U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
CENTER FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45226

HEALTH HAZARD EVALUATION DETERMINATION REPORT
HE 78-125-712

OWENS-CORNING FIBERGLAS CORPORATION
CONROE, TEXAS

JULY 1980

I. SUMMARY

On July 27, 1978, the National Institute for Occupational Safety and Health (NIOSH) received a request from an authorized representative of the United Paperworkers International Union to evaluate possible hazards to plant employees from exposure(s) to methylene chloride, methyl ethyl ketone, styrene, fibrous glass, silica (quartz/cristobalite), and nuisance particulate matter. On July 19-20, 1979, environmental samples were collected to determine airborne concentrations of those contaminants. In addition, interviews were conducted with fourteen (14) production area employees in an attempt to identify any known or existing employee medical conditions.

A total of thirty-one personal breathing-zone samples were collected during the evaluation; the results were all below NIOSH and ACGIH recommended levels and OSHA standards as summarized below:

Methylene chloride (six personal air samples in the range of 18-85 milligrams per cubic meter; criteria - 261 mg/M^3). Methyl ethyl ketone (eight personal air samples in the range of 4-20 mg/M^3; criteria - 590 mg/M^3). Styrene (eight personal air samples in the range of 65-200 mg/M^3; criteria - 215 mg/M^3. Fibrous glass (one personal air sample showing a concentration of less than 0.01 fiber per cubic centimeter). Nuisance particulate matter (six personal air samples in the range of 0.3-4.7 mg/M^3; criteria - 10 mg/M^3). Silica, quartz/cristobalite (one personal air sample was below the lower detection limit of the analytical method and one personal sample was 0.33 mg/M^3, based on a free silica content of 25 percent).

Employee interviews with fourteen (14) production area employees failed to identify work-related employee health problems.

Based on results of environmental samples and employee interviews obtained during this investigation, NIOSH determined that a hazard of occupational exposure to methylene chloride, methyl ethyl ketone, styrene, fibrous glass, nuisance particulate matter, or silica (quartz/cristobalite) did not exist in the production areas at Owens-Corning Fiberglas Corporation, Conroe, Texas.

Recommendations relating to the administering of pre-placement examinations are presented on page six (6) of this report.

II. INTRODUCTION

Under the Occupational Safety and Health Act of 1970*, NIOSH is authorized to investigate the toxic effects of substances found in the workplace. On July 27, 1978, NIOSH received a request from the United Paperworkers International Union to investigate production area employee exposure to methylene chloride, methyl ethyl ketone, styrene, fibrous glass, silica (quartz/cristobalite), and nuisance particulate matter.

III. BACKGROUND

The Owens-Corning Fiberglas Corporation, Conroe, Texas, currently employs a total of 218 persons, 157 of which are involved in the fabrication of tanks and pipe produced from fibrous glass and polyester resins, utilizing a combination of dripping, spray-up and lay-up to form the units.

The tanks, used primarily by the oil and chemical industries, are constructed from fiberglas filaments and styrene resin. Tank bodies and endcaps are "layed up" by mechanical spray application of chopped fiberglas and resin to tank forms. Pipes of various sizes are fabricated from the operation of appropriate mandrels.

IV. EVALUATION DESIGN AND METHODS

An initial walk-through survey was performed at the facility on November 8, 1978. The purpose of that visit was to gather information on the characterization of all substances used in the production areas, as well as conditions of their use. All areas within the plant where significant exposure to applicable chemicals might occur, were identified.

In order to more fully and adequately evaluate employee exposure to various chemicals/compounds used in the manufacture of the fibrous glass tanks and pipe, environmental sampling was conducted on July 19-20, 1979.

*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 receipt of a written request from 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.

Personal breathing-zone air samples were collected to evaluate employee exposure to methylene chloride (fixed mandrel, end cap, gas end cap and Drostholm areas); methyl ethyl ketone (fixed mandrel, end cap, gas end cap and Drostholm areas); styrene (fixed mandrel, end cap, gas end cap and Drostholm areas); fibrous glass (end cap and gas end cap areas); and silica, quartz/cristobalite (Drostholm area). Samples were collected by using both filters (pore size, 0.8-5.0 micron) and standard charcoal tubes, depending on the prescribed sampling/analytical method.

