 calendar days the Determination Report in a prominent place(s) near where exposed employees work.

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 an 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 United Automobile Workers of America (UAW) Local Union #962.regarding workers exposure to chromic acid, sulfuric acid, nitric acid, methylene chloride, ethanol, sodium hydroxide, methyl ethyl ketone, toluene, acetone and vinyl chloride. The alleged potential health hazards were confined to five areas in the plant - the Anodizing Department, Stripping Room, Paint Room, Vinyl Assembly and Final Assembly.

IV. HEALTH HAZARD EVALUATION

A. Description of Process - Conditions of Use

The Hayes & Albion Company, Spencerville, Ohio is a diversified company whose manufacturing facilities and management skills are readily projected into new products and markets. Among the products produced by the company are such distinctively different items as malleable iron castings, automotive engine cooling flex fans, aluminum textile beams. The Spencerville plant manufactures automobile trim and side molding and employs a total of 325 employees, two shifts per day, five days per week. Approximately 200 employees work on the first shift (7:00am - 3:30pm) and 125 employees work on the second shift (3:30pm -12:00 midnight). Of the 325 employees, 100 to 125 employees may be exposed to the alleged potential health hazards.

The anodize area is one of the main activities in the plant. The anodize area consists of a total of 28 anodize and cleaning tanks. The various aluminum parts are suspended in a sodium hydroxide solution, the anodizing is preceded and followed by various cleaning and rinsing baths. All caustic and acid tanks are ventilated. The chromic strip tank located in the anodize area is ventilated also.

The stripping operation is conducted in an isolated room for a period of four to six hours per day. Aluminum parts are submerged in a cleaning solution containing methylene chloride, acetone and toluene. The two stripping tanks are ventilated and the operators are provided with an organic vapor cartridge respirator.

The vinyl assembly and final assembly make up the largest group of employees consisting of 86 employees on two shifts. These employees rotate jobs every day. In the final assembly department polyvinyl chloride (PVC) strip application is heated with propane gas and pressure roller pressing PVC trim to the aluminum strip. In this area employees apply glue to the aluminum molding by means of an automatic spray which is ventilated. In the vinyl assembly department aluminum parts are heated with glue on them and PVC is bonded to the parts at 200°F-400°F by means of a heated press.

B. Evaluation Design

An initial survey was conducted on April 1-2, 1976. This survey included obtaining background information, conducting a walk-through survey in the five areas where the alleged hazards were present. They were 1) the Anodizing Department, 2) Stripping Room, 3) Paint Room, 4) Vinyl Assembly, and 5) Final Assembly. Twenty workers were interviewed. A brief confidential medical questionnaire was completed, containing identification data, occupational history and a medical history related to work exposures.

A follow-up survey was conducted on July 27 through 29, 1976. In addition to environmental sampling, thirty employees were interviewed using a structured questionnaire containing occupational history, health symptoms, prescreened conditions and smoking history. The work areas from which employees were interviewed included: anodizing, stripping room, paint room, vinyl assembly, final assembly. Each employee had worked in at least two different work areas; consequently, exposure years could not be calculated by work area. This prevents associating symptoms with other than present work area.

C. Environmental Evaluation Methods

Methyl ethyl ketone, ethanol and toluene were determined by collecting personal samples on charcoal tubes using a Sipin pump operating at 50 cc/minute flow rate and analyzed by gas chromatography. Charcoal tubes were changed after approximately half of the shift.

Concentrations of phosphoric and sulfuric acid were determined by collecting personal samples using a 3-piece closed face cassette containing an "AA" filter; flow rate at 1.5 lpm using a MSA pump. The samples were analyzed by a titrametric method.

Concentration of nitric acid was determined by collecting personal samples using a glass midget impinger containing sodium hydroxide solution at 1.0 lpm with a MSA pump and analyzed by colormetric method.

Concentration of sodium hydroxide was determined by collecting personal and general area samples using a glass impinger containing hydrochloric acid at 1.0 lpm with a MSA pump and analyzed by atomic absorption spectrophotometry.

Concentration of vinyl chloride was determined by collecting personal samples by drawing air using a Sipen pump operating at 50 cc/minute through tubes of activated charcoal, two tubes connected in series, and analyzed by gas chromatography.

Concentrations of methylene chloride and acetone were determined by collecting personal samples on charcoal tubes using a Sipin pump operating at 50 cc/minute flow rate and a maximum of 2 liters. The samples were analyzed by gas chromatography.

Concentration of chromic trioxide was determined by collecting personal samples using a 3-piece closed face cassette containing a VM-1 filter, flow rate at 1.5 lpm using a MSA pump. The samples were analyzed for chromic trioxide by a titration method.

Carbon monoxide was measured with a Drager pump and detector tubes.

