U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
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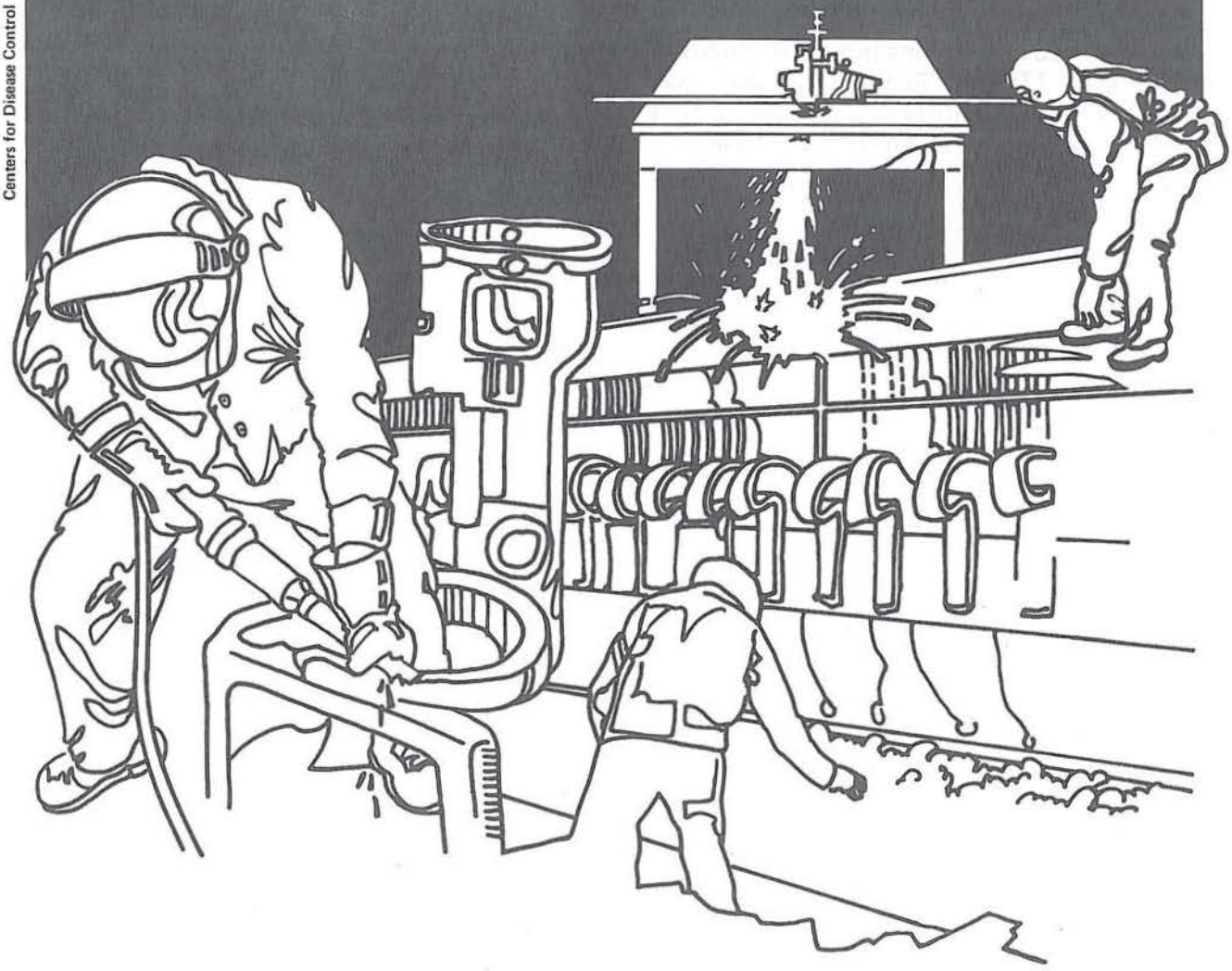
NIOSH



Health Hazard Evaluation Report

HHE 80-165-907
INTERNATIONAL HARVESTER
TRUCK ENGINEERING AND DESIGN CENTER
FT. WAYNE, INDIANA

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.