Analytical methods utilized were: (a) gas chromatography (charcoal tubes); (b) x-ray diffraction (silica); (c) phase contrast microscopy (fiberglas); and (d) gravimetric analysis (nuisance particulate matter).

During the November 8, 1978, and July 19-20, 1979, surveys, a total of fourteen (14) production area employees were interviewed in an attempt to identify any workers with work-related health conditions resulting from their exposure to various chemicals/compounds in their respective work areas.

V. EVALUATION CRITERIA

A. Environmental

Environmental standards and criteria considered to be applicable to this evaluation are shown below.

Substance	NIOSH, 8-10 hr. TWA Recommendation (mg/M^3)*	ACGIH, TLV Committee, 8-hr TWA (mg/M^3)*	OSHA, 8-hr TWA Standard (mg/M^3)*
Methylene Chloride	261	700	1750
Methyl Ethyl Ketone	590	590	590
Styrene	xx	215	430
Crystalline Silica (total)	xx	30 mg/M^3 / % SiO_2+3	30 mg/M^3 / % SiO_2+2
Fibrous Glass	3 fibers/cc**	xx	xx
Nuisance Particulate Matter	xx	10	15

* Eight or ten-hour, time-weighted-average concentrations in milligrams of substance per cubic meter of air sampled.

** Fibers per cubic centimeter of air (having a diameter equal to or less than 3.5 micrometers and a length equal to or greater than 10 micrometers).

B. Toxic Effects

Methylene Chloride [1,2]

Methylene chloride is the least toxic of the four chlorinated methanes. The toxic effect is predominantly narcosis, although not

effective enough for good anesthesia. It does not cause significant organic injury. The symptoms of excessive exposure may be dizziness, nausea, tingling or numbness of the extremities, sense of fullness in the head, sense of heat, stupor or dullness, lethargy, and drunkeness. The principal problem from excessive exposure will be the "drunkeness" and incoordination, which may lead to unsafe operation. Exposure to very high concentrations may lead to rapid unconsciousness.

Prompt removal from exposure usually results in complete recovery. Methylene chloride is rapidly eliminated from the body and the usual symptoms of overexposure disappear quickly in fresh air, with no permanent effects on the normal heart, liver, or kidneys. There is no evidence that continued exposure to low concentrations of methylene chloride vapor can result in damage to healthy organs.

Methylene chloride is mildly irritating to the skin on repeated contact. The problem may be accentuated by the chemical being sealed to the skin by shoes or tight clothing.

Methyl Ethyl Ketone (MEK)[3,4]

Potentially harmful concentrations of this vapor give warning of their presence by odor and irritation. The vapor of MEK is irritating to the mucous membrane of the eyes, nose and respiratory tract and may result in headache(s), dizziness, upset stomach, and vomiting. Liquid MEK is a powerful degreasing solvent and prolonged or repeated contact with the skin should be avoided.

Styrene [5,6]

Styrene can cause irritation, violent itching of the eyes, lachrymation, and severe human eye injuries. Its toxic effects are usually transient and result in irritation and possible narcosis. It is not considered a very toxic material because, under ordinary conditions, it does not vaporize sufficiently to reach harmful concentrations. The severity of hazards for both acute and chronic exposures to styrene vapors is low in single dose oral toxicity.

In industry, the danger of acute styrene poisoning has occured as the result of a breakdown or faulty plant operation. A polymerization reaction that gets out of control is accompanied by a rapid release of heat and necessitates prompt evaluation of the product from the reaction vessel; this operation leads to a sudden rise of the styrene concentrations in the workplace atmosphere, and the workers involved become exposed to the danger of severe intoxication unless protected by suitable respiratory equipment.

Although bioassays by the National Cancer Institute (NCI) and the Inter Agency for Research on Cancer (IARC) have failed to identify styrene as a carcinogen, no conclusions were drawn as to its connection as a mutagen. Its metabolite, styrene oxide (e.g. styrene plus peroxides/styrene plus high humidity) has, however, been shown to be both carcinogenic and mutagenic in animals.