D. Evaluation Criteria

1. Physiological Effects

The following is a brief summary of the adverse effects that may result from excessive exposure to each of the substances of concern:

Methyl Ethyl Ketone (MEK) - Industrial exposures to MEK are mainly those of inhalation and skin and eye contact. Skin absorption, while it may occur, is not considered to present a problem. Exposure to vapors of this agent may produce mucous membrane irritation, skin irritation, and dermatitis. More prolonged exposure may result in nausea, vomiting, headache, paresthesia and narcosis.[1]

Ethanol - Ethanol vapor is irritating to eyes and upper respiratory tract even at low concentration; other symptoms include headaches, sensation of heat, intra ocular tension, stupor, fatigue, and a great need for sleep.[2]

Toluene - Prolonged excessive exposure to this agent may acutely cause headache, weakness, fatigue, unconsciousness, loss of coordination, nausea, vomiting, anorexia, acute dermatitis and irritation of skin and mucous membranes.[3]

Phosphoric Acid - Reported to be a potent irritant of skin, eyes and mucous membranes of nose, throat and respiratory tract.[1]

Sulfuric Acid - Sulfuric acid mist is a strong irritant and the inhalation of concentrations of around 3 mg/cu. meter causes a choking sensation. Sulfuric acid also attacks the enamel of the teeth.[4]

Nitric Acid - Nitric acid is a strong irritant. Continued exposure to the vapor and/or mist is suspected of causing chronic bronchitis and possible chemical pneumonitis.[5]

Sodium Hydroxide - Characteristic irritation of nasal tissue frequently causes sneezing. The greatest hazard is that of rapid destruction of any tissue upon contact with concentrated solutions. Dermatitis may result from contact with dilute solutions.[6]

Vinyl Chloride - Much attention has recently been directed toward vinyl chloride in the work environment. Vinyl chloride exposures occur primarily in the production of vinyl chloride, in polymerization of vinyl chloride and the handling of freshly manufactured resin powder containing residual vinyl chloride. Trace concentrations of free vinyl chloride have sometimes been found at extrusion and molding operations during NIOSH studies at other plants utilizing PVC formulations.[7,8,9]

Vinyl chloride (the monomer from which PVC is made) is a carcinogenic agent. It is an etiological agent in the development of angiosarcoma of the liver (a rare form of liver cancer). As stated in NIOSH's Recommended Standard for Occupational Exposure to Vinyl Chloride[10], "there is probably no threshold for carcinogenesis although it is possible that with very low concentrations, the latency period might be extended beyond the life expectancy." In view of these considerations and NIOSH's inability to describe a safe exposure level as required in Section 20(a)(3) of the Occupational Safety and Health Act, the concept of a threshold limit for vinyl chloride gas in the atmosphere was rejected. As a result, the NIOSH recommended Standard for Occupational Exposure to Vinyl Chloride states that exposure to vinyl chloride monomer should not exceed levels that are detectable by the recommended methods of sampling and analysis.

Methylene Chloride - The toxic effect is predominantly narcosis. Symptoms of excessive exposure may be vertigo, weakness, headache, difficulty in speech, and possible blurred vision. Methylene chloride is only mildly irritating to the skin but the problem may be accentuated by its being sealed to the skin by tight clothing or shoes.[11]

Acetone - can produce a dry, scaly and fissured dermatitis after repeated exposure. High vapor concentrations may irritate conjunctive and mucous membranes of nose and throat.[1]

Chromic Trioxide - Exposure to chromic trioxide produces irritation and injury to the nasal passages and other respiratory symptoms.[12]

Carbon Monoxide - The signs and symptoms of acute carbon monoxide poisoning may include headache, nausea, vomiting, dizziness, drowsiness and collapse. Carbon monoxide exerts its harmful effect by reducing the oxygen-carrying capacity of the blood through the formation of carboxyhemoglobin. The intensity of the symptoms is related to the carboxyhemoglobin levels achieved. Deleterious alterations to the heart muscle may be initiated or enhanced in individuals with coronary heart disease who are exposed to carbon monoxide concentrations sufficient to produce a carboxyhemoglobin level greater than 5%. The role of cigarette smoking also must be considered since cigarette smoking causes increased exposure to carbon monoxide and there is an undeniable relationship between chronic cigarette smoking and increased risk of coronary heart disease. Important evidence

also exists which indicates that subtle aberrations may occur in the central nervous system during exposure to low levels of carbon monoxide. Upon weighing all these factors, NIOSH in its 1972 criteria document recommended an 8-hour time weighted average exposure of 35 ppm and a ceiling limit of 200 ppm.[13] The recommended time weighted average standard of 35 ppm is based on the concentration of carbon monoxide sufficient to produce a carboxyhemoglobin level not exceeding 5%. The ceiling concentration of 200 ppm represents an excursion above the 35 ppm level which is not expected to significantly alter the employees' carboxyhemoglobin level.

This recommended standard does not consider the smoking habits of workers since the level of carboxyhemoglobin in chronic cigarette smokers has generally been found to be in the 4 to 5 percent range before exposure to carbon monoxide.

The current permissible OSHA limit for an 8-hour time weighted average exposure to carbon monoxide is 50 ppm. This value also is recommended by the ACGIH as its 1975 threshold limit value.

