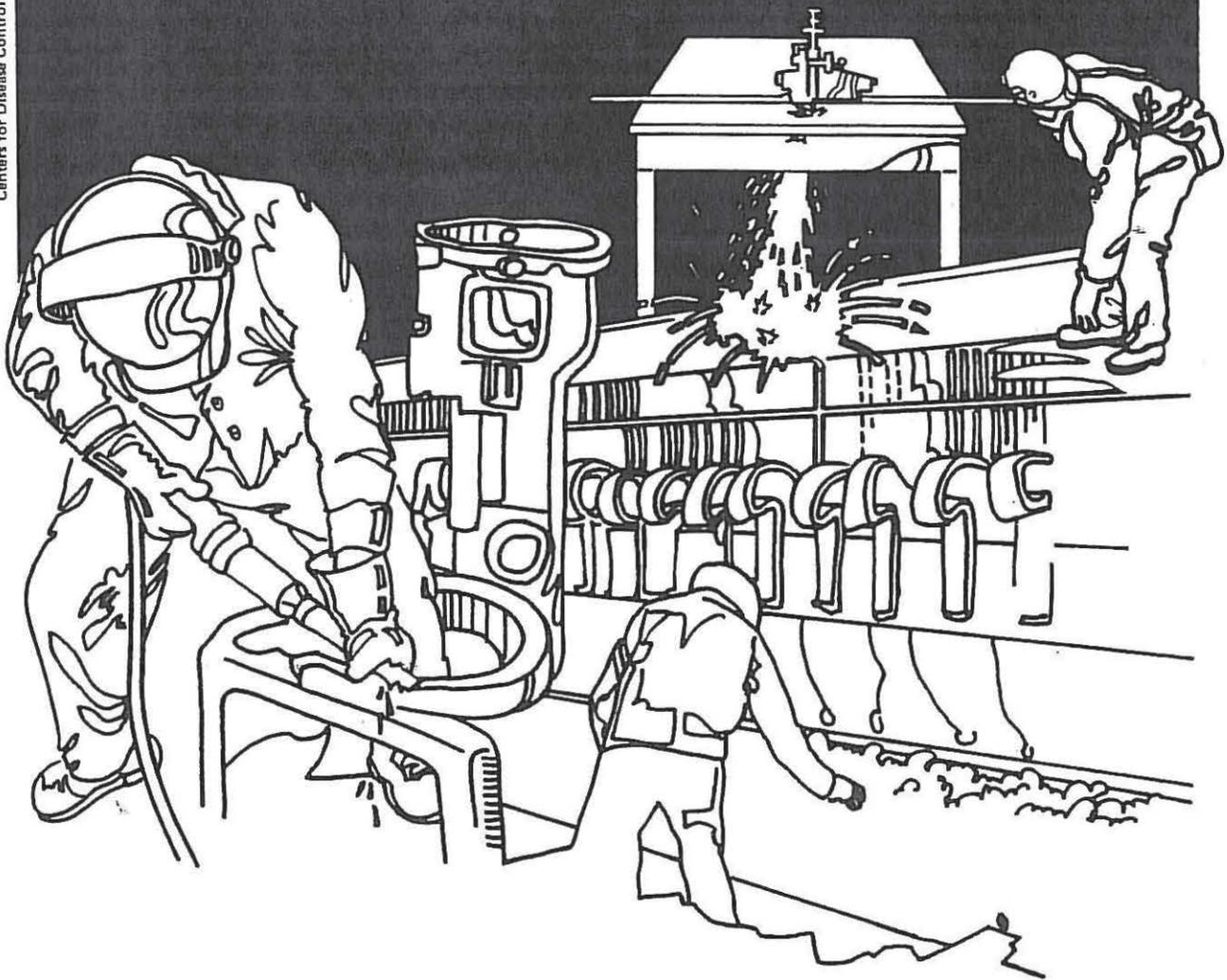


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Centers for Disease Control ■ National Institute for Occupational Safety and Health

# NIOSH



## Health Hazard Evaluation Report

HHE 80-058-874  
FEDERAL - MOGUL  
METAL REMOVAL TOOLING DIVISION  
CHICAGO, ILLINOIS

## 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.

Mention of company names or products does not constitute endorsement by the National Institute for Occupational Safety and Health.

