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. 77-125-547

AMPHENOL CADRE
LONGMONT, COLORADO

DECEMBER 1978

I. TOXICITY DETERMINATION

A health hazard evaluation was conducted by the National Institute for Occupational Safety and Health (NIOSH) at Amphenol Cadre, Longmont, Colorado, on March 2 and April 20, 1978. At the time of this evaluation breathing zone and general room air samples were taken on workers for methyl ethyl ketone (MEK), toluene, xylene, 4,4'-Methylene bis (2-Chloroaniline) (MOCA), and Toluene-2,4-diisocyanate (TDI). Only one overexposure to MEK was observed in 12 Time Weighted Average (TWA) samples. All other breathing zone and general room samples taken for toluene, xylene, MOCA, and TDI were below laboratory detection limits with the exception of one toluene sample which contained 60 mg/M^3. Confidential employee interview forms were completed on 20 workers. Twelve of the workers had neither complaints nor symptoms. Eight of the workers had complaints that may or may not have been related to their work exposures. These complaints consisted of coughing, sinus problems, bronchitis, nasal congestion, headaches, and burning eyes. A potential health hazard exists from exposures to MEK. This is based on results of employee interviews which indicated workers were being affected by MEK exposures.

II. DISTRIBUTION AND AVAILABILITY

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), 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. Amphenol Cadre
2. U.S. Department of Labor/OSHA - Region VIII
3. Colorado Department of Health
4. NIOSH - Region VIII

For the purpose of informing approximately 20 employees, a copy of this report shall be posted in a prominent place accessible to the employees for a period of 30 calendar days.

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 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.

NIOSH received such a request from an authorized representative of employees at Amphenol Cadre, Longmont, Colorado, to evaluate potential exposures associated with solvents and paint sprays used throughout the plant.

IV. HEALTH HAZARD EVALUATION

A. Processes Evaluated

Amphenol Cadre makes electrical wiring and harnesses for helicopters, other aircraft, and various other military machinery. The processes evaluated during this survey consisted of a mold room where MOCA and TDI were used to make flexible connections for electrical harnesses. The MOCA and TDI used in this operation is in the premixed form and is frozen. When the MOCA and TDI mixture is removed from the freezer, it is placed in a warmer underneath a hood. As the MOCA and TDI softens, it is poured into a mold to form electrical harnesses and connections. Because the MOCA and TDI is frozen and used under a hood, there is no dust hazard and a vapor hazard is unlikely. The MEK, xylene, and toluene were used as polishers, cleaners, and in repairs after the harnesses are removed from the mold.

B. Evaluation Design

There are approximately 20 workers in the specific areas of this request. All workers were monitored. A large number of the workers were interviewed, and questions were directed at work history. Most workers were monitored for the particular chemical they were either exposed to or working with.

C. Evaluation Methods

TDI samples were collected using glass impingers and vaccum pumps operated at 1.5 liters per minute. These samples were collected in Marcali solution and analyzed according to NIOSH P&CAM #141. MOCA samples were collected on silica gel sorbent tubes and analyzed according to NIOSH P&CAM #236. MEK, toluene, and xylene were collected on organic vapor charcoal sampling tubes and analyzed according to NIOSH P&CAM #127 using a gas chromatograph with a flame ionization detector.

D. Criteria for Assessing Concentrations of Air Contaminants

Three sources of criteria are generally used to assess workroom concentrations of air contaminants: (1) recommended Threshold Limit Values (TLVs) and their supporting documentation as set forth by the American Conference of Governmental Industrial Hygienists (ACGIH), 1978; (2) Occupational Safety and Health Administration (OSHA) standards (29 CFR 2920), January 1976; and (3) NIOSH criteria for recommended standards. NIOSH criteria and ACGIH TLVs represent the most recent and relevant recommendations and are given prominence in this evaluation.

	Permissible Exposures 8-Hour Time-Weighted Exposures Basis (mg/M^3)		
Substances	TLV	Current OSHA Standard	NIOSH Criteria For Recommended Standard
MOCA	0.02 (skin)	--	--
TDI	0.015	0.14	0.036
MEK	590.0	590.0	590.0
Toluene	375.0	750.0	375.0
Xylene	435.0	435.0	435.0

mg/M^3 = approximate milligrams of substance per cubic meter of air

Occupational health standards are established at levels designed to protect individuals occupationally exposed to toxic substances on an 8-hour per day, 40-hour per week basis over a normal working lifetime.

E. Toxicology

Methyl Ethyl Ketone (MEK)--MEK is a widely used industrial solvent. Prolonged exposures above the TLV of 590 mg/M^3 may cause mucous membrane irritation, nausea, vomiting, dermatitis, headache, and paresthesias. Workers strongly object to its odor. However, there have been very few reports of serious ill effects.

Toluene--High concentrations, above TLV of 375 mg/M^3, may cause conjunctivitis and corneal burns, produces defatting dermatitis, causes fatigue and weakness, headache, dizziness and irritability. The level required to produce narcosis can exist without eye or respiratory tract irritation.[1]

Xylene--Xylene has an irritant effect on the skin and mucous membranes and may also affect liver, kidneys, and gastrointestinal tract. Maintaining levels as low as found in this study and avoidance of skin contact should eliminate adverse effects.