2. Environmental Evaluation Criteria

To assess the potential toxicity for the concentrations of air contaminants found in the place of employment, three primary sources of criteria were used (1) NIOSH Criteria for Recommended Standards for Occupational Exposure to Substances (Criteria Documents); (2) recommended and proposed threshold limit values (TLV's) and their supporting documentation as set forth by the American Conference of Governmental Industrial Hygienists (ACGIH) 1976; and (3) Occupational Health Standard as promulgated by the U.S. Department of Labor (29 CFR Part 1910.1000).

In the following tabulation of criteria, the most appropriate values in the opinion of the author are presented with reference:

Substance	Permissible Exposures (8-hour time weighted average)
[1]Methyl Ethyl Ketone (MEK)	200 mg/M^3*
[1]Ethyl Alcohol (Ethanol)	1900 mg/M^3
[2]Toluene	375 mg/M^3
[1]Phosphoric Acid	1 mg/M^3
[3]Sulfuric Acid	1 mg/M^3
[4]Nitric Acid	5 mg/M^3
[5]Sodium Hydroxide	2 mg/M^3
[6]Methylene Chloride	720 mg/M^3
[1]Acetone	2400 mg/M^3
[7]Chromic Trioxide	0.1 mg/M^3
[8]Carbon Monoxide	35 ppm**
[9]Vinyl Chloride	---

* Units of measured concentrations: mg/M^3 - milligrams of substance per cubic meter of air.
** Parts of carbon monoxide per million parts of contaminated air by volume.

[1]Reference: 1976 ACGIH TLV and the current OSHA standards.

[2]Reference: The NIOSH 1973 criteria document and the 1976 ACGIH TLV. The current OSHA standard 375 mg/M^3.

[3]Reference: The NIOSH 1975 criteria document, the 1976 ACGIH TLV and the current OSHA standard.

[4]Reference: The NIOSH 1976 criteria document, the 1976 ACGIH TLV and the current OSHA standard.

[5]Reference: The NIOSH 1975 criteria document, the 1976 ACGIH TLV and the current OSHA standard.

[6]Reference: The 1976 ACGIH TLV. The current OSHA standard is 1750 mg/M^3.

[7]Reference: The NIOSH 1973 criteria document is 0.05 mg/M^3. The 1976 ACGIH TLV and the current OSHA standard is 0.1 mg/M^3.

[8]Reference: The NIOSH 1972 criteria document. The 1976 ACGIH TLV and the current OSHA standard is 50 ppm.

[9]Reference: No safe exposure level has been described as required in Section 20(a)(3) of the Occupational Safety and Health Act of 1970; therefore, any detectable level of vinly chloride is unsafe. The Occupational Safety and Health Standard (29 CFR 1910.1000) as of January 1, 1976, for vinyl chloride is one part per million average over any 8-hour period; at five parts per million, average over any period not exceeding 15 minutes.

TLV's or occupational health standards for substances are usually established at levels designed to protect workers occupationally exposed on an 8-hour per day, 40 hours per week basis over a working lifetime. Because of a wide variation in individual susceptibility, some workers may experience ill effects at or below the designated levels. Thus, an evaluation of the work place cannot be based entirely upon comparisons made against such TLV's or standard, as various TLV's and standard do not represent absolute protection of all workers. Federal standards are the legal standards and enforcement is a responsibility of the U.S. Department of Labor, OSHA.

E. Evaluation Results and Discussion

1. Environmental

It has been determined on the basis of environmental sampling in the five work areas covering eleven substances on July 27 through 29, 1976, that none of the samples analyzed were above the recommended criteria used in this evaluation. For a detailed description of all environmental samples, process operations and locations please refer to Tables I through VI.

Nine personal and one general area samples were collected in the anodize area for phosphoric acid, sulfuric acid and sodium hydroxide; all samples were below the analytical limit of detection. Only low levels of nitric acid were reported. Four personal samples were collected at the chromic strip tank for phosphoric acid and chromium trioxide; all samples were below the analytical limit of detection.

Ten personal samples were collected at the stripping operation. No levels of methyl ethyl ketone or acetone were detected; levels of methylene chloride and toluene were detected at 15 to 60% of the criteria.

Ten personal samples were collected at the spray painting booths. No levels of acetone were detected. Levels of methylene chloride approached 70% of the criteria, toluene 15% and methyl ethyl ketone 10% with one sample at 50% of the criteria.

Ten personal samples were collected in the vinyl and final assembly for vinyl chloride. All levels were found to be below the analytical limit of detection (<0.001 mg).

Twelve personal samples were collected at the glue operation for three substances contained in the glue. No levels of ethanol were found. Levels less than 5% of the criteria for methyl ethyl ketone and toluene were detected.

The levels of carbon monoxide in the five areas monitored were less than 10 ppm, below the federal standard of 50 ppm.

2. Medical

There were 25 female employees ranging in age from 25-60, with a mean of 38 years, and five male employees ranging in age from 30-52, with a mean of 45 years. 16/30 reported smoking cigarettes. 14/30 reported as not smoking; however, eight of the 14 were former smokers.