HE 80-165-907
International Harvester
Truck Engineering and Design Center
Ft. Wayne, Indiana
June 1981

NIOSH INVESTIGATOR:
James M. Boiano, IH

I. SUMMARY

On June 4, 1980 the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation from the Society of Engineering Employees Union (S.E.E.) to evaluate chemical hazards and exposures in workers employed at the International Harvester, Truck Engineering and Design Center, Ft. Wayne, Indiana. Workers were concerned about exposures to wood and cured resin dusts, epoxy resin systems, and solvents used in model making, and about the development of colon cancer in one model maker. Other reported health complaints included eye and skin irritation. At the request of the union NIOSH postponed the investigation until plastic layup work was in progress.

On February 3-4, 1981, NIOSH conducted an industrial hygiene evaluation of 16 model and pattern makers employed at this facility. Personal air samples were collected for styrene, acetone, methyl ethyl ketone (MEK), toluene, and 1,1,1,-trichloroethane analysis on modelers using lacquer thinner; and for MEK, methyl isobutyl ketone (MIBK), ethyl acetate, n-butyl acetate, and cellosolve acetate analysis on modelers using epoxy sealer. Personal and/or general area air samples for analysis of bisphenol A (BPA) and diglycidyl ether of bisphenol A (DGEBPA), wood dusts, and cured resin particulates (nuisance dusts) were also collected. In addition, the general and local exhaust ventilation systems were assessed.

Results of the environmental sampling indicate that concentrations of these substances were all below the evaluation criteria used in this report. The only solvent vapors detected were styrene, toluene, and MIBK. Styrene levels ranged to 14.6 mg/M^3 (criteria - 435 mg/M^3). Toluene levels ranged from 31.8 to 58.5 mg/M^3 (criteria - 375 mg/M^3) and MIBK levels ranged to 1.6 mg/M^3 (criteria - 200 mg/M^3). Exposure to the mixture of styrene and toluene vapors ranged to 0.18 of the mixture criteria of 1.00.

Measured concentrations of BPA and DGEBPA ranged up to 0.0083 and 0.0004 mg/M^3, respectively. Currently no environmental criteria have been suggested for these compounds. The measured levels for both compounds are, however, very low and should present no adverse health effects to workers.

Two air samples collected for wood dust showed concentrations of 0.80 and 0.31 mg/M^3 (criteria - 5.0 mg/M^3). Personal samples for cured resin particulate ranged from 2.19 to 3.13 mg/M^3 (criteria - 10 mg/M^3).

Ventilation measurements of the local exhaust hoods indicated that capture velocities were sufficient to remove vapors and fine dusts. However, dusts generated by hand-held grinding of cured resins were not effectively contained. General ventilation was calculated to produce 4 to 5 room changes per hour which is within the proposed guidelines for model shops with local exhaust supplementation.

From data obtained during the investigation NIOSH determined that the small quantities of airborne contaminants detected at International Harvester Company are not hazardous to exposed employees. Recommendations on improving the ventilation system and for assuring safe and healthful working conditions are presented on pages 7 and 8 of this report.

KEYWORDS: SIC 3999 (Manufacturing Industries; Not Elsewhere Classified) styrene, acetone, methyl ethyl ketone, toluene, 1,1,1,-trichloroethane, methyl isobutyl ketone, ethyl acetate, n-butyl acetate, cellosolve acetate, bisphenol A, diglycidyl ether of bisphinol A, wood dust, cured resin particulates, nuisance dust.

II. INTRODUCTION

Under the Occupational Safety and Health Act of 1970 NIOSH investigates the toxic effects of substances found in the workplace. During June 1980 NIOSH received a request from an authorized representative of the Society of Engineering Employees union (S.E.E.) at International Harvester Company, Fort Wayne, Indiana regarding exposure of employees to solvents, cured resin dusts and wood dust. The request stated that employees were experiencing skin and eye irritation due to work exposures.

At the request of the union this investigation was postponed until February 3-4, 1981, when plastic layup work was in progress.

III. BACKGROUND

1. Plant/Process Description

International Harvester, Truck Engineering and Design Center, Ft. Wayne, Indiana, employs approximately 350 workers responsible for the conceptualization, engineering, design and fabrication of prototype truck models. The facility, occupied by the company since 1965 is a brick, single story building of approximately 160,000 sq. ft. Offices, drafting, and design studios comprise about 80% of the floor space. The remaining area, located in the northeast section of the building includes the Styling department, the area of concern in this evaluation.

