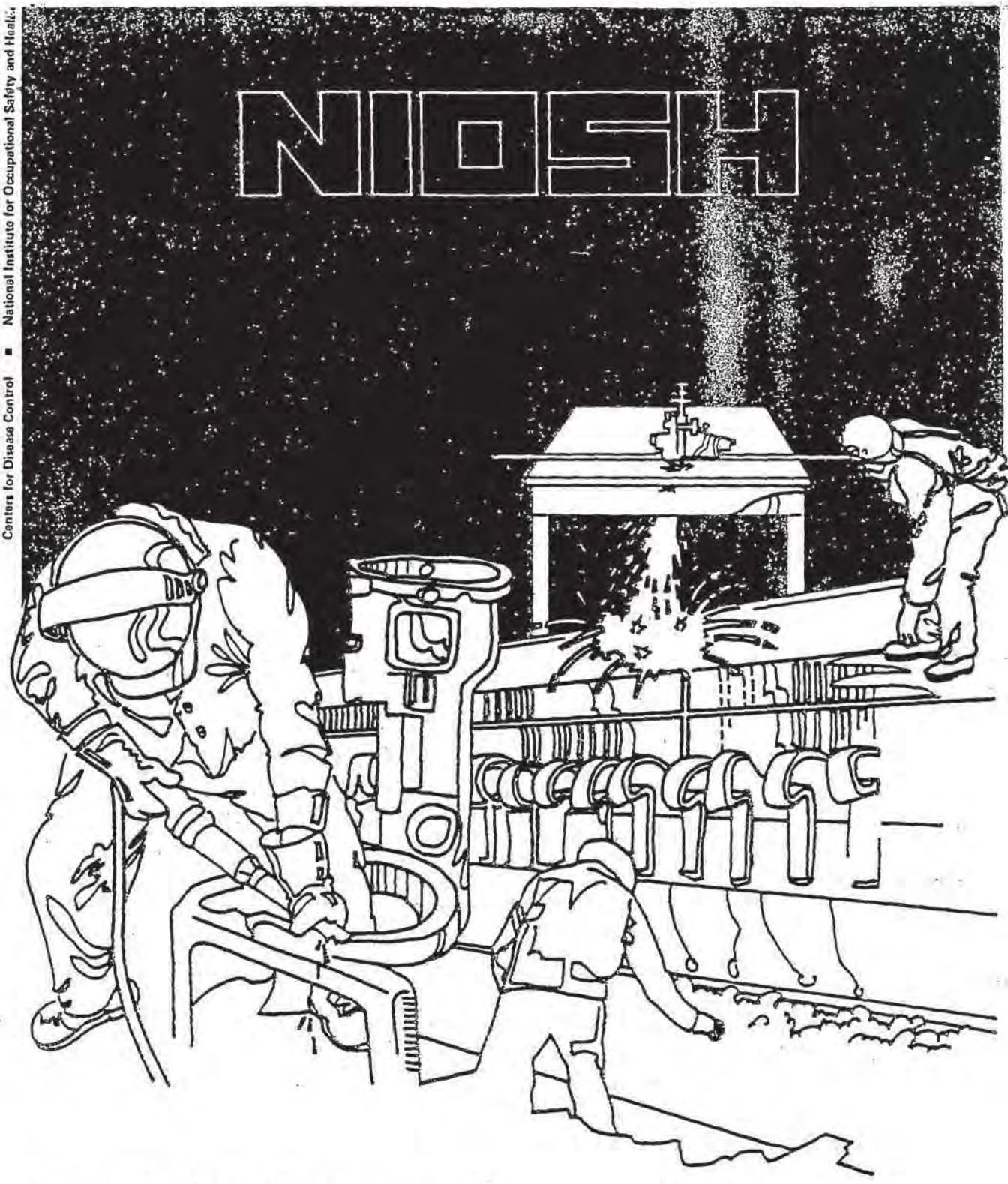
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
Centers for Disease Control ■ National Institute for Occupational Safety and Health



Health Hazard Evaluation Report

HHE 79-156-899
GULF-WANDES CORPORATION
BATON ROUGE, LOUISIANA

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.