Fibrous Glass [7,8]

Different dimensions of fibrous glass will produce different biologic effects. Large diameter (greater than 3.5 micrometers {μm}) glass fibers have been found to cause skin, eye and upper respiratory tract irritation; a relatively low frequency of fibrotic changes; and a very slight indication of an excess mortality due to nonmalignant respiratory disease.

Smaller diameter (less than 3.5 micrometers {μm}) fibrous glass has not been conclusively related to health effects in humans, but glass fibers of this dimension have been regularly produced only since the 1960's. Smaller diameter fibers have the ability to penetrate to the alveoli and this potential is cause for concern, and the primary reason that fibers 3.5 μm or smaller are subject to special controls.

Experimental studies in animals (fibrous glass implanted in pleural/peritoneal cavities) have demonstrated carcinogenic effects, with the long (greater than 10 μm) and thin (usually less than 1 μm in diameter) fibers. Data from studies with these routes of exposure, however, cannot be directly extrapolated to conditions of human exposure.

Silica [9,10]

Silica occurs in the pure state in nature as quartz. The prolonged inhalation of dusts containing excessive free silica may result in the development of a disabling pulmonary fibrosis known as silicosis. Silicosis is defined as a disease due to the breathing of air containing silica (SiO_2), characterized by generalized fibrotic changes and the development of miliary nodules in both lungs, and clinically by shortness of breath, decreased chest expansion, absence of fever, lessened capacity for work, and increased susceptibility to tuberculosis. The duration of exposure which is associated with the possible development of silicosis varies widely for different occupations.

The most common physical sign of silicosis is a limitation of expansion of the chest. There may be a dry cough, sometimes very troublesome. Where the disease advances, the shortness of breath becomes worse, and the cough more productive and troublesome.

Nuisance Particulate Dust [11,12]

The effects of dust vary according to the composition. If it is organic dust, it is primarily a nuisance, but may produce asthma by being an allergen. If the dust contains toxic compounds, either organic or inorganic, the hazard is that of the toxic component.

Even though a dust may be considered generally innocuous, and not be recognized as the direct cause of a pathological condition, its level should be maintained as low as is practical. A concentration of ten (10) milligrams per cubic meter of air sampled is suggested as the threshold limit for a number of nuisance dusts. With good engineering practice, there is no need for this level to be exceeded. Any reduction below this level will increase the comfort of employees and improve housekeeping.

VI. RESULTS AND DISCUSSION

Results appearing in Tables 1, 2 and 3 show airborne concentrations of six (6) methylene chloride; eight (8) methyl ethyl ketone; and eight (8) styrene personal breathing-zone air samples were well below the applicable NIOSH recommended level, ACGIH, TLV Committee recommended/proposed 8-hour TWA and/or OSHA, 8-hour TWA/ceiling standard(s).

Table 4 shows a single fibrous glass air sample to be well below the recommended NIOSH 8-10 hour, TWA, fiber count.

Similarly, Table 5 indicates that six (6) particulate air samples were all considerably below both the ACGIH, TLV Committee, 8-hour TWA recommendation (10 mg/M^3); and the OSHA, 8-hour TWA standard (15 mg/M^3) for nuisance particulate matter.

On July 19, 1979, an attempt was made to monitor the resin mixer for potential silica exposure. An injury to that individual shortly after commencing the sampling period, however, resulted in the removal of the monitoring equipment and the sample being rendered "invalid". As shown in Table 6, two (2) other silica samples, collected in the Drostholm area on July 20, 1979, were found to be either below the: (a) lower detection limit of the analytical method; (b) applicable ACGIH,TLV Committee recommended level; or (c) applicable OSHA standard.

Employee interviews with fourteen (14) persons performing duties in the production area(s) failed to identify definite work-related health conditions.

VII. CONCLUSIONS

Results of the environmental sampling and employee interviews indicate that employees were not exposed to toxic levels of various chemicals/compounds, listed earlier, during the time of this evaluation.