The Styling Department consists of a model studio and workshop. The model studio occupies 19,200 sq. ft. and houses prototype clay and fibrous glass reinforced plastic truck models, either completed or at various stages of assembly. Work activities in this area include clay modeling and plaster casting of body parts. The workshop, occupying an area of 4,800 sq. ft., is where most of the model fabrication work is done. Activities in the workshop include mixing and layup of epoxy resin systems into plastic molds; fibrous glass reinforced plastic body filling with styrene containing polyester resin; sawing, grinding, and/or sanding of cured epoxy resin/polyester; and carpentering of plaster mold support forms.

2. Demography

Seventeen workers, all male, are employed in the Styling Department. They include 15 modelers (10 industrial designers and 5 concept engineers), 1 patternmaker, and 1 supervisor. All employees except for the patternmaker are salaried, and only the industrial designers are S.E.E. members. The average length of employment for the non-supervisory personnel is 17.4 years (range 9-26 yrs). The work shift is from 7:30am to 4:00pm, five days a week.

3. Engineering Controls

Engineering controls in the workshop include (1) a main ceiling local exhaust system for layup and fabrication of epoxy resin systems, (2) local exhaust for some of the wood and plastic fabricating machines, and (3) a ventilated spray paint booth. The main ceiling system encompasses 4 hoods, 3 of which are part of the Swing Arc Fume Exhauster (SAFE) units which are positionable, flexible ducts with slanted conical hoods. The other hood is a bench top lateral slot hood used during epoxy mixing and solvents use. An incomplete section of ducting to the model studio was also connected to this system for the impending addition of a fourth SAFE unit.

The wood and plastic fabricating machines, used infrequently during this evaluation, are exhausted in combination or individually. Three of the machines, two grinders and a planer, are exhausted into a Torit floor model dust collector. The table saw and two band saws are equipped with intrinsic dust collectors. One grinder and a bandsaw were not vented.

A 30x16x12 ft. spray paint booth was used by modelers for polyester body filling work since spray painting is done on an infrequent basis.

IV. ENVIRONMENTAL DESIGN AND METHODS

Bulk liquid samples of the two solvents in use in the model shop (epoxy sealer and lacquer thinner) were obtained and qualitatively analyzed for organics by gas chromatography/mass spectroscopy (GC/MS). An air sample collected on charcoal/silica gel tubes directly above a container of epoxy resin/hardener was also analyzed by GC/MS for volatile organics/amines possibly generated during the curing process. Based on the analyses NIOSH concluded that the environmental evaluation should focus on the determination of environmental concentrations of (1) organic solvents, i.e., styrene, acetone, methyl ethyl ketone (MEK), toluene, and 1,1,1,-trichloroethane (111-TCE) during use of lacquer thinner in the paint spray booth, (2) organic solvents, i.e., MEK, methyl isobutyl ketone (MIBK), ethyl acetate, n-butyl acetate, and cellosolve acetate during use of epoxy sealer in the general workshop area, (3) bisphenol A (BPA) and diglycidly ether of bisphenol A (DGEBPA) particulates (4) wood dust and (5) cured resin dust which-for environmental evaluation purposes - will be considered a nuisance dust. BPA/DGEBPA and cured resin dusts were collected during grinding/sanding of cured resin in the general workshop and paint spray booth. Wood dusts were primarily confined to the general workshop area. Sampling and analytical methods for these compounds will be discussed below.

Organic Solvents

Personal breathing zone (BZ) samples for each group of solvent vapors were collected on standard charcoal tubes using low flow sampling pumps calibrated at a flowrate of 20 cc/min. Samples were desorbed with carbon disulfide and analyzed by gas chromatography according to NIOSH Method P&CAM 127. Limits of detection for the individual compounds are presented in Table II and III.

BPA and DGEBPA (as particulate)

Personal (BZ) samples were collected on glass fiber filters using MSA Model G sampling pumps calibrated at 1.6 liters per minute (lpm). The samples were extracted with acetonitrile and analyzed by high pressure liquid chromatography equipped with a UV spectrometer according to NIOSH Method P&CAM 333. The limit of detection was 0.6 ug per sample for each analyte.

Wood Dust

Personal (BZ) samples for wood dust were collected on tared polyvinyl chloride acrylonitrile copolymer M5 filters using calibrated MSA Model G pumps at a flowrate of 1.7 lpm. The filters were analyzed gravimetrically.