HHE 79-156-899
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GULF-WANDES CORPORATION
BATON ROUGE, LOUISIANA

NIOSH INVESTIGATORS:
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I. SUMMARY

In September, 1979, the National Institute for Occupational Safety and Health (NIOSH) received a request from an authorized representative of the Oil, Chemical and Atomic workers Union, Local 4-620, to evaluate possible health hazards to 54 Baton Rouge, Louisiana, plant employees from exposure to styrene, methyl ethyl ketone (MEK), tetrahydrofuran (THF), dimethylaniline (DMA), acetone, methylene chloride, benzoyl peroxide (BPO), and fibrous glass. The request alleged a high prevalence of urinary tract infections among all employees, as well as reproductive and menstrual problems among the ten female employees.

Environmental/medical evaluations were performed at the facility in January and April, 1980. Results of 73 personal breathing-zone air samples collected on April 22, 1980, were as follows: Styrene [12 air samples in the range of 16-150 milligrams per cubic meter of air sampled (mg/M^3); MEK [12 air samples in the range of 1-9 mg/M^3]; THF [12 air samples in the range of 1-10 mg/M^3]; DMA [12 air samples in the range none detected (ND) -2 mg/M^3]; Acetone [10 air samples in the range of 23-183 mg/M^3]; Methylene chloride [10 air samples, 9 of which were below the lower limit of detection of the analytical method, the remaining sample measured as 59 mg/M^3]; BPO [3 air samples, all of which were below the lower limit of detection of the analytical method]; and Fibrous glass [2 air samples in the range of 0.03-0.04 fibers per cubic centimeter]. The results for each substance, when considered individually and as a mixture, did not exceed the evaluation criteria used for this report.

A questionnaire designed to obtain information regarding the prevalence of urinary tract symptoms and disease, was administered to all production area employees. All female employees were interviewed concerning past and present reproductive and menstrual problems. Based on this information, it was concluded that only four employees had symptoms consistent with urinary tract infection and that only one of these experienced symptoms more than once per week. None of the currently employed female respondents had experienced miscarriages or menstrual problems since starting work at the plant. 44 of the 54 employees reported one or several work-related symptoms, the most common being nausea and eye and upper respiratory tract irritation.

Based on the results of this evaluation, NIOSH determined that a health hazard from overexposure to styrene, MEK, THF, DMA, acetone, methylene chloride, BPO, and fibrous glass, did not exist at the time of the survey, that the prevalence of urinary tract symptoms among the employees was not high and that none of the female employees had experienced reproductive or menstrual problems. However, a large proportion of the subjects reported effects related to their occupation. Eye irritation, cough, and nausea were the most common symptoms. These findings indicate that efforts must be made to reduce exposure to irritating substances in the plant.

Recommendations relating to this evaluation are presented in Section VII of this report.

KEYWORDS: SIC 2881, Solvent exposure, Styrene, MEK, THF, DMA, Acetone, Methylene chloride, BPO, and Fibrous glass.

II. INTRODUCTION

On September 10, 1979, NIOSH received a request from the Oil, Chemical and Atomic Workers International Union to evaluate possible hazards to production-line employees at the Gulf-Wandes Corporation in Baton Rouge, Louisiana, The request stated that the employees are exposed to styrene, methyl ethyl ketone (MEK), tetrahydrofuran (THF), dimethylaniline (DMA), acetone, methylene chloride, benzoyl peroxide (BPO) and fibrous glass.

The request alleged a high prevalence of urinary tract infection among all employees and reproductive and menstrual problems among the ten female employees.