VIII. RECOMMENDATIONS

1. Workers subject to fibrous glass exposure should have pre-placement medical examinations with special emphasis directed towards evidence of acute/chronic skin conditions, pulmonary disease and prior exposure in the dusty trades.

2. Medical examinations should be conducted prior to assigning an employee to work with styrene. Individuals who suffer from diseases of the respiratory tract may be affected by lower concentrations of styrene than would ordinarily be the case. Such individuals, as well as those who exhibit intolerance to low concentrations, should be placed in jobs where they are not exposed to styrene.

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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 and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After ninety (90) days, the report will be available through the National Technical Information Service (NTIS), Springfield, Virginia 22161. Information regarding its availability through NTIS can be obtained from NIOSH, Publications Office, at the Cincinnati, Ohio, address.

Copies of this report have been sent to:

a) Owens-Corning Fiberglas Company, Conroe, Texas
b) Authorized Representative of Employees
c) U.S. Department of Labor, Region VI
d) NIOSH, Region VI
e) Texas State Department of Health

Table 1

Methylene Chloride Concentrations

Owens-Corning Corporation
Conroe, Texas

July 19-20, 1979

Sample Number	*Type of Sample	Date of Sample	Location	Sampling Period	**Concentratio (mg/M^3)
MC-1	P	7-19-79	Fabricator - Fixed Mandrel	1521-1638	45
MC-2	P	7-19-79	Fabricator - Gas End Cap	1507-1610	83
MC-3	P	7-20-79	Sr. Fabricator - Drostholm	0726-0910	18
MC-4	P	7-20-79	Mach. Tender - Drostholm	0733-0906	70
MC-5	P	7-20-79	Sr. Fabricator - End Cap	0744-0907	85
MC-6	P	7-20-79	Sr. Fabricator - Fixed Mandrel	0749-0914	22

NIOSH, 8-10 hour, TWA Recommendation	261
ACGIH, TLV Committee Recommendation	700
ACGIH, TLV Committee (Proposed)	360
OSHA Standard	1750
OSHA Standard (ceiling)	3500

*P = Personal
**mg/M^3 = Milligrams of substance per cubic meter of air sampled

Table 2

Methyl Ethyl Ketone Concentrations

Owens-Corning Corporation
Conroe, Texas

July 19-20, 1979

Sample Number	*Type of Sample	Date of Sample	Location	Sampling Period	**Concentration (mg/M^3)
SM-1	P	7-19-79	Sr. Fabricator - Fixed Mandrel	1527-1930	15
SM-2	P	7-19-79	Fabricator - Fixed Mandrel	1520-1931	(a)
SM-3	P	7-19-79	Spray Operator - Gas End Cap	1510-1923	5
SM-4	P	7-20-79	Sr. Fabricator - Drostholm	0726-1240	4
SM-5	P	7-20-79	Sr. Fabricator Drostholm	0729-1213	13
SM-6	P	7-20-79	Mach. Tender - Drostholm	0732-1223	20
SM-7	P	7-20-79	Sr. Fabricator - Drostholm	0736-1232	6
SM-8	P	7-20-79	Sr. Fabricator - Fixed Mandrel	0737-1205	3
SM-9	P	7-20-79	Spray Operator - End Cap	0749-1203	5

NIOSH, 8-10 hour, TWA, Recommendation	590
ACGIH, TLV Committee Recommendation	590
OSHA Standard	590

*P = Personal
**mg/M^3 = Milligrams of substance per cubic meter of air sampled
(a) Pump malfunction - invalid sample

Table 3

Styrene Concentrations

Owens-Corning Corporation
Conroe, Texas

July 19-20, 1979

Sample Number	*Type of Sample	Date of Sample	Location	Sampling Period	**Concentration (mg/M^3)
SM-1	P	7-19-79	Sr. Fabricator - Fixed Mandrel	1527-1930	200
SM-2	P	7-19-79	Fabricator - Fixed Mandrel	1520-1931	(a)25
SM-3	P	7-19-79	Spray Operator - Gas End Cap	1510-1923	125
SM-4	P	7-20-79	Sr. Fabricator - Drostholm	0726-1240	119
SM-5	P	7-20-79	Sr. Fabricator - Drostholm	0729-1213	138
SM-6	P	7-20-79	Mach. Tender - Drostholm	0732-1223	150
SM-7	P	7-20-79	Sr. Fabricator - Drostholm	0736-1232	165
SM-8	P	7-20-79	Sr. Fabricator - Fixed Mandrel	0737-1205	65
SM-9	P	7-20-79	Spray Operator - End Cap	0749-1203	67

