Automobile Trim Plant Tris
Sewing machine

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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. 77-39-400

Fisher Body No. 2 Plant
Grand Rapids, Michigan

JUNE 1977

I. TOXICITY DETERMINATION

It has been determined based upon environmental samples that a potential health hazard exists due to employees' exposure to tris-2,3-dibromopropyl phosphate, (Tris), a demonstrated carcinogen in rats and mice and which was found to be present in the material Typar. Tris was also found to be present on white gloves worn by some employees, on swipe samples taken on employee's hands and on the sewing machine tables, in dust samples collected around the sewing machine needles and on seven of the ten breathing zone air samples collected on employees. Because Tris is a suspect carcinogen for man and environmental conditions have not been sufficiently defined to assign a safe exposure level, the presence of the material in the workplace alone indicates a potential health hazard and it is recommended that a substitute be found.

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) Fisher Body No. 2 Plant, Grand Rapids, Michigan
b) Authorized representatives of employees - Local 1231 - UAW
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 Local 1231 of the United Automobile Workers regarding employees exposure to Typar, a material containing tris-2,3-dibromopropyl phosphate (commonly known as Tris). Reported symptoms included nausea, bitter taste, headache, sore throat, watering eyes and itching.

IV. HEALTH HAZARD EVALUATION

A. Conditions of Use

The departments of the Fisher Body No. 2 Plant in Grand Rapids, involved in this study sew seat covers and interior carpets for automobiles. The particular material investigated was Typar. Typar is a man-made fibrous strip, approximately two inches wide, which is sewn onto various areas of the seat covers or carpeting for reinforcement purposes. The Typar strips, as received from the supplier, have been treated with a fire retardant. The fire retardant used contains tris-2,3-dibromopropyl phosphate and aluminum trihydrate.

B. Evaluation Methods

The study at Fisher Body was conducted on March 16 and 17, 1977. On March 17, AA filters were used to collect breathing zone air samples on nineteen employees. Ten of the filter samples were analyzed for Tris. The filters were extracted with benzene and the extracts cleaned up on silica gel before being analyzed by a gas chromatographic method. The remaining nine samples were analyzed for aluminum trihydrate by atomic absorption spectroscopy. Also obtained were a strip of Typar and of carpeting for Tris and aluminum trihydrate analyses. In addition, three bulk dust samples were obtained from around the sewing machine needles. The samples were divided and analyzed for both substances. During the shift, the stockman for Typar and three rewind workers were asked to wear white cotton gloves while they conducted their normal work activities. The right glove of each pair was analyzed for Tris content and the left glove for aluminum trihydrate. Swipe samples on employees' hands and work areas were taken. Six were analyzed for Tris and five for aluminum trihydrate.

Twenty-five employees on the second shift on March 16, who were working with Typar were interviewed to elicit any symptoms or health problems that they had experienced. An additional nineteen employees were interviewed on March 17, to determine if they were experiencing any health problems.

C. Evaluation Criteria

Tris - Laboratory tests on Tris, until recently, indicate this material to be of very low oral and dermal toxicity, not a skin or eye irritant and to have a low order of subacute toxicity, as determined by 28-day rat feeding studies. In March, 1976, results were released which indicated Tris produced positive results on the Ames Test.[1] The Ames Test has been widely applied as a mutagenic screen that could identify possible carcinogens. In the test, a specific strain of salmonella bacteria is exposed to the chemical. Development of mutagenic strains under these conditions has been closely correlated to chemicals that are carcinogenic. Researchers at New York Medical College reported positive results of the mutagenicity test on Tris washed from fabric. (The test, however, does not conclusively demonstrate that Tris is a cancer-causing agent.)

The National Cancer Institute, (NCI), commissioned a two year feeding study on Tris conducted at Mason Research Institute in Rockville, Maryland. Computer printout results of the bioassay results released in March, 1977, according to the Environmental Defense Fund, (EDF), showed an increased incidence of kidney tumors in rats and tumors of the lung, stomach, liver and kidney in mice.[2] The NCI final report on its two-year study of Tris, released later in March, 1977, confirmed the carcinogenicity in animals.[3] Based on this information, in April, 1977, the Consumer Product Safety Commission made a decision to ban sleepwear treated with the flame retardant. In the case of Tris, as is the case with many carcinogens or suspected carcinogens, environmental conditions have not been sufficiently defined to assign a safe exposure level.

Aluminum Trihydrate - Aluminum trihydrate is a white, odorless, tasteless, amorphous powder. No instance of acute or chronic toxicity have been reported in either animals or man.[4] There is no occupational health standard for aluminum trihydrate at the present time.

D. Evaluation Results and Discussion

A strip of Typar was analyzed to determine if Tris and aluminum trihydrate were present. Both substances were detected. The concentrations are given in Table 1. Also analyzed was a piece of carpeting. No Tris was detected, but a considerable quantity of aluminum trihydrate was noted. In addition, bulk samples of dust collected around the needles of two machines were analyzed. Tris content in one sample accounted for 0.33 mg/g of the sample.

In one sample, the aluminum trihydrate content was 257 mg/g of the sample. Sample locations and concentrations are given in Table I.

Personal breathing zone samples were collected on nineteen individuals working with Typar. Ten of these filter samples were analyzed for Tris. The sample locations and concentrations are given in Table II. Concentrations of Tris ranged from nondetectable to 0.2 ug/M^3. The remaining nine filter samples were analyzed for aluminum trihydrate. No detectable levels of aluminum trihydrate were found. Limit of detection was 5 ug/M^3.