III. BACKGROUND

Gulf-Wandes Corporation manufactures plastic tanks, hoods, and ducts from fibrous glass. The fabrication area consists of three shops and one "resin mixing" shed, all constructed of corrugated tin. The hand lay-up laminating process is accomplished by alternating layers of liquid resin and fibrous glass mat. The fibrous glass arrives at the plant in large rolls and is cut at the work site. A roller is used to expel air bubbles from the finished product. Pipes are produced by providing layers of fibrous glass resins on either the pipe roller or the pipe puller. The pipe roller consists of a rotary motor on a stand and a twenty-foot shaft that turns as the resin and fibrous glass are laid around it, and rotates continously until the pipe is dry.

When pipe is produced on the pipe puller a mold is pulled through the center of the fibrous glass/resin layers to hollow-out the inside of the pipe. By using the pipe puller/pipe roller, pipes up to twenty feet long can be fabricated.

The average set-up time for a specific product is approximately thirty minutes; however, this time may vary from a few minutes to several hours, depending on the amount of catalyst added to the resin mixture. Some pieces are inserted into a drying oven. After pipe or other products are cut to specified lengths with saws, the edges are then sanded and may be welded to other pipes.

Styrene is utilized as the solvent for the resins, and MEK, methylene chloride and acetone are used for the cleaning of tools and removal of spills.

IV. EVALUATION DESIGN AND PROCEDURES

A. Environmental

An initial walk-through survey was performed at the facility on January 24, 1980. The purpose of that visit was to gather information on the characterization of all substances used in the production area, as well as the conditions of their use. All areas of the plant where significant exposure to applicable chemicals might occur, were identified.

To evaluate employee exposure to chemicals being used in the manufacture of the fibrous glass tanks, hoods, and ducts, environmental sampling was performed on April 22, 1980. Personal breathing-zone air samples were collected to evaluate employee exposure to styrene, MEK, THF, DMA, acetone, methylene chloride, BPO, and fibrous glass.

Samples were collected by using both filters (0.8 micron pore size, 37 millimeter diameter), and standard charcoal tubes. Analytical methods utilized were gas chromatography, high pressure liquid chromatography and phase contrast mocroscopy.

B. Medical

During the follow-up visit to the plant on April 22, 1980 a questionnaire designed to obtain information regarding prevalence of urinary tract symptoms and disease, as well as information regarding other health effects was administered to all production area employees.

Female employees were also interviewed concerning reproductive problems and menstrual irregularities, using a separate interview schedule. During these interviews information was also sought concerning former female employees with the above health problems.

Demographic data, a work and smoking history, and information concerning alcohol usage was also obtained.

V. EVALUATION CRITERIA

A. Environmental

Environmental standards and criteria considered applicable to this evaluation are shown on the following page.

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)*
Styrene	---	420	420
Methyl Ethyl Ketone (MEK)	590	590	590
Tetrahydrofuran (THF)	---	590	590
Dimethylaniline (DMA)	---	25	18
Acetone	---	2400	2400
Methylene Chloride	261	700	1750
Benzoyl Peroxide (BPO)	5	5	5
Fibrous Glass	3 fibers/cc**	---	---

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

**Fibers per cubic centimeter of air (having a diameter no greater than 3.5 micrometers and a length of at least 10 micrometers).

ACGIH- American Conference of Governmental Industrial Hygienists, Threshold Limit Value Committee; OSHA - Occupational Safety and Health Administration.

B. Toxic Effects

Styrene[1,2,3,4,5,6]

Styrene is commonly used in the plastics and rubber industries. At exposure levels of less than the eight-hour TLV ($420mg/M^3$), subjective symptoms are usually not observed when exposure time is short. Mild eye and throat irritation may, however, develop if exposure continues. At higher concentrations, nasal, eye, and throat irritation are more noticeable. In addition, symptoms of headache and nausea, extreme fatigue, and a felling of somnolence or intoxication have also been reported.

Workers with long-term (mean, 5 years) occupational exposure to high concentrations of styrene (over 210 mg/M^3) have shown an increased prevalence of abnormal electro-encephalograms. These highly exposed styrene workers also demonstrated slightly impaired visual motor accuracy and psychomotor performance. Thus, long-term high styrene exposure may have chronic adverse central nervous system effects, but further evidence is needed to firmly establish this theory. Anecdotal reports from Finland have hypothezised an association between styrene exposure and increased prevalence of birth defects in exposed women.