HE 80-058-874  
FEDERAL-MOGUL, METAL REMOVAL TOOLING DIVISION  
CHICAGO, ILLINOIS  
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## I. SUMMARY

In January 1980, the National Institute for Occupational Safety and Health (NIOSH) received a request from the Metal Processors Union, Local 16, to evaluate a reported high incidence of neonatal death and spontaneous abortion among women in Department 140, Federal-Mogul, Metal Removal Tooling Division, Chicago, Illinois. The plant manufactures tungsten carbide drill-bits and other specialty tool products. In Department 140, major exposures were reported to tungsten carbide dust, oil and water soluble coolants, petroleum distillates, and 1,1,2-trichloro-1,2,2-trifluoroethane (Freon 113).

In February 1980, NIOSH investigators conducted an initial survey. Women working on each of two shifts were interviewed and reproductive information was collected from company records for those working a third shift. Results were obtained from environmental sampling conducted by the Occupational Safety and Health Administration (OSHA) in April 1979 and January 1980. A telephone survey was conducted in February 1980, to determine the outcome of pregnancies reported during the initial survey. A follow-up plant survey was conducted in April 1981.

Analysis of the data indicated 2 neonatal deaths and 4 spontaneous abortions among the 21 women pregnant in 1979. No epidemiological significance could be associated with these data because of the small number of fertile women and pregnancies, as well as the lack of an adequate control group.

Analysis of the OSHA environmental data indicated levels below the evaluation criteria for tungsten, Freon 113, methylene chloride, and butyl cellosolve. The samples for cobalt ranged from .011 to .12 mg/M<sup>3</sup>, with a mean of .036 mg/M<sup>3</sup>. One of 10 personal air samples collected for cobalt was found to be in excess of the OSHA standard of 0.1 milligrams per cubic meter of air (mg/M<sup>3</sup>) for an 8-hour time weighted average (TWA).

Data collected during the telephone survey indicated that the 7 women reporting pregnancies in 1980 had normal births. During the follow-up plant survey, no changes in plant operations were observed which would have altered employee exposures during the period of these pregnancies.

On the basis of the data obtained in this investigation, NIOSH could not determine whether a hazard existed in this plant with respect to adverse reproductive outcomes. Recommendations on work practices, environmental monitoring, and continued surveillance are incorporated in Section VIII.

KEY WORDS: tungsten carbide, oil soluble coolants, water soluble coolants, petroleum distillates, butyl cellosolve, 1,1,2-trichloro-1,2,2-trifluoroethane, (Freon 113), degreasing, spontaneous abortion, neonatal death, teratogenesis

SIC 3545 MACHINE TOOL ACCESSORIES

## II. INTRODUCTION

On January 21, 1980, NIOSH received a request from the Metal Processors Union, Local 16, to evaluate a reported high incidence of neonatal deaths and spontaneous abortions among women at Federal-Mogul, Metal Removal Tooling Division, Chicago, Illinois. The requestor indicated that the problem appeared to be most severe in Department 140, particularly in the area where pointing operations were performed. A concern was expressed regarding the role of degreasing solvents and metal dust as abortifacients.

NIOSH representatives conducted an initial survey on February 7-8, 1980. This included an opening conference with management and union officials, a walk-thru survey of the areas of concern, review of company records, and interviews with employees.

An interim report was disseminated to representatives of management and the union in June, 1980. No definitive conclusions were made regarding the relation of the adverse reproductive outcomes to workplace exposures. Recommendations were made to continue surveillance among pregnant women in Department 140.

