U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45202

HEALTH HAZARD EVALUATION DETERMINATION
REPORT NO. 73-103-128

AMERICAN STANDARD FIBERGLASS
STOCKTON, CALIFORNIA

MARCH 1974

I. TOXICITY DETERMINATION

It has been determined that styrene and methylene bisphenyl isocyanate (MDI) is toxic at the concentrations experienced by workers in the American Standard Fiberglass Company. This determination is based upon the findings of medical interviews of all the employees at the plant and environmental sampling for styrene and MDI in air on two occasions by NIOSH personnel.

Although there is a mechanical exhaust system present in the plant, its effectiveness is nullified due to the lack of sufficient make-up air into the plant.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report are available upon request from the Hazard Evaluation Services Branch, NIOSH, U.S. Post Office Building, Room 508, 5th and Walnut Streets, Cincinnati, Ohio 45202. Copies have been sent to:

a) American Standard Fiberglass, Inc., Stockton, California
b) Authorized Representative of Employees
c) U.S. Department of Labor - Region IX
d) NIOSH - Region IX

For purposes of informing the affected employees, the employer will promptly "post" the Determination Report in a prominent place(s) near where affected employees work for a period of thirty (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.

The National Institute for Occupational Safety and Health (NIOSH) received such a request from an authorized representative of employees regarding exposure to toxic chemicals at the American Standard, Inc. plant in Stockton, California.

IV. HEALTH HAZARD EVALUATION

A. Plant Process - Conditions of Use

The American Standard, Inc. plant in Stockton, California has only been in operation for about two years. Their product consists in the manufacture of fiberglass tubs and showers in an assembly-line type operation. There are approximately 100 persons engaged in the production activity which operates one shift per day, five days per week. The operations consist of the following:

1. Glassing Areas 1&2

These two areas are the same. There are 2 male gunners and 7 female rollers in each of the areas. The gunner has a spray gun device which pulls fiberglass yarn through a chopper and mixes it with polyester resin, catalysts, and sprays the mixture on the tubs and showers. Approximately 7 girls use rollers to smooth the mixture into a uniform coating. The exposures to these workers are fiberglass dust and styrene. The workers wear some protective clothing and are provided with gauze-type masks only (3M Company, 7C-21C-132 #8710). The employees work at a distance of 4-8 feet from the provided local exhaust ventilation. A housing extends from the floor to the roof which supports 3 fans with 18,000 CFM capacity. A continuous slot of about 15 inches is built into the housing and functions as the local exhaust ventilation.

2. Glassing Area 3

Two gunners are located in this area and 1 or 2 rollers. The first gunner uses one additional material. A foaming agent is sprayed on tubs and showers in this area. The compound is reported to be polymethylene polyphenylene polyisocyanate (Polymir Ind., 1091 Calcot Place, Oakland, California) which the manufacturer claims contains no free TDI. The worker using the foam wears a respirator (Glendale Optical Co.) with C-20 cartridges for low concentration of organic vapors. The Glendale has BM-21A-82 approval number.

3. Gelcoat

This area has two men rotating jobs. One man sprays a lacquer mixture containing polyesters, styrene and fillers and the other man turns the tubs and showers. These workers wear Glendale Optical Co. respirators. Local exhaust ventilation is provided in the same manner as described above in the glassing area. The fan capacity is 22,000 CFM.

4. Reinforcing Gun Area

A small spraying operation is located at the end of one conveyor line. One worker sprays the fiberglass-resin mixture on small strips of liner material for the edges of the tubs and showers. The operation is done in a small hood.

5. General

The tubs and showers are put together in a Grinding Room where the rough edges are shaped with sanders. Potential exposures in this area are Noise and Dust. Seven employees are in this area.

B. Evaluation Methods

On August 10, 1973, Mr. Mel Okawa, NIOSH - Region IX, Industrial Hygienist, conducted an initial worksite evaluation. After discussing the hazard evaluation request with management he proceeded to conduct a non-directed interview with eleven employees chosen at random to determine if any health problems existed that could be attributed to their occupation. Mr. Okawa also collected 23 airborne samples on charcoal tubes in order to determine the concentrations of styrene in the work area. (See Table 1)

On December 11-12, 1973, Dr. Arnold Bodner and Mr. George Butler conducted a follow-up survey in order to confirm the findings of the initial survey and also evaluate the isocyanate foaming operation. At this time 35 exposed workers and 4 non-exposed office workers were interviewed by Dr. Bodner to determine if any ill-effects were present as a result of working at this plant. A number of integrated air samples were also collected on charcoal tubes in order to establish the concentration of styrene present in the operation during winter conditions. Airborne samples were also collected in the Glassing Area 3 where the urethane foaming operation occurs to determine the levels of isocyanate present in the air. (See Tables 2 & 3 respectively) Due to the fact that a long chain polyisocyanate is used in this foaming operation, it could not be well established whether part of the isocyanate was toluene-2,4-diisocyanate or other amines, however it was established that

methylene bisphenyl isocyanate (MDI) was present.

C. Evaluation Criteria

The OSHA Standard for styrene is taken from Part 1910 of Title 29 of the Code of Federal Regulations, Section 1910.93, Table G-2.

Material	8-hour time weighted average	Acceptable ceiling concentration	Acceptable maximum peak above the acceptable ceiling concentration for an 8-hour shift	
			Concentration	Maximum duration
Styrene	100 ppm	200 ppm	600 ppm	5 mins. in any 3 hours

The OSHA Standard for MDI and TDI is taken from Part 1910 of Title 29 of the Code of Federal Regulations, Section 1910.93, Table G-1.