Table VII lists the number of employees reporting specific symptoms away from work, during work hours and on the day of interview. 26/30 employees reported symptoms present during work hours. 21/30 employees reported symptoms present off the job. 21/30 employees reported symptoms present on the day of the interview. Five employees reported symptoms present on the job but not occurring off the job. The symptoms they reported included: nose irritation, tightness in the chest; runny nose; headache.

Employees reporting symptoms of shortness of breath, coughing, nose irritation, throat irritation, tightness in chest, and pain in chest on the days of the sampling were either current smokers or former smokers with the following exceptions. Two of the twelve reporting coughing and throat irritation did not or had never smoked. Two of the ten reporting tightness in the chest did not smoke, one of the three reporting pain in the chest did not smoke.

One of the six employees reporting nausea was pregnant and stated her symptoms were related to the pregnancy.

Table VIII lists the total number of employees reporting symptoms by work area.

Table IX lists the number of employees reporting conditions that have been diagnosed by a physician. 9/30 employees reported health conditions for which they are currently seeing a physician. 11/30 employees reported current use of medication prescribed by a physician. 16/30 employees reported hospitalization within the last five years. None of the above conditions could be related to any specific job in the five areas.

3. Conclusions

It has been determined on the basis of environmental sampling that exposure to chromic acid, sulfuric acid, nitric acid, methylene chloride, ethanol, sodium hydroxide, methyl ethyl ketone, toluene, acetone, carbon monoxide and vinyl chloride did not exceed recommended environmental criteria within the worksite areas.

However, it is our opinion that workers in the spray painting, and stripping areas may occasionally be exposed to excessive concentrations of methylene chloride, methyl ethyl, ketone, and toluene. These substances are known to produce nose, throat and skin irritation, nausea and headaches - symptoms which were reported by workers on confidential health questionnaires during this survey.

V. RECOMMENDATIONS

On July 27 through 29, 1976 several spray painters and a shieldwash operator were observed wearing respirators. Pursuant to Part 1910.134(b) of the U.S. Department of Labor (OSHA) Code of Federal Regulations (CFR), it is recommended that a written respirator program meeting the outlined eleven criteria for a "minimal acceptable program" be prepared.

1. Respirators used should be those certified under the NIOSH Respirator Standard, 30 CFR, Part II.

2. An educational program should be instituted so that employee is made aware of the hazard associated with the materials. Good work practices and first aid procedures should also be included in this program.

3. All local exhaust ventilation systems should be serviced regularly to insure that they are operating at maximum efficiency.

REFERENCES

1. Occupational Diseases, A Guide to their Recognition, USPHS, 1964, Wm. Gafafer, Ed.

2. Documentation of Threshold Limit Values, American Conference of Governmental Industrial Hygienists, Committee of Threshold Limit Values, Cincinnati, Ohio.

3. Criteria for Recommended Standard for Occupational Exposure to Toluene.

4. Criteria for Recommended Standard for Occupational Exposure to Surfuric Acid.

5. Criteria for Recommended Standard for Occupational Exposure to Nitric Acid.

6. Criteria for Recommended Standard for Occupational Exposure to Sodium Hydroxide.

7. Okawa, M., HHE Report No. 74-96-173, NIOSH, February, 1975.

8. Straub, W., HHE Report No. 74-85-185, NIOSH, April, 1975.

9. Okawa, M., HHE Report No. 75-1-194, NIOSH, May 1975.

10. NIOSH Recommended Standard for Occupational Exposure to Vinyl Chloride, with excerpt from a March 11, 1974 memorandum from Marcus M. Key, Director, National Institute for Occupational Safety and Health to John H. Stender, Assistant Secretary of Labor, Occupational Safety and Health Administration.

11. Criteria for Recommended Standard for Occupational Exposure to Methylene Chloride.

12. Criteria for Recommended Standard for Occupational Exposure to Chromium VI.

13. Criteria for Recommended Standard for Occupational Exposure to Carbon Monoxide.

VII. AUTHORSHIP AND ACKNOWLEDGMENTS

Report Prepared By:

Raymond L. Ruhe
Industrial Hygienist
Hazard Evaluation and
Technical Assistance Branch
Cincinnati, Ohio

Laura Andersen, R.N.
Section Chief
Medical Services Section
Support Services Branch
Cincinnati, Ohio

Originating Office:

Jerome P. Flesch
Acting Chief, Hazard Evaluation
and Technical Assistance Branch
Cincinnati, Ohio

Acknowledgments

Environmental Evaluation:

John R. Kominsky
Industrial Hygienist

Norbert Schutte
Industrial Hygienist

Computer and Statistical Services Section:

Jeanne R. Burg, Ph.D.
Chief

Dorothy Lowe
Statistician

Analytical Laboratory Services:

James B. Perkins, Chemist
Utah Biomedical Test Laboratory
Salt Lake City, Utah

TABLE I

Anodizing Area

Hayes and Albion Company
Spencerville, Ohio

Job and/or Location	Date	Sample Period	Sample Volume (Liters)	Type	Nitric Acid ***mg/M^3)	Phosphoric Acid (mg/M^3)	Sulfuric Acid (mg/M^3)	Sodium Hydroxide (mg/M^3)
Anodizing Lineman	7-28-76	0804 - 1346	342	*PBZ	0.10	-	-	-
Anodizing Lineman	7-29-76	0720 - 1321	361	PBZ	0.03	-	-	-
Anodizing Lineman	7-29-76	0759 - 1324	325	PBZ	0.02	-	-	-
Anodizing Lineman	7-28-76	0804 - 1346	513	PBZ	-	LD	-	-
Anodizing Lineman	7-29-76	0722 - 1324	543	PBZ	-	LD	-	-
Anodizing Lineman	7-28-76	0804 - 1346	513	PBZ	-	-	LD	-
Anodizing Lineman	7-29-76	0722 - 1324	543	PBZ	-	-	LD	-
Anodizing Area	7-28-76	0804 - 1346	342	**GA	-	-	-	LD
Anodizing Lineman	7-29-76	0725 - 1321	354	PBZ	-	-	-	LD
Anodizing Lineman	7-29-76	0759 - 1324	325	PBZ	-	-	-	LD
The NIOSH 1976 Criteria Document					5	-	-	-
The 1976 ACGIH TLV and the current OSHA Standard					-	1	-	-
The NIOSH 1974 Criteria Document					-	-	1	-
The NIOSH 1975 Criteria Document					-	-	-	2

*PBZ - Personal Breathing Zone
**GA - General Area
***mg/M^3 - Milligrams of substance per cubic meter of air

Nitric Acid - Limit of Detection	0.2 ug/ml
Phosphoric Acid - Limit of Detection	0.2 ug/ml
Sulfuric Acid - Limit of Detection	0.2 mg/sample
Sodium Hydroxide - Limit of Detection	0.006 mg/sample

L.D. - Less than detectable limits

TABLE II

Anodizing Area
Chromic Strip Tank

Hayes and Albion Company

Job and/or Location	Date	Sampling Period	Sample Volume (Liters)	Type	Phosphoric Acid (mg/M^3)**	Chromium Trioxide
Chromic Strip Tank	7-28-76	720 - 1100	330	PBZ*	LD	-
Chromic Strip Tank	7-29-76	709 - 1345	504	PBZ	LD	-
Chromic Strip Tank	7-28-76	720 - 1100	330	PBZ	-	LD
Chromic Strip Tank	7-29-76	709 - 1345	504	PBZ	-	LD
The 1976 ACGIH TLV and current OSHA Standard					1	-
The NIOSH 1973 Criteria Document is						0.05

*Persqnal Breathing Zone
**mg/M^3 - milligrams of substance per cubic meter of air

Phosphoric Acid - Limit of Detection 0.02 ug/ml
Chromium Trioxide - Limit of Detection < 0.2 ug/sample
LD - less than detectable limits

TABLE III

Stripping Aluminum Parts

Hayes and Albion Company

Job and/or location	Date	Sampling Period	Sample Volume (Liters)	Type	Methyl Ethyl Ketone (MEK) (mg/M^3)**	Toluene (mg/M^3)	Methylene Chloride (mg/M^3)	Acetone (mg/M^3)
Shieldwash	7-28-76	1217 - 1247	1.4	PBZ*	-	-	280	LD
Shieldwash	7-28-76	1217 - 1247	1.5	PBZ	-	-	200	LD
Shieldwash	7-28-76	1250 - 1320	1.7	PBZ	-	-	412	LD
Shieldwash	7-28-76	1250 - 1320	1.8	PBZ	-	-	278	LD
Shieldwash	7-28-76	1322 - 1352	1.5	PBZ	-	-	127	LD
Shieldwash	7-28-76	1322 - 1352	1.7	PBZ	-	-	135	LD
Shieldwash	7-29-76	1203 - 1233	1.7	PBZ	-	-	129	LD
Shieldwash	7-29-76	1235 - 1305	1.6	PBZ	-	-	125	LD
Shieldwash	7-28-76	734 - 1107	12.1	PBZ	LD	56	-	-
Shieldwash	7-29-76	748 - 1113	11.4	PBZ	LD	53	30	LD
The 1976 ACGIH TLV and current OSHA Standard.					590	-	-	-
The NIOSH 1973 Criteria Document and the 1976 ACGIH TLV					-	375	-	-
The 1976 ACGIH TLV. The current OSHA Standard is 500ppm					-	-	720	-
The 1976 ACGIH TLV and current OSHA Standard					-	-	-	2400