Cured Resin Dusts (as nuisance dust)

Personal (BZ) and general area air samples were collected and analyzed for nuisance particulate similar to the method described above for wood dust.

Ventilation Measurements

The local exhaust ventilation systems in the workshop were inspected. Air velocity measurements were taken at all hoods with a calibrated thermal anemometer air velocity meter. Information was provided by the company on the general air circulation in the Styling department. Data obtained for each of these systems were compared to appropriate ventilation guidelines.

No formal interviews were conducted but discussions with employees during the workshift provided an opportunity to learn of employee health concerns.

V. EVALUATION CRITERIA

1. Environmental

Airborne exposure limits for the protection of the health of workers have been recommended or promulated by several sources. These limits are established at levels designed to protect workers occupationally exposed to a substance on an 8-or 10-hour day, 40-hour-per-week basis over a normal working lifetime. For this evaluation the criteria used to assess the degree of health hazards were selected from three sources: (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) (1980); and (3) occupational health standards as promulgated by the U.S. Department of Labor (29 CFR 1910.1000). These exposure limits are derived from existing human and animal data and industrial experience.[1-6]

The environmental criteria are presented in Table 1. For purposes of this investigation the most stringent criterion is used when more than one is listed. Compliance with all of the evaluation criteria limits should prevent adverse affects on the health and safety of workers.

In assessing the health hazards associated with exposure to mixtures of organic solvents exhibiting similar health effects, the overall effects are considered as additive. The following formula was used to calculate exposure for contaminant mixtures:

$$\frac{C_1}{T_1} + \frac{C_2}{T_2} + \ldots \frac{Cn}{Tn}$$

Where C_1 is the airborne concentration of contaminant 1 and
T_1 is the permissible exposure limit of contaminant 1, and so on.

If the sum of the fraction exceeds unity, then the permissible exposure limit of the mixture is exceeded.

It should be noted that there are no established standards or criteria for BPA or DGEBPA. At present there is insufficient data available to suggest a standard for these compounds.

2. Biological

Epoxy Resin Systems (Bisphenol A type, DGEBPA/BPA)

Thermoset 265 and 285 epoxy resin systems, each consisting of resin and hardener, were used in the plastic layup operation. According to the manufacturer the uncured resin in both systems contains a high-molecular weight compound, diglycidyl ether of bisphenol A. Other constituents in the formulation include filers, pigments, and diluents. The uncured epoxy hardeners or curing agents primarily contain aliphatic polyamine compounds i.e., triethylene pentaamine (TEPA) and/or diethylene triamine (DETA) and Bisphenol A.

BPA and DGEBPA are of low toxicity based on animal feeding studies.[7] In animals both compounds exhibit minimal eye and skin irritation. They are, however, capable of producing skin sensitization reactions on repeated contact. Mutagenesis studies with DGEBPA have thus far resulted in equivocal findings.[8,9]

In a recent NIOSH report worker exposures to BPA and DGEBPA were evaluated.[10] Exposure levels ranged to 1.06 and 0.20 mg/M^3, respectively. Reported health effects included eye and mucous membrane irritation, and mild skin manifestations including red papules, erythema, and peeling which were confined to the hands, neck, and upper chest. No acute respiratory problems were noted.

Information provided by the manufacturer has indicated that TEPA and DETA are capable of producing pulmonary and skin irritation. Repeated skin contact may cause sensitization and rash. Upon contact with the eye both curing agents are capable of causing corneal injury.

Wood Dust (soft wood varieties)

The principal health hazards associated with exposure to wood dusts include dermatitis, respiratory irritation, and nasal cancer. Nasal cancer, however, has been only reported in wood workers in the furniture industry where various types of hardwood are used. Reports have indicated that wood workers in the building industry (where soft wood of the type used in this model shop) did not appear to be at an increased risk of contracting nasal cancer. Because of the apparent low disease risk in the building industry the ACGIH has recommended a TLV of 5 mg/M^3 for soft wood.(11)

Cured Resin Particulates (as nuisance dusts)

The dusts generated during sanding and grinding operations primarily consisted of cured plastic resin particulates and, to a lesser extent, fibrous glass. Although no exposure criteria exist for cured polyester or epoxy resin particulates, the available toxicological data would indicate that they would be categorized as nuisance dusts. Lung tissue reaction, if any, to nuisance type dust is characterized by the following histological features: (1) the architecture of the air spaces remains intact; (2) collagen (scar tissue) is not formed to a significant extent, and (3) the tissue reaction is potentially reversible.