ACGIH, TLV Committee Recommendation	420
ACGIH, TLV Committee (Proposed)	215
OSHA Standard	420
OSHA Standard (ceiling)	840

*P = Personal
**mg/M^3 = Milligrams of substance per cubic meter of air sampled
(a) Pump malfunction - invalid sample

Table 4

Fibrous Glass Concentrations (Fiber Count)

Owens-Corning Corporation
Conroe, Texas

July 19-20, 1979

Sample Number	*Type of Sample	Date of Sample	Location	Sampling Period	Concentration (fibers per cubi centimeter
FG-A1	P	7-19-79	Spray Operator - Gas End Cap	1511-1923	(a)
FG-1	P	7-19-79	Fabricator - Gas End Cap	1509-1923	(a)
FG-A2	P	7-20-79	Spray Operator End Cap	0748-1203	(a)
FG-2	P	7-20-79	Senior Fabricator - End Cap	0743-1203	<0.01

NIOSH, 8-10 hour, TWA, Recommendation..... 3.0

*P = Personal
(a) Laboratory accident

Table 5

Nuisance Particulate Matter Concentrations

Owens-Corning Corporation
Conroe, Texas

July 19-20, 1979

Sample Number	*Type of Sample	Date of Sample	Location	Sampling Period	**Concentrati (mg/M^3)
D-1	P	7-19-79	Fabricator 1 - Gas/Fuel Oil	1532-1935	4.0
D-2	P	7-19-79	Fabricator 2 - Gas/Fuel Oil	1529-1935	0.8
D-3	P	7-19-79	Fabricator 3 - Gas/Fuel Oil	1531-1925	4.7
D-4	P	7-20-79	Fabricator 1 - Gas/Fuel Oil	0721-1923	0.3
D-5	P	7-20-79	Fabricator 2 - Gas/Fuel Oil	0720-1923	0.5
D-6	P	7-20-79	Fabricator 3 - Gas/Fuel Oil	0719-1913	0.8

ACGIH, TLV Committee Recommendation (Nuisance Particulate Matter)..... 10.0
OSHA Standard (Nuisance Particulate Matter)..... 15.0

*P = Personal
**mg/M^3 = Milligrams of substance per cubic meter of air sampled.

Table 6

Silica (Quartz/Cristobalite) Concentrations

Owens-Corning Corporation
Conroe, Texas

July 19-20, 1980

Sample Number	*Type of Sample	Date of Sample	Location	Sampling Period	% Free Silica(SiO_2)	**Concentration (mg/M^3)
SI-4216	P	7-19-79	Resin Mixer	1309-1349	50	(a)
SI-4228	P	7-20-79	Sr. Fabricator-Drostholm	0728-1213	(b)	(b)
SI-4218	P	7-20-79	Sr. Fabricator-Drostholm	0735-1232	25	0.33(c)

ACGIH, TLV Committee Recommendation..... $\frac{30mg/M^3}{\%SiO_2+3}$

OSHA Standard..... $\frac{30mg/M^3}{\%SiO_2+2}$

*P = Personal
**mg/M^3 = Milligrams of substance per cubic meter of air sampled,
(a) Sampling accident - invalid sample (See "Results and Discussion" section of this report).
(b) Concentration below lower detection limit (0.03 milligrams) of analytical method.
(c) Sample calculation: $\frac{\text{Quartz}}{\text{Total weight}} = \frac{0.04 \text{ mg.}}{0.16 \text{ mg.}} = 0.25$

By OSHA Std., Allowable concentration is:

$$\frac{30mg/M^3}{\%SiO_2+2} = \frac{30}{25+2} = 1.11 \text{ mg/M}^3$$

Since 0.33 mg/M^3 < 1.11 mg/M^3, Std. not exceeded