*Personal Breathing Zone

**mg/M^3 - Milligrams of substance per cubic meter of air

Methyl Ethyl Ketone - Limit of detection 0.01 mg/sample

Toluene - Limit of detection 0.01 mg/sample

Methylene Chloride - Limit of detection 0.01 mg/sample

Acetone - Limit of detection 0.01 mg/sample

LD - Less than detectable limits

TABLE IV

Spray Painting

Hayes and Albion Company

Job and/or Location	Date	Sampling Period	Sample Volume (liters)	Type	Methylene Chloride (mg/M^3)**	Acetone (mg/M)	Toluene (mg/M^3)	Methyl Ethyl Ketone (mg/M^3)
Spray Painting	7-28-76	1300 - 1425	5.1	PBZ*	30	LD	53	LD
Spray Painting	7-29-76	808 - 910	3.1	PBZ	503	LD	-	-
Spray Painting	7-29-76	910 - 1018	3.8	PBZ	418	LD	-	-
Spray Painting	7-28-76	845 - 1050	14.5	PBZ	-	-	57	300
Spray Painting	7-28-76	847 - 1053	14.3	PBZ	-	-	25	74
Top Coating Operator	7-28-76	850 - 1056	14.6	PBZ	-	-	10	56
Spray Painting	7-28-76	856 - 1055	14.1	PBZ	-	-	11	4
Spray Painting	7-28-76	859 - 1054	14.6	PBZ	-	-	22	41
Spray Painting	7-28-76	903 - 1054	10.1	PBZ	-	-	18	50
Top Coating Operator	7-29-76	808 - 1018	6.4	PBZ	-	-	25	73
The 1976 ACGIH TLV is 720 mg/M^3. The current OSHA Standard is 1750 mg/M^3.					720	-	-	-
The 1976 ACGIH TLV and the current OSHA Standard					-	2400	-	-
The 1973 Criteria Document and the 1976 ACGIH TLV					-	-	375	-
The 1976 ACGIH TLV and current OSHA Standard					-	-	-	590

*Personal Breathing Zone
**mg/M^3 - milligrams of substance per cubic meter of air
Methylene Chloride - Limit of detection 0.01 mg/sample
Acetone - Limit of detection 0.01 mg/sample
Toluene - Limit of detection 0.01 mg/sample
Methyl Ethyl Ketone - Limit of detection 0.01 mg/sample
LD - less than detectable limits

TABLE V

Vinyl and Final Assembly Department

Hayes and Albion Company
Spencerville, Ohio

Job and/or Location	Date	Sampling Period	Sample Volume (Liters)	Type	Vinyl Chloride **Milligrams
Final Assembly Machine Operator	7-28-76	0817 - 1411	20.3	*PBZ	L.D.
Final Assembly Machine Operator	7-28-76	0825 - 1411	15.6	PBZ	L.D.
Final Assembly Machine Operator	7-28-76	0827 - 1413	16.7	PBZ	L.D.
Final Assembly Machine Operator	7-28-76	0830 - 1414	14.6	PBZ	L.D.
Vinyl Roll Machine Operator #2	7-28-76	0836 - 1416	12.9	PBZ	L.D.
Vinyl Roll Machine Operator #1	7-28-76	0840 - 1107	7.1	PBZ	L.D.
Vinyl Roll Machine Operator #6	7-28-76	0843 - 1415	13.8	PBZ	L.D.
Vinyl Set Up Man	7-28-76	0847 - 1111	8.2	PBZ	L.D.
Vinyl Roll Machine Operator #8	7-28-76	0958 - 1415	14.5	PBZ	L.D.
Vinyl Assembly Salvage Operator	7-29-76	0735 - 1339	17.1	PBZ	L.D.

*PBZ - Personal Breathing Zone
**Milligrams of substance
Vinyl Chloride - Limit of detection 0.001 mg
L.D. = Less than detectable limits

TABLE VI

Automatic Glue Spraying Application

Hayes and Albion Company

Job and/or Location	Date	Sampling Period	Sample Volume (Liters)	Type	Methyl Ethyl Ketone (mg/M^3)**	Toluene (mg/M^3)	Ethanol mg/M^3)
Glue Operator	7-28-76	752 - 1059	9.8	PBZ*	3	8	-
Glue Operator	7-28-76	755 - 1058	8.2	PBZ	LD	5	-
Glue Operator	7-28-76	901 - 1200	9.9	PBZ	29	16	-
Glue Operator	7-29-76	725 - 1120	12.8	PBZ	LD	3	-
Glue Operator	7-29-76	1239 - 1309	1.4	PBZ	-	-	LD
Glue Operator	7-28-76	1206 - 1216	0.6	PBZ	-	-	LD
Glue Operator	7-28-76	1206 - 1216	0.5	PBZ	-	-	LD
Glue Operator	7-28-76	1216 - 1226	0.6	PBZ	-	-	LD
Glue Operator	7-28-76	1226 - 1246	1.1	PBZ	-	-	LD
Glue Operator	7-28-76	1226 - 1246	1.2	PBZ	-	-	LD
Glue Operator	7-29-76	1310 - 1340	1.5	PBZ	-	-	LD
The 1976 ACGIH TLV and current OSHA Standard					590	-	-
The 1973 Criteria Document and the 1976 ACGIH TLV					-	375	-
The 1976 ACGIH TLV and current OSHA Standard					-	-	1900

*Personal Breathing Zone

**mg/M^3 - Milligrams of substance per cubic meter of air

LD - Limit of Detection

Methyl Ethyl Ketone - Limit of detection 0.01 mg/sample

Toluene - Limit of detection 0.01 mg/sample

Ethanol - Limit of detection 0.01 mg/sample

TABLE VII

Hayes and Albion Company
Spencerville, Ohio

Number of employees reporting specific symptoms away from work, during work hours and on the day of interview.