Excessive concentrations of nuisance dusts can cause skin and mucous membrane irritation, bronchitis, and safety hazards such as decreased visibility.

VI. EVALUATION RESULTS AND DISCUSSION

1. Air Sampling Measurements

Solvent concentrations for the personal samples taken on model makers in the paint spray booth/model shop during plastic layup operations are presented in Tables II and III. Exposures to individual solvents ranged from non-detectable to 16% of the pertinent environmental criteria. When considering the combined effects of styrene and toluene, employee exposure ranged up to 18% of the environmental criterion for mixtures.

Total dust samples analyzed for BPA and DGEBPA on modelers sanding/grinding cured epoxy resins are presented in Table IV. Airborne concentrations for BPA and DGEBPA ranged up to 0.0083 and 0.0004 mg/M^3 respectively. These concentrations are very low and should not present any problem to exposed workers.

Wood dust concentrations for the two samples taken on the patternmaker are presented in Table V. Time weighted average concentrations were 0.80 and 0.31 mg/M^3, which are well below the permissible exposure limit of 5.0 mg/M^3 for soft wood dust.

Cured resin particulate concentrations for three personal and one area sample are presented in Table VI. The results of the personal samples averaged 2.69 mg/M^3 (range 2.19 - 3.13 mg/M^3). Most particulate exposure probably resulted during pressurized air cleaning of sanded work pieces. The area sample taken in the model studio was 0.15 mg/M^3. All values were below the environmental criterion of 10 mg/M^3 for total nuisance particulates.

2. Ventilation Measurements

The ventilation measurements of the slot and SAFE hoods are presented in Table VII. Measurements were taken at the hood face and at selected distances in front of the hood. The slot hood face velocity averaged 3000 feet per minute (fpm), which is considered good for removal of chemical vapors.[12] Face velocities averaging 1400 fpm were obtained for the three SAFE hoods and increased to 1800 fpm when two of the hoods were capped. At a distance of one foot from the hood, the capture velocity decreased to about 80 fpm. With two of the SAFE hoods capped, it increased to 100 fpm. The measurements for the SAFE hoods indicate acceptable capture velocities for removal of vapors/fine dusts and demonstrate the importance of proper hood positioning and idle hood capping. The air flow measurements obtained during this survey, however, will change when the fourth SAFE unit is added to the system.

General ventilation in the styling department was provided by three heating/air conditioning units. When combined, these units deliver about 31,800 cubic feet of air per minute, of which 20-22% is fresh air makeup. Based on the total volume of the styling department (384,000 sq. ft.) the general ventilation was calculated to range between 4 and 5 room changes per hour. This value is within the proposed guidelines for model shops with local exhaust ventilation supplementation.[13]

Observations of the local exhaust system revealed that during epoxy layup some of the "curing" surfaces were considerably larger than the effective capture range of the SAFE hood. Also, the SAFE hood per se was ineffective in controlling cured resin dusts generated during use of hand-held grinders.

3. Work Practices

Observations of employee work practices revealed the following deficiencies: use of compressed air to clean clothing, floors and sanded models; inadequate wearing of protective clothing such as gloves and coveralls; and eating drinking, and smoking at the work station. The company provides the modelers with protective clothing, safety glasses, gloves, and appropriate respirators. Only the safety glasses are required to be worn.

VII. RECOMMENDATIONS

An improved education program should be developed to insure that employees are made aware of the potential health hazards associated with and the precautions to be observed in the safe handling of epoxy resins. Good work practices and good personal hygiene should be stressed with the goal of preventive or minimizing inhalation, ingestion, skin and eye contact with these materials. Included in this program should be (1) thorough and frequent hand washing, especially before eating, drinking, smoking, etc; (2) no eating, drinking, smoking at the work stations; and (3) use of protective clothing, i.e., gloves, coveralls for employees in operations that generate cured resin dusts or involve direct contact with epoxy resin systems.

A formalized preventive maintenance program for the ventilation system should be developed. This program should (1) establish written procedures for checking systems; (2) assign responsibilities for insuring the ventilation system works properly; and; (3) provide for the record-keeping of system checks and maintenance. Scheduled maintenance checks should include emptying of dust collection bags before they are full (full bags decrease air flow at the machines), removing settled dust in the ducting, and checking for leaking ducts, and proper fan balancing.