In February, 1980, a telephone survey was conducted to determine the outcome of pregnancies reported during the initial survey. A follow-up visit was made to the plant on April 9, 1981, to observe any changes in plant operations occurring during the previous year.

## III. BACKGROUND

In January 1980, the National Cancer Institute was advised that several workers at the Federal-Mogul, Metal Removal Tooling Division had experienced spontaneous abortions during December 1979 and January 1980. Subsequently, the Births Defects Branch, Chronic Diseases Division, Centers for Disease Control (CDC), advised the employee who originally raised the complaint, to file a request for a NIOSH health hazard evaluation.

The Federal-Mogul, Metal Removal Tooling Division plant has been at its present location for approximately two years. The workforce consists of 350 non-administrative employees divided in three work shifts: 7am-3pm, 3pm-11pm, and 11pm-7am (shifts 1, 2, and 3 respectively).

The plant is engaged in tooling tungsten carbide blanks into drill-bits, burrs, endmills, reamers, circuit board drills and other specialty tool products. Tungsten carbide blanks of various sizes undergo semi-automated and automated diamond wheel grinding of three types: dry grinding, water soluble coolant grinding, and oil based coolant grinding. The grinding activities include forming, fluting, clearing, and pointing. Pointing and clearing operations are performed in one room, while forming and fluting are conducted in an adjacent room. In addition to dry grinding, degreasing operations are conducted in the pointing area. Metal parts are dipped in 10" by 24" open baths of an alkaline solution, water, petroleum distillates (containing less than 5% butyl cellosolve), and Freon 113, sequentially. This operation involves one employee per shift and occurs several times per hour.

Grinding machines in Dept. 140 were originally equipped with local exhaust ventilation consisting of a 4" flexible duct intake at the grinding wheel

which connected to a portable exhaust unit. In March 1981, the ventilation system was modified to exhaust contaminants to a central collection system located outside the building. Local ventilation was not present and protective gloves were not used at the degreasing operation.

#### IV. METHODS AND MATERIALS

##### A. Medical:

During the initial survey, NIOSH investigators interviewed 76 women in Dept. 140 working on shifts one and two. A questionnaire was used to record age, race, and employment, marital, and pregnancy history. The identification of cases of spontaneous abortion or neonatal death were elicited by personal interviews and company records. Information on 5 additional women, absent due to pregnancy or sick leave, was collected from plant records, co-workers, and union representatives.

Reproductive history information was collected from company records on those employees working in Department 140 on the third shift. This group was found to contain only 3 women of childbearing age. Since these 3 women were not interviewed, they were excluded from the study.

NIOSH maintained contact with the Metal Processors Union, Local 16, from the time of the initial survey through December 1980. A telephone survey was conducted on February 10, 1981, to determine the outcome of the pregnancies reported at the time of the initial survey.

##### B. Environmental:

During the course of the initial survey, information was collected relating to the work process, engineering controls, and potentially hazardous substances present in the plant. Information was also obtained in relation to prior OSHA inspections involving Dept. 140. A follow-up visit to the facility was conducted on April 9, 1981, to determine if any changes has been made in plant operations within the previous year which could affect employee exposures.

#### V. EVALUATION CRITERIA

##### A. Environmental:

A number of sources recommend airborne levels of substances under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse effect. Due to variations in individual susceptibility, a small percentage of workers may experience effects at levels below these limits; a smaller percentage may be more seriously affected by aggravation of a pre-existing condition or by a hypersensitivity reaction.<sup>2</sup>

The following table lists the substances evaluated in this study. Also given is the environmental criteria used in this report, the current OSHA standard, and the primary health effects for each substance. Values are expressed as 8-10 hour time weighted average (TWA) exposure limits.