Symptoms	Employees reporting		Away from work		During work		On day of interview	
	No.	%	No.	%	No.	%	No.	%
Shortness of breath	6	20.0	5	16.6	6	20.0	1	3.3
Tightness in chest	10	33.3	7	23.3	8	26.6	7	23.3
Pain in your chest	3	10.0	1	3.3	2	22.2	0	--
Coughing	12	40.0	11	36.6	10	33.3	7	23.3
Nose irritation	11	36.6	3	10.0	10	33.3	7	23.3
Throat irritation	12	40.0	4	13.3	11	36.6	9	30.0
Nose bleeds	1	3.3	1	3.3	1	3.3	0	--
Runny nose	6	20.0	4	13.3	6	20.0	2	22.2
Sinus problems	9	30.0	8	26.6	9	30.0	3	10.0
Eye soreness	6	20.0	2	22.2	6	20.0	3	10.0
Skin rashes	4	13.3	3	10.0	4	13.3	2	22.2
Frequent headaches	11	36.6	4	13.3	11	36.6	2	22.2
Dizziness	3	10.0	3	10.0	3	10.0	0	--
Nausea	6	20.0	1	3.3	6	20.0	2	22.2
Loss of coordination	2	22.2	1	3.3	2	22.2	0	--
Total number of specific symptoms	102		58		95		45	

TABLE VIII

Hayes and Albion Company
Spencerville, Ohio

Total Number of employees reporting symptoms by present areas

SYMPTOMS	Anodizing	Final Assembly	Paint Shop	Stripping Room	Vinyl Assembly
Shortness of Breath	3	2	1	0	0
Tightness in chest	1	5	3	0	1
Pain in chest	1	1	1	0	0
Coughing	3	4	3	1	1
Nose irritation	1	3	5	1	1
Throat irritation	1	5	4	1	1
Nose bleeds	0	0	1	0	0
Runny nose	0	2	3	0	1
Sinus problems	2	2	4	0	1
Eye soreness	0	4	1	0	1
Skin rashes	1	1	1	1	0
Frequent headaches	3	5	2	0	1
Dizziness	0	2	1	0	0
Nausea	0	3	2	0	0
Loss of coordination	0	1	1	0	0
Total number of employees reporting symptoms	6	12	7	2	3

TABLE IX
Hayes and Albion Company
Spencerville, Ohio

Number of employees reporting conditions which had been diagnosed by a physician

Conditions	Employees Reporting Conditions
An injury to chest	1
Bronchitis	3
Pneumonia	7
Pleurisy	6
Bronchial Asthma	1
Emphysema	1

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
4676 COLUMBIA PARKWAY
CINCINNATI, OHIO 45226

CONSENT FORM

I voluntarily agree to participate in a study conducted by the U.S. Public Health Service at Hayes-Albion Company. I understand that the medical evaluation will consist of my answering questions about my health.

I understand that my participation in this study is voluntary and that all information obtained will be confidential in accordance with U.S. Public Health Service Regulations (42 CFR Part I).

DATE_____ SIGNATURE_____

PRINT NAME_____

AUTHORITY TO GIVE MEDICAL REPORT

I hereby request the Public Health Service to inform:

My Personal Physician: Yes ___ No ___

NAME_____

ADDRESS_____ _____
Signature

_____

Any other physician: Yes ___ No ___

NAME_____

ADDRESS_____ _____
Signature

_____

of my test results from this study.

(7/76)

SUBJECT IDENTIFICATION

NAME _____
Last First Middle Initial

ADDRESS: _____

CITY: _____

STATE: _____ ZIP CODE _____

PERSONAL DATA

1. Interviewer: _____

2. Date of interview: _____

3. Social Security Number: _____ - _____ - _____

4. Telephone: _____

5. Sex/Race:
   1. White male _____
   2. White female _____
   3. Black male _____
   4. Black female _____
   5. Other male _____
   6. Other female _____

6. Birthday: (month/day/year) _____

7. Age last birthday in years _____

OCCUPATIONAL HISTORY

Now I am going to ask you about the jobs you have held, since you started working regularly. I would like to begin with your present job, here at the Hayes-Albion Company

---

PRESENT JOB

1. In what year did you start working here? _____
2. What department do you work in? _____
3. What is(was) your occupation or job title? _____
4. How many years have you had this job? _____
5. Have you held any <u>other</u> jobs in this department? Yes____ No____

   (If Yes: Repeat questions 3,4, and 5. Record all jobs held in the department Repeat question 5 until unproductive.)