Alternative hood fittings (i.e., slots, flanged hoods) should be utilized to accommodate large work pieces during epoxy layup, and fabrication work using hand-held power tools.

Shut-off dampers should be installed in the exhaust lines of the planar and two grinders. When less than three of these machines are in use, the exhaust to the idle machine(s) should be shut off to maximize the exhaust for the other machine(s). The SAFE hoods should be capped under similar circumstances. In addition, the SAFE hoods should be positioned as close as possible to the work piece for maximum capture and removal of contaminants.

Compressed air should not be used to blow off surfaces of work, work areas or clothing. Vacuum systems equipped with high efficiency filters should be used to clean surfaces throughout the shop.

A housekeeping program should be established whereby shop floors are vacuumed at the end of the workday, all shop surfaces are vacuumed weekly, and light fixtures, rafters, etc., are vacuumed on an annual basis.

Preliminary studies in the automotive industry have shown that model and pattern makers have an increased incidence of colo-rectal cancer.[14] Consideration should be given to a colo-rectal screening program for the model and pattern makers at this facility.[15,16]

VIII. AUTHORSHIP/ACKNOWLEDGEMENTS

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IX. DISTRIBUTION AND AVAILABILITY OF REPORT

Copies of this 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 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:

1. International Harvester, Truck Engineering and Design Center
2. Society of Engineering Employees Union Representatives
3. U.S. Department of Labor, Region V
4. NIOSH, Region V

For purposes of informing the "affected employees", the employer shall promptly "post" the determination report for a period of 30 days in a prominent place near where exposed employees work.

X. REFERENCES

1. NIOSH Criteria for a Recommended Standard ... Occupational Exposure to Ketones. DHEW Publication No. 78-113. 1978.

2. NIOSH Criteria for a Recommended Standard ... Occupational Exposure to Toluene. DHEW Publication No. 73-11023. 1973.

3. NIOSH Criteria for a Recommended Standard ... Occupational Exposure to 1,1,1,-trichloroethane (Methyl Chloroform) DHEW Publication No. 76-184. 1976.

4. Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment with Intended Changes for 1980. American Conference of Governmental Industrial Hygienists, Cincinnati, Ohio. 1980.

5. OSHA Safety and Health Standards (29 CFR 1910) U.S. Department of Labor. OSHA 2206 Revised November 7, 1978.

6. Proctor, N.H. and Hughes, J.P.: Chemical Hazards of the Workplace. J.B. Lippencott Company, Philadelphia. 1978.

7. 1979 Registry of Toxic Effects of Chemical Substances. DHHS Publication No. 80-111, 1980.

8. Patty's Industrial Hygiene and Toxicology. 3rd Revised Edition, Volume 2A: Toxicology, Clayton and Clayton Editors, J. Wiley and Sons Publishers, pgs. 2141-2258, 1981.

9. Anderson, et al. Mutagenic Action of Aromatic Epoxy Resins Nature 276:391, 1978.

10. Hervin, R.L., Federick, L. and McQuilkin, S., Hazard Evaluations and Technical Assistance Report No. HE 79-7-639. Hazard Evaluations and Technical Assistance Branch; Division of Surveillance, Hazard Evaluations and Field Studies; National Institute for Occupational Safety and Health, Cincinnati, Ohio, 1979.

11. Documentation of Threshold Limit Values for Substances in Workroom Air 4th Edition. American Conference of Governmental Industrial Hygienists, P.O. Box 1937, Cincinnati, Ohio 45201 pgs. 436-37, 1980.

12. American Conference of Governmental Industrial Hygienists, Industrial Ventilation - A Manual of Recommended Practice (16th Edition) Lansing, Michigan, 1980.

13. NIOSH Draft Report, "Some Guidelines for Reducing Health Risks in Pattern Makers Using Ventilation, Protective Equipment, Work Practices and Hygiene Methods." Division of Surveillance, Hazard Evaluations and Field Studies, Industry Wide Studies Branch, Cincinnati, Ohio.

14. Crapnell, S.G.: "What's Causing Cancer Among Auto Workers?" Occupational Hazards, November 1980.

15. Cancer-Related Checkup: Guidelines for Site Tests and Examinations, American Cancer Society, Inc., New York, New York.