Substance	Environmental Criteria	OSHA Standard(1)	Primary Health Effects
Cobalt (metal fume & dust)	0.1 mg/M <sup>3</sup> OSHA <sup>1</sup>	0.1 mg/M <sup>3</sup>	Mucous membrane irritation, asthma, cardiomyopathy
Tungsten (water insoluble)	5 mg/M <sup>3</sup> ACGIH <sup>2</sup>	none	Mucous membrane irritation, interstitial fibrosis
Freon 113	1,000 ppm OSHA <sup>1</sup>	1,000 ppm	Upper respiratory irritation, asphyxia
Methylene chloride	75 ppm NIOSH <sup>3*</sup>	500 ppm	Dermatitis, mucous membrane irritation, narcosis
Butyl Cellosolve	50 ppm OSHA <sup>1</sup>	50 ppm	Mucous membrane irritation narcosis

\*\*The current Federal standard for methylene chloride is 500 ppm on an eight-hour TWA basis, with an acceptable ceiling level of 1000 ppm and a maximum peak concentration of 2000 ppm for 5 minutes in any two-hour period. NIOSH has recommended that the permissible exposure limit be reduced to 75 ppm on a ten hour TWA basis, with a ceiling level of 500 ppm averaged over a 15-minute period. NIOSH further recommends that permissible levels of methylene chloride be reduced where carbon monoxide is present.<sup>3</sup>

#### B. Medical:

The population chosen for epidemiological study was limited to the current workforce in Department 140. Spontaneous abortions and neonatal deaths were recorded. The medical literature indicates that the rate of neonatal death is about 1% for the United States population. The estimates of the spontaneous abortion rates vary from 10-25% depending on which ascertainment method is used and how early the pregnancies are documented. These rates were utilized as controls.<sup>4,5,6</sup>

## VI. RESULTS

#### A. Environmental:

During the April 1979 OSHA survey, personal air samples for cobalt, tungsten, Freon 113, and methylene chloride were obtained. Of five samples collected for cobalt, the exposures ranged from 0.028 mg/M<sup>3</sup> to 0.043 mg/M<sup>3</sup>, with a mean of 0.032 mg/M<sup>3</sup> (OSHA standard: 0.1 mg/M<sup>3</sup>). Of five samples collected for tungsten, the exposures ranged from 0.4 mg/M<sup>3</sup> to 1.5 mg/M<sup>3</sup> with a mean of 0.88 mg/M<sup>3</sup> (OSHA standard: 5 mg/M<sup>3</sup>). Freon 113 and methylene chloride were not detected in the one air sample collected for each of these substances.

During the January 1980 OSHA survey, personal air samples for cobalt, Freon 113, and butyl cellosolve were obtained. Additionally, three wipe samples for cobalt were obtained from the worker's lunchroom. Of five personal air samples for cobalt, exposures ranged from 0.011 mg/M<sup>3</sup> to 0.12 mg/M<sup>3</sup>, with a mean of 0.039 mg/M<sup>3</sup> (OSHA standard: 0.1 mg/M<sup>3</sup>). Butyl cellosolve and Freon 113 were not detected in the two air samples collected for each of these substances. Additionally, cobalt was detected in the wipe samples

collected from the workers lunchroom in amounts of 6.3, 20, and 92 micrograms per sample.

#### B. Medical:

Of the 81 women in Dept. 140 of various ages and ethnic backgrounds, 21 were pregnant during 1979. Of these women, there were 4 spontaneous abortions and 3 neonatal deaths. Three women with reproductive problems were not included in the study for the following reasons: one woman had an induced abortion, another had a series of spontaneous abortions prior to the 1979 pregnancy, and the third had experienced a number of C-sections and had been advised not to become pregnant. This left 18 remaining pregnancies in the study.

Table 1 classifies the remaining 18 women pregnant in 1979 by pregnancy history. The table is divided into 3 parts--the first includes women who had spontaneous abortions and neonatal deaths; the second, women who had live births; and the third, the 4 spontaneous abortions and 7 current pregnancies.