6. Have you worked in any <u>other</u> department? Yes____ No____

   (If yes: Repeat questions 3,4,5, and 6. Repeat question 6 until you ascertain that the subject has worked in no other departments.)

Hayes-Albion YEAR STARTED 19____

DEPARTMENT	JOB TITLE	NO. OF YEARS

PREVIOUS EMPLOYMENT

7. How, where did you work before you started working for Hayes-Albion?

8. What kind of company (was) is it; what do they(did)do there?

9. In what year did you start working there?

10. And, in what year did you stop working there?

11. What was your occupation or job title?

12. What exactly was your main job or activity?
(What kind of work did you do most of the time?)

Repeat Questions 8-12 for each job. Repeat question 7 until you ascertain that you have recorded all of the subjects regular jobs prior to 1966.

EMPLOYER	TYPE CO.	FROM	TO	JOB TITLE	WORK DESCRIPTION

SYMPTOMS

I am going to read you a list of health conditions which people sometimes have. Do you have, or have you recently had, any of the following conditions?

If Yes: (a) Do you usually have this away from the job or during the workshift?

If during the workshift: (b) Do you have this condition today?

		YES		
	NO	AWAY FROM JOB	DURING WORKSHIFT	TODAY
1. Shortness of breath	___	___	___	___
2. Tightness in your chest	___	___	___	___
3. Pain in your chest	___	___	___	___
4. Coughing	___	___	___	___
5. Nose irritation or dryness	___	___	___	___
6. Throat irritation or dryness	___	___	___	___
7. Nose bleeds	___	___	___	___
8. Runny nose	___	___	___	___
9. Sinus problems	___	___	___	___
10. Eye soreness or irritation (burning, watering, itching, redness)	___	___	___	___
11. Skin rashes or irritations	___	___	___	___
12. Frequent headaches	___	___	___	___
13. Dizziness	___	___	___	___
14. Nausea or feeling sick to your stomach	___	___	___	___
15. Loss of coordination	___	___	___	___

CONDITION

Have you ever been told by a doctor that you had any of the following:
(Insert proper code Code: 0 = No; 1 = Once; 2 = Twice;....9 = Nine or more times.)

1. An injury or operation affecting your chest? _____
2. Bronchitis? _____
3. Pneumonia? _____
4. Pleurisy? _____
5. Pulmonary tuberculosis? _____
6. Bronchial asthma? _____
7. Emphysema? _____
8. Bronchiectasis? _____
9. Other chest trouble? _____
10. Do you now have any health condition for which you are seeing a doctor?

    Yes_____ No_____

    If Yes: What kind of condition? Are you seeing a doctor for any other health conditions?

    Specify: _____

    _____

    _____

11. Are you regularly taking any medicines prescribed by a doctor or other health practioner?

    Yes_____ No_____

    If Yes: What medicines are you regularly taking? _____

    _____

    Are you regularly taking any other medicines prescribed by a doctor or health practioner?

    Yes_____ No_____

    Specify_____

    _____

12. Have you been hospitalized in the last 5 years? Yes_____ No_____
If yes: Why were you hospitalized? When? What Year?

DATE	REASON
_____	_____
_____	_____
_____	_____
_____	_____

TOBACCO SMOKING

1. Do you now smoke cigarettes? Yes_____ No_____
If Yes: Go to question 4.
If No:
2. Have you ever smoked cigarettes? Yes_____ No_____
If Yes: Go to question 4
If No:
3. Have you smoked at least as many as five packs of cigarettes, that is 100, cigarettes during your entire life?
Yes_____ No_____
If No: Go to question 8
If Yes:
4. How old were you when you started smoking cigarettes regularly?
_____Age in years

(For Ex-smokers)

5. How old were you when you last gave up smoking cigarettes?
_____Age in years

6. How much do/did you smoke on the average? _____Cig/day

7. Do/did you inhale the cigarette smoke? Yes_____ No_____

8. What do/did you mostly smoke?
a) _____Filter _____Non-Filter
b) _____Regular _____King Size _____100 Millimeter

9. Do you now smoke a pipe? Yes_____ No_____

If Yes: Go to question 11

If No:

10. Have you ever smoked a pipe? Yes_____ No_____

11. How many bowlsful a week do/did you smoke? _____

12. Do you now smoke cigars? Yes_____ No_____

If Yes: Go to question 14

If No:

13. Have you ever smoked cigars Yes_____ No_____

14. How many cigars a week do/did you smoke? _____Cigars/day

ALCOHOL CONSUMPTION

1. Have you drunk as many as 20 alcoholic beverages in your entire life?

Yes_____ No_____

(If NO, skip remainder of section)

2. Do you drink alcoholic beverages now? Yes_____ No_____

IF NO:

3. How old were you when you have up drinking? _____Year

4. On the average, how many beers do/did you drink per day? _____

5. About how many bottles of wine do/did you usually drink per week? _____

6. On the average, how many cocktails or drinks of other liquor do/did you have per week?

_____

7. How old were you when you started drinking? _____Age