16. Blueprint for Fighting Cancer in Pattern Makers, Pattern Maker's League of North America, Arlington, Virginia.

Other

Epoxy Wise is Health Wise, DHEW Publication No. 76-152. 1976.

Fiberglass Layup and Sprayup - Good Practices for Employees DHEW Publication No. (NIOSH) 76-158, 1976.

TABLE I

OCCUPATIONAL EXPOSURE CRITERIA*

INTERNATIONAL HARVESTER
TRUCK ENGINEERING AND DESIGN CENTER
FT. WAYNE, INDIANA

February 3-4, 1981

HE 80-165

COMPOUND	NIOSH[1]	ACGIH[2]	OSHA[3]	PRIMARY HEALTH EFFECTS[4]	COMMENT
Styrene	-	425	425	central nervous system (CNS) depression; dermatitis	skin absorption; 215 mg/M^3 proposed[2]
Acetone	590	2400	2400	skin, mucous membrane, and eye irritation; CNS depression	skin absorption; 1780 mg/M^3 proposed[2]
MEK	590	590	590	same as above	skin absorption; odor threshold: 75 mg/M^3
Toluene	375	375	752	CNS depression; dermatitis	skin absorption
111-TCE	1900	1900	1900	CNS depression; eye and skin irritation; dermatitis	skin absorption; odor threshold: 87-2180 mg/M^3
MIBK	200	410	410	same as above	skin absorption
Ethyl acetate	-	1400	1400	respiratory tract irritation; narcosis at high concentrations; dermatitis	skin absorption; odor threshold: 36 mg/M^3
n-Butyl acetate	-	710	710	skin, mucous membrane irritation	
Cellosolve acetate	-	540	540	upper respiratory tract irritation; CNS depression; dermatitis	skin absorption; 270 mg/M^3 proposed[2]
Bisphenol A			see Section V		
Diglycidyl ether of bisphenol A			see Section V		
Wood dust	-	5.0	15.0	eye and respiratory tract irritation (see Section V)	OSHA treats wood dust as nuisance particulate
Nuisance dust	-	10.0	15.0	eye and upper respiratory tract irritation at high concentrations (see Section V)	

*Values in mg/M^3

1. National Institute for Occupational Safety and Health: Criteria for a Recommended Standard ... Occupational Exposure to _____.
2. American Conference of Governmental Industrial Hygienists: TLV's for Chemical Substances in Workplace Air, 1980.
3. OSHA Safety and Health Standards (29 CFR 1910) November 7, 1978.
4. Chemical Hazards of the Workplace. N.H. Protor, J.P. Hughes, 1978.

TABLE II

ENVIRONMENTAL RESULTS OF PERSONAL BREATHING ZONE SAMPLES FOR
STYRENE, ACETONE, METHYL ETHYL KETONE (MEK), TOLUENE, AND 111-TRICHLOROETHANE (111-TCE)

INTERNATIONAL HARVESTER
TRUCK ENGINEERING AND DESIGN CENTER
STYLING DEPARTMENT - WORKSHOP
FT. WAYNE, INDIANA

February 3-4, 1981

HE 80-165

Date	Job Classification	Location	Sampling Time (min.)	Sample Volume (liters)	Environmental Concentration[1] (mg/M^3) Styrene	Acetone	MEK	Toluene	111-TCE	TLV of Mixture[2]
2/3/81	Industrial Designer	Workshop Paint Booth	130	2.85	N.D.	N.D.	N.D.	35.1	N.D.	-
2/4/81	"	"	475	8.82	14.6	N.D.	N.D.	58.5	N.D.	0.18
2/4/81	"	"	470	5.03	9.9	N.D.	N.D.	31.8	N.D.	0.10
	Environmental Criteria:				435	590	590	375	350	1.00
	Laboratory Limit of Detection (mg/sample):				0.02	0.09	0.04	0.01	0.03	

1. Time Weighted Average over total sampling period.
2. ACGIH TLV's (1980) Threshold Limit Value for Mixtures.
3. N.D. - Nothing Detected, below detection limits.