Substance	ppm	mg/M^3
Methylene bisphenyl isocyanate (MDI)	0.02	0.2
Toluene-2,4-diisocyanate (TDI)	0.02	0.14

D. Evaluation Results

Thirty-five workers were interviewed in the gelcoat area, and glassing areas 2 and 3. Twenty-one of thirty-five workers (60%) were female; their average age was 34 years and their average work experience at American Standard was 3.7 years. Forty-six percent of the workers smoked at least 1/2 pack of cigarettes a day.

Four office workers (three were female) with an average age of 28 were also interviewed as a control. They averaged 2 years of work experience; two smoked and two did not.

Thirty-four out of thirty-five workers or 97% complained of some form of eye, nose, or throat irritation; 49% of the workers also complained of wheezing, shortness of breath, or chest tightness. Also, 40% of the workers complained of skin rashes, hives, darkening skin color, or skin sores. Several other complaints were also noted, such as nose bleeds, anorexia, excessive thirst, numbness of extremities, frequent headaches, occasional vomiting, and upset stomach.

Of the four office workers used as controls, none complained of eye, nose, throat irritation, chest discomfort, skin problems, or any other health problems.

The environmental evaluation results indicate excessive concentrations of styrene in the plant especially during the hot summer months. Improvement in the overall ventilation system and increased amounts of supplied air for make-up may possibly improve the working conditions where the styrene is involved. The determinations for isocyanates indicate that the main problem centers around the foam gunning operation and is minimized as the product continues down the assembly line. Environmental results are tabulated in Tables I, II and III.

E. Evaluation Discussion

Styrene vapor in concentrations of 200-400 ppm has been reported to cause irritation to eyes and mucous membranes of the nose and also to produce an offensive odor. At even higher levels, styrene can cause weakness, stupor, incoordination, tremors, and eventually unconsciousness, but this is unusual because styrene does not vaporize sufficiently to reach vapor concentrations of several thousand parts per million under ordinary room conditions.[1]

Methylene bisphenyl isocyanate (MDI) is considered much less irritating and sensitizing than toluene diisocyanate (TDI). Human studies with MDI have been limited but animal studies show that only very high concentrations of MDI will cause irritation of even sensitive tissues such as the rabbit conjuntiva.[2]

Due to the high frequency of complaints of mucous membrane irritation, skin rashes and chest tightness, combined with the high levels of styrene and isocyanates found at the American Standard Company of Stockton, California, it is felt that a health hazard exists. Adverse effects to styrene vapor at levels found in this plant is confirmed by reports in existing scientific literature; however, the role of isocyanates in the symptomotology found here is less clear. While MDI is present in levels higher than the OSHA Standard, there is no evidence from studies in the literature that MDI causes the symptoms found at levels reported here. In addition, since both MDI and styrene are primary mucous membrane irritants, it would be difficult to isolate the effects of each substance on the workers studied.

V. REFERENCES

1. Patty, Frank A.: Industrial Hygiene & Toxicology, Volume II, New York City, New York, 1963, p. 1231.

2. Woolrich, P.F. and Rye, W.A.: Urethanes, Upjohn Company, Kalamazoo, 1968.

VI. AUTHORSHIP AND ACKNOWLEDGMENTS

Report Prepared By: Arnold H. Bodner, M.D.
Medical Officer
Salt Lake City, Utah

George J. Butler
Industrial Hygiene Engineer
Salt Lake City, Utah

Melvin T. Okawa
Industrial Hygienist - Region IX
San Francisco, California

Originating Office: Jerome P. Flesch, Chief
Hazard Evaluation Services Branch
Cincinnati, Ohio

Acknowledgments

Analytical Laboratory Staff
Western Area Occupational Health Laboratory
Salt Lake City, Utah

TABLE 1

AMERICAN STANDARD, INC.
STOCKTON, CALIFORNIA
AUGUST 1973

Sample Location	Styrene Concentration P.P.M.*
Glassing Area #1 - Gunner	143
" Roller	120
" Gunner	151
" Roller	147
" Gunner	152
" Roller	128
" Gunner #2	106
" Roller	143
" Gunner #2	130
" Roller	163
" Gunner #2	175
" Roller	154
Reinforcing Gunner	83
Glassing Area #2 - Roller	120
Reinforcing Gunner	77
Gelcoat Sprayer	215
" Turner	346
" Sprayer	254
" Turner	326
" Sprayer	237
Glassing Area #2 - Roller	536
" Roller	431
" Roller	550

*P.P.M. - part per million of air by volume

TABLE II

AMERICAN STANDARD, INC.
STOCKTON, CALIFORNIA
DECEMBER 1973

Sample Location	Styrene Concentration P.P.M.*
Glassing Area #1 - Roller	45
" Gunner	73
Glassing Area #2 - Gunner	123
" Roller	158
" Inside Roller	210
Gelcoat Sprayer	95
Gelcoat Sprayer	123
Glassing Area #3 - Gunner	67
" Roller	78

*P.P.M. - parts per million of air by volume

TABLE III

AMERICAN STANDARD, INC.
STOCKTON, CALIFORNIA

DECEMBER 1973

Sample Location	M.D.I. Concentration mg/M^3	Other Isocyanates/Amines mg/M^3
Glassing Area #3 - Foam Gunner	0.21	0.02
Bottom glass gunner	0.22	0.01
Bottom glass roller	0.05	<0.005
Foam Gunner	0.17	0.01
Bottom glass gunner	0.12	0.02
Foam Gunner	0.27	0.01
Glass gunner	0.02	0.01
Foam Gunner	0.26	0.01
Area adjacent to foam gunner	0.15	0.01
Area adjacent to last roller in Glassing Area #3	0.01	0.01