Table 2 compares the 60 women in Department 140 who were not pregnant in 1979 with the 18 women in the department in the study who were pregnant, by age distribution, ethnic group, and prior pregnancy history. The age distribution for the 18 pregnant women seems to be shifted to the older ages of child bearing. Assyrian women account for 4 of the 6 adverse outcomes, but they also account for a large portion of the work force. The prior pregnancy history for the two groups was similar, the adverse outcome rates prior to 1979 were 9.2% and 9.5% respectively.

Table 3 demonstrates that among the 18 women pregnant in 1979, there is an equal distribution of women in the 2 work areas of pointing and clearing, and fluting and forming. There were 3 cases of adverse reproductive outcomes as well. Table 4 lists pregnancy outcomes according to shifts. There were 4 cases of adverse reproductive outcomes (2 spontaneous abortions, 2 neonatal deaths) among women working the first shift and 2 cases among women working the second shift. There were a total of 11 pregnancies among women in the first shift, 11 for those in the second.

Among the 76 women interviewed, only 2 reported menstrual irregularities or a history of difficulty becoming pregnant.

Subsequent to the initial survey, plant management furnished a list of women, by age, for other departments of the plant. Out of 29 women less than 35 years of age, one normal delivery occurred in 1979. Based on fertility rates of the United States women of this age group, one would expect 1 or 2 live births. Abnormal outcomes of pregnancies in other areas of the plant were not reported.

Between January 1980, and April 1981, no further adverse pregnancy outcomes were reported. In a telephone survey conducted on February 10, 1980, it was determined that all seven women reporting pregnancies at the time of the initial survey, had normal births.

## VII. DISCUSSION

Recent data suggest that there is an increase in spontaneous abortions in women exposed to anesthetic gases, as well as the wives of men so exposed. A

number of the halogenated hydrocarbons, including the Freons, have structural and physiological activity similiar to anesthetic gases and are currently being studied for such effects.<sup>7</sup>

Recent testing of 2-ethoxyethanol, a glycol ether structurally similar to butyl cellosolve, found this substance to be embryotoxic at high exposure levels and teratogenic at lower levels in rats.<sup>8</sup> These findings could indicate a cause for concern if the employee working in the degreasing area was pregnant.

The evaluation of a cluster of adverse reproductive outcomes often challenges ones ability for meaningful and conclusive interpretation. In this investigation, we find that no definitive conclusions can be reached about the presence or absence of an agent in the workplace that is adversely affecting pregnancy outcome.

Problems exist in interpreting this cluster for three reasons. First, the number of fertile women and the number of pregnancies are so small that any estimate of adverse effects is difficult and, statistically, inherently unreliable. Second, it is an extremely difficult to obtain reliable data on spontaneous abortion as a reproductive outcome because it is frequently based on recall and subjective responses. Thirdly, there is no easy solution to selecting an appropriate control or comparison group.

#### VIII. RECOMMENDATIONS

Due to the recent reports concerning the various health effects of the classes of chemicals being used in the degreasing operations, the company should periodically evaluate employee exposure to these solvents. Proper work practices (including the use of impervious gloves) and good personal hygiene should be stressed to prevent or minimize inhalation, ingestion, and skin and eye contact with these substances. Further, to be adequately cautious, pregnant women should not work as degreasers.

In order to fully assess the possible reproductive hazard presented by exposure to these chemicals, on-going surveillance would be advisable. The pregnancy outcomes in this plant should continue to be monitored, and NIOSH should be notified should the rate continue at its present level or grow during the next year.

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X. AUTHORSHIP AND ACKNOWLEDGEMENTS

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## XI. DISTRIBUTION AND AVAILABILITY OF DETERMINATION 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 Services (NTIS), Springfield, Virginia. 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 the following:

- A. Metal Processors Union, Local 16
- B. Requestor
- C. Federal-Mogul, Metal Removal Tooling Division
- D. NIOSH: Director, DSHEFS, Region V
- E. U. S. Department of Labor, OSHA Region V

For the purpose of informing the affected employees, copies of the report should be posted in a prominent place accessible to the employees, for a period of 30 calendar days.