Toluene-2,4 diisocyanate (TDI)--TDI acts as an irritant; it is very corrosive to the skin and upper respiratory tract, and is a strong sensitizer.

Acute and chronic exposures may produce irritation of eyes, dehydration of tissues, and corneal damage.

TDI has a serious affect on the respiratory system, causing headache, cough, chest tightness, and pulmonary edema. The respiratory changes caused by TDI can be permanent. Sensitization may also be permanent.[2]

4,4-Methylene bis (2-Chloroaniline) (MOCA)--MOCA is a yellow or light tan solid and has been classified as a suspect carcinogen for man. This is based on either (1) limited epidemiologic evidence, exclusive of clinical reports of single cases, or (2) demonstration of carcinogenesis in one or more animal species by appropriate methods.[3,4]

MOCA is sold as a curing agent for epoxy resins and epoxy-urethane resin blinds.

MOCA has induced tumors in rats and mice. It has not been documented that it causes cancer in humans. Skin absorption is usually more important than inhalation.

During this study MOCA was used in a premixed form and was frozen. It had already begun to react with the isocyanate prepolymer. There was neither a dust or vapor hazard.

F. Environmental Results and Discussion

Results of environmental samples showed that workers were exposed to MEK at levels approaching the threshold limit value. These levels are capable of causing burning eyes and respiratory irritation which were the most consistent complaints obtained from the employee interviews.

Workers were monitored for 6 hours whenever possible and the TWA is based on 6 hours. The workers exposure will not vary significantly since they perform the same duties for the entire work shift.

V. RECOMMENDATIONS

1. Solvents should be placed in safety dispensing cans when used at individual work stations for cleaning and repair.

2. Eating should be prohibited in the work area.

3. The area where MOCA is being used should be posted "Suspect Carcinogen".

VI. REFERENCES

1. Plunkett, E.R., Handbook of Industrial Toxicology, Chemical Publishing Company, New York, 1976, pp. 412-413.

2. Ibid., pp. 222-223.

3. Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment with Intended Changes for 1978, American Conference of Governmental Industrial Hygienists, p. 38.

4. Carcinogens - Job Health Hazard Series, U.S. Department of Labor, OSHA 2204, January 1975.

VII. AUTHORSHIP AND ACKNOWLEDGMENTS

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TABLE I

Breathing Zone Air Concentrations (TWA) of
Methyl Ethyl Ketone (MEK), Toluene, and Xylene

Amphenol Cadre

March 2, 1978

Sample Number	Location	Job Classification	Time of Sample	MEK	Toluene (mg/M^3)	Xylene
1	Molding	Molder	7:55 AM - 2:00 PM	360	*	*
3	Molding	Molder	7:40 AM - 2:01 PM	177	*	*
4	Cleanup	Cleaner	7:30 AM - 2:00 PM	68	*	*
5	Molding	Molder	7:48 AM - 2:30 PM	135	*	*
6	Molding	Molder	7:45 AM - 2:03 PM	57	*	*
7	Molding	Molder	7:32 AM - 2:00 PM	564	*	*
8	Molding	Molder	7:35 AM - 2:10 PM	81	*	*
9	Molding	Molder	7:35 AM - 1:50 PM	69	*	*
10	Molding	Molder	8:30 AM - 2:00 PM	683	*	*
2	Molding	Molder	7:38 AM - 11:00 AM	233	*	*
19	General Room	------	1:30 PM - 2:00 PM	*	*	*
21	General Room	------	9:30 AM - 1:30 PM	50	*	*
			EVALUATION CRITERIA	590	375	435
		LABORATORY LIMIT OF DETECTION (mg/sample tube)		0.01	0.01	0.01

* = below laboratory limit of detection

TABLE II

General Room Air Concentrations of
4,4'-Methylene bis (2-Chloroaniline) (MOCA)

Amphenol Cadre

April 20, 1978

Sample Number	Location	Time of Sample	MOCA ppm
M-1	Molding	7:20 AM - 10:45 AM	*
M-2	Molding	7:24 AM - 10:45 AM	*
M-3	Molding	7:27 AM - 10:45 AM	*
M-4	Molding	7:30 AM - 10:45 AM	*
		EVALUATION CRITERIA	0.02
		LABORATORY LIMIT OF DETECTION	0.08 µg/sample

* = below laboratory limit of detection

TABLE III

General Room Air Concentrations of
Toluene-2,4-diisocyanate (TDI)

Amphenol Cadre

April 20, 1978

Sample Number	Location	Time of Sample	TDI (mg/M^3)
T-1	Molding	7:20 AM - 10:45 AM	*
T-2	Molding	7:24 AM - 10:45 AM	*
T-3	Molding	7:27 AM - 10:45 AM	*
T-4	Molding	7:30 AM - 10:45 AM	*
T-5	Molding	7:30 AM - 10:45 AM	*
T-6	Molding	7:30 AM - 10:45 AM	*
		EVALUATION CRITERIA	0.015
		LABORATORY LIMIT OF DETECTION	0.2 µg/sample

* = below laboratory limit of detection