TABLE III

ENVIRONMENTAL RESULTS OF PERSONAL BREATHING ZONE SAMPLES FOR
METHYL ETHYL KETONE (MEK), METHYL ISOBUTYL KETONE (MIBK), ETHYL ACETATE, n-BUTYL ACETATE AND CELLOSOLVE ACETATE

INTERNATIONAL HARVESTER
February 3-4, 1981

Date	Job Classification	Location	Sampling Time (min.)	Sample Volume (liters)	Environmental Concentration[1] (mg/M^3) MEK	MIBK	Ethyl Acetate	n-Butyl Acetate	Cellosolve Acetate
2/3/81	Industrial Designer	Workshop	149	1.60	N.D.	N.D.	N.D.	N.D.	N.D.
2/4/81	"	"	442	12.4	N.D.	1.6	N.D.	N.D.	N.D.
	Environmental Criteria:				590	200	1400	710	540
	Laboratory Limit of Detection (mg/sample):				0.04	0.01	0.04	0.01	0.02

1. Time Weighted Average over total sampling period.
2. N.D. - Nothing Detected, below detection limits.

TABLE IV

ENVIRONMENTAL RESULTS OF PERSONAL BREATHING ZONE SAMPLES FOR
BISPHENOL A (BPA) AND DIGLYCIDYL ETHER OF BISPHENOL A (DGEBPA)

INTERNATIONAL HARVESTER
TRUCK ENGINEERING AND DESIGN CENTER
STYLING DEPARTMENT - WORKSHOP
FT. WAYNE, INDIANA

February 4, 1981

HE 80-165

Date	Job Classification	Location	Type of Sample	Sampling Time (min.)	Total Volume (liters)	Environmental Concentration[1] mg/M^3	
						BPA	DGEBPA
2/4/81	Industrial Designer	model shop	total dust	517	827	0.0083	0.0002
2/4/81	Industrial Designer	model shop paint booth	total dust	475	760	0.0004	0.0004
			Environmental Criteria:			--*	--*
			Laboratory Limit of Detection:			0.0006	0.0006

1. Time Weighted Average over total sampling period.
* No Environmental Criteria or Standards have been recommended for BPA and DGEBA. Refer to text for further information.

TABLE V

ENVIRONMENTAL RESULTS OF PERSONAL BREATHING ZONE SAMPLES FOR WOOD DUST

INTERNATIONAL HARVESTER
February 3-4, 1981

Date	Job Classification	Location	Type of Sample	Sampling Time (min.)	Total Volume (liters)	Environmental Concentration[1] mg/M^3
2/3/81	Pattern maker	Workshop	total	125	213	0.80
2/4/81	Pattern maker	Workshop	total	467	794	0.31
			Environmental Criterion:			5.0

1. Time Weighted Average over total sampling period.

TABLE VI

ENVIRONMENTAL RESULTS OF PERSONAL BREATHING ZONE SAMPLES AND GENERAL AREA AIR SAMPLES FOR CURED RESIN PARTICULATES

INTERNATIONAL HARVESTER
TRUCK ENGINEERING AND DESIGN CENTER
STYLING DEPARTMENT
FT. WAYNE, INDIANA

February 3-4, 1981

HE 80-165

Date	Job or Area Classification	Location	Sampling Time (min.)	Sample Volume (liters)	Environmental Concentration[1] mg/M^3
2/3/81	Concept Engineer	Workshop Paint Booth	135	230	3.13
2/4/81	"	"	470	799	2.74
2/4/81	"	Model Studio	399	678	2.19
2/4/81	Model Studio	Beam H-19	441	750	0.15
		Environmental Criterion (as nuisance dust):			10.0

1. Time Weighted Average over total sampling period.

TABLE VII

VENTILATION MEASUREMENTS

INTERNATIONAL HARVESTER
TRUCK ENGINEERING AND DESIGN CENTER
STYLING DEPARTMENT - WORKSHOP
FT. WAYNE, INDIANA

February 4, 1981

HE 80-165

Hood Type	Velocity (fpm)[1]		
	Hood Face	6" From Hood Face	12" From Hood Face
SLOT[2]	3000	-	150
SAFE A[2]	1300	250	80
SAFE B[2]	1500	250	70
SAFE B[3]	1800	350	100
SAFE C[2]	1400	300	80

1. fpm - feet per minute.
2. Measurements taken with all SAFE (Swing Arc Fume Exhauster) hoods open.
3. Measurements taken with SAFE hoods A and C capped.

NOTE: SAFE hood A is farthest from fan.

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