TABLE ONE

PREGNANCIES IN 1979

	<u>Adverse Reproductive Outcome</u>	<u>Year</u>	<u>Gestation</u>	<u>Prior Pregnancies</u>		<u>AB</u>
				<u>Live</u>	<u>Still</u>	
1	S. Abortion	1979	12 wks	0	0	0
2	"	1980	8 wks	0	0	0
3	"	1980	12 wks	0	0	0
4	"	1979	12 wks	0	0	0
5	Neonatal D.	1979	24 wks	2	0	0
6	Neonatal D.	1979	36 wks	?	0	0
1	Live Birth	1979	term	3	0	0
2	"	1979	"	11	0	0
3	"	1979	"	3	0	0
4	"	1979	"	2	0	1
5	"	1979	"	3	0	0
1	Presently Pregnant		?	-	-	-
2	" "		5 mo	2	0	0
3	" "		7 mo	0	0	0
4	" "		8 mo	0	0	0
5	" "		8 mo	0	0	0
6	" "		6 mo	2	0	0
7	" "		6 mo	3	0	0

Summary

<u>Births</u>	<u>Spont. Ab.</u>	<u>Neonatal Deaths</u>	<u>Presently Pregnant</u>
5	4	2	7

Adverse Reproductive Outcome =  $\frac{\text{Sp.Ab.} + \text{neonatal deaths}}{\text{Total preg.}} \times 100 = \frac{6}{18} \times 100 = 33\%$

$\frac{6}{18} \times 100 = 33\%$

% Spontaneous abortion = 22.2%

% Neonatal Deaths = 11.1%

TABLE TWO

AGE

	<20	20-24	25-29	30-34	35-39	40+	Total
8 Women Preg. in 1979	0	2 1 S. abor.	9(1 neonatal, 1 S. abortion)	7(1 neonatal, 2 S. abortion)	0	0	18
0 Women not Pregnant in 1979	1	10	6	12	6	25	60

ETHNIC BACKGROUND

	Asyrian	Serbian	Hispanic	White	Other	Total
Women Preg in 1979	10 2 S. abor. 3 neonatal	1	4 1-S. Abortion	2 1-S. Abortion	1	18
Women <u>not</u> Pregnant in 1979	21	11	10	4	14	60

PREGNANCY HISTORY PRIOR TO 1979

	Total	Live	Stillbirths	Sp.Ab.	Induced Ab.	Fetal Wastage Rate
Prior experience of 18 Women Preg. in 1979	21	19	0	2	0	9.5%
0 Women <u>not</u> Pregnant in 1979	120	103	0	11	6	9.2%

TABLE THREE

WOMEN PREGNANT DURING 1979 ACCORDING TO WORKPLACE

Pointing & Cleaning	Fluting & Forming
<p style="text-align: center;">9 Pregnancies</p> <div style="display: flex; justify-content: space-between;"> <div style="text-align: left;"> <p>2 Births</p> <p>4 presently pregnant</p> </div> <div style="text-align: right;"> <p>1 Neonatal Death</p> <p>2 Spont. Ab.</p> </div> </div>	<p style="text-align: center;">9 Pregnancies</p> <div style="display: flex; justify-content: space-between;"> <div style="text-align: left;"> <p>3 births</p> <p>3 presently pregnant</p> </div> <div style="text-align: right;"> <p>1 Neonatal Death</p> <p>2 Spont. Ab.</p> </div> </div>

" TABLE FOUR

WOMEN PREGNANT DURING 1979 BY SHIFT

Shift	I	II
	<p>2 sp. ab.</p> <p>2 neonatal deaths</p> <p>3 presently pregnant</p> <hr/> <p>7 pregnancies 1979</p>	<p>2 sp. ab.</p> <p>5 live births</p> <p>4 presently pregnant</p> <hr/> <p>11 pregnancies 1979</p>

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