Eleven swipe samples were taken on employees' hands or on the table top where they worked. Six of the samples were analyzed for Tris. Tris was detected on one employee's hands and on the table top which was checked (Table III). Of the five samples analyzed for aluminum trihydrate, four showed concentrations varying from 14-1115 ug/sample (Table IV).

The three employees in the rewind area and the stockman wore white cotton gloves while handling Typar. (Other employees were not asked to wear gloves because of the danger of them being caught in the machines while sewing.) Results are given in Table V. The concentration of Tris ranged from 0.17-1.65 mg/glove. Aluminum trihydrate content ranged from 6-197 mg/glove.

The interviews conducted with fourty-four employees revealed sixteen with no reported health complaints. The most common complaint from employees was of bitter taste. This was reported by twenty workers or 45 percent of those interviewed. Eleven employees reported having sinus problems or nasal irritation, some with nose bleeds and five workers reported experiencing a rash occasionally. Other complaints included headaches, cough, sore throats and eye irritation.

The reported symptoms do not appear to correlate with symptoms presented in the literature which result from exposure to either Tris or aluminum trihydrate. The symptoms may be a result of and are typical of complaints received from a work population exposed to dust in their work environment. The symptoms are typical of mild upper respiratory irritation and appear to present no serious health problems.

Tris, as stated earlier, has been found to be a carcinogen in animals. In the case of Tris, as is the case with many carcinogens or suspected carcinogens, environmental conditions have not been sufficiently defined to assign a safe exposure level. Therefore, based on the presence of Tris in the work environment, as shown by the results of the various types of environmental samples, it is recommended that a substitute be found for Typar. It is our understanding however, that the supplier of Typar has changed the composition of the material and, therefore, it no longer contains Tris. Fisher Body should verify this information with the supplier and make arrangements for handling the present supply of the material.

V. REFERENCES

1. Markets for Tris burned by new tests. Chemical Week, March 2, 1977, p. 39-40.

2. Tris, Ban Demanded by EDF. Chemical Marketing Reporter, Vol. 221, No. 7, February 14, 1977, p. 53.

3. Toxicity becomes burning issue. Chemical Week, March 30, 1977, p. 24.

4. Patty, Frank A.; Industrial Hygiene and Toxicology, Vol. II, p. 989, 1963.

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TABLE I

Fisher Body
Grand Rapids, Michigan
March 16-17, 1977

Sample	Tris (mg/g of sample)	Aluminum Trihydrate (mg/g of sample)
Strip of Typar	0.004	28
Carpet Strip	N.D.	140
Dust from Area 60-Machine 40(March 16)	0.153	257
Dust from Area 60-Machine 40(March 17)	0.314	*
Dust from Area 56-Machine 28(March 17)	0.33	2.6

N.D.-Not Detected
*Total sample used in Tris analysis

TABLE II

Fisher Body
Grand Rapids, Michigan

Tris-2,3-Dibromopropyl Phosphate
March 17, 1977

Sample Location	Sample Number	Sampling Period	Sample Volume (liters)	Tris ($\mu g/M^3$)
Area 56-Machine 28	AA-2	6:52-11:40 12:46-14:37	598	N.D.*
Area 82-Machine 32	AA-63	7:05-14:10	637	0.05
Area 71-Machine 6	AA-10	7:41-12:55	471	0.06
Area 72-Machine 6	AA-61	7:46-13:33	520	0.08
Area 73-Machine 8	AA-11	7:54-12:52	447	N.D.
Area 60-Machine 42-44	AA-8	6:31-14:51	750	0.2
Area 60-Machine 40	AA-6	6:35-14:51	744	0.2
Area 55-Machine 8	AA-65	6:45-14:07	663	0.06
Area 84-Machine 33	AA-51	7:03-14:27	666	0.04
Area 80-Machine 17	AA-4	7:20-14:35	652	N.D.

*N.D. - Not Detected

TABLE III
Swipe Tests for Tris
March 17, 1977

Sample Location	Sample Number	Tris (µg/sample)
Employees' Hands (Area 84-Machine 32)	P-1	N.D.
Employees' Hands (Area 72-Machine 6)	P-3	0.44
Employees' Hands (Area 75-Machine 19)	P-5	N.D.
Table Top (Area 60-Machine 40)	P-7	0.24
Employees' Hands (Area 60-Machine 1)	P-9	N.D.
Employees' Hands (Area 56-Machine 28)	P-11	N.D.

*N.D. - Not Detected - Minimum Detectable Limit 0.03µg/filter

TABLE IV
Fisher Body
Grand Rapids, Michigan

Swipe Tests for Aluminum Trihydrate

Sample Location	Sample Number	Aluminum Trihydrate
Employees' Hands (Area 73-Machine 8)	P-2	14
Employees' Hands (Area 59-Machine 15)	P-4	N.D.*
Table Top (Area 73-Machine 8)	P-6	108
Employees' Hands (Area 84-Machine 33)	P-8	1115
Table Top (Area 60-Machine 42)	P-10	17

*Not Detected - Limit of Detection 5µg

TABLE V
Fisher Body
Grand Rapids, Michigan
March 17, 1977

Gloves Analyzed for Tris

Location	Sample Number	Tris mg/glove
Rewind Machine Operator Machine 42-43-44	G-1A	1.65
Rewind Machine Operator Machine 41	G-2A	1.09
Rewind Machine Operator & Cutter Machine 40	G-4A	1.00
Stockman	G-3A	0.17

Minimum Detectable Level=0.14mg

Gloves Analyzed for Aluminum Trihydrate

Location	Sample Number	Aluminum Trihydrate mg/glove
Rewind Machine Operator Machine 42-43-44	G-1B	197
Rewind Machine Operator Machine 41	G-2B	91
Rewind Michine Operator Machine 40	G-4B	82
Stockman	G-3B	6