Methyl Ethyl Ketone[7,8]

Methyl ethyl ketone (MEK) is an irritant of the eyes, mucous membranes, and skin; at high concentrations it causes narcosis in animals, and it is expected that high exposures to humans will produce the same effect. It can be recognized at 25 parts per million by its odor, which is similar to acetone, but more irritating; these warning properties help prevent inadvertent exposure to toxic levels.

Tetrahydrofuran[9]

Tetrahydrofuran (THF) is an irritant of the eyes and mucous membranes and a central nervous system depressant in animals. No chronic systemic effects have been reported in humans, although nausea, dizziness, and headaches are said to occur with overexposure. These conditions are, however, readily reversible in fresh air.

Dimethylaniline[10]

Dimethylaniline (DMA) is moderately irritating and shares the ability of many aniline derivatives to change the blood's hemoglobin to methemoglobin and, thus, alter the ability of the blood of sufficiently exposed workers to transport oxygen. Although DMA is readily absorbed through the skin, or by inhalation, there have been few reports of adverse effects of occupational exposure, and it is felt that the OSHA exposure standard of 18 milligrams per cubic meter (8-hour TWA) provides adequate protection for workers.

Acetone[11]

Acetone is an eye and mucous membrane irritant. Few adverse health effects have been reported, despite widespread use for many years. Very high concentrations (12,000 parts per million) depress the central nervous system, causing headache, drowsiness, weakness, and nausea. Repeated and prolonged contact of the liquid with the skin can cause dryness and erythema.

Methylene Chloride[12]

Methylene chloride is a mild central nervous system depressant and an eye, skin, and respiratory tract irritant. At extremely high concentrations, it has caused liver and kidney damage in animals. Liquid methylene chloride is irritating to the skin on repeated or prolonged contact. Splashed in the eye, it is painfully irritating, but is not likely to cause serious injury.

Benzoyl Peroxide[13]

Benzoyl peroxide (BPO) may cause nose, eye, and throat irritation at concentrations above the TLV of 5 milligrams per cubic meter. Its main hazard is its explosive potential and it must, therefore, be handled with care in occupational settings.

Fibrous Glass[14]

Fibrous glass exposure can cause skin, eye, and respiratory tract irritation. Employees frequently suffer skin irritation when first working with fibrous glass, but usually the symptoms subside after one to two weeks of exposure either because the workers adopt work practices that decrease fibrous glass skin exposure or because the skin becomes less sensitive to fibrous glass.

VI. RESULTS AND DISCUSSION

A. Environmental

Results appearing in Tables 1-4, show that airborne concentrations of 12 each styrene/methyl ethyl ketone/tetrahydrofuran/dimethylaniline; 10 each acetone/methylene chloride; 3 benzoyl peroxide; and 2 fibrous glass personal breathing-zone/production area air samples were either below: (a) applicable NIOSH, 8-10 hour recommended levels; (b) ACGIH, TLV Committee 8-hour TWA recommended levels; (c) OSHA, 8-hour TWA standards; or (d) the lower detection limit of the analytical method. When considered as a mixture, those same exposures did not exceed 100 percent of the allowable daily dose for the highest concentrations measured.

Doors in the various production areas were open, and "general" ventilation was basically adequeate at the time of the evaluation. In spite of the generally low concentration of chemicals , extensive efforts should be made to minimize skin exposure by the use of good work practices and the utilization of appropriate personal protective equipment.

B. Medical

At the time of the evaluation, the plant had fifty-four hourly shop employees (44 male, 10 female), their ages ranging from 19-58 years with a median of 25 years. The personnel turnover at the plant is high, ten respondents had worked one month or less, and the median duration of employment was approximately two years.

Urinary tract infections (UTI) are usually caused by Gram negative bacteria belonging to the intestinal flora. It is thought that infection results from contamination of the external urethral orifice with fecal material. The infection then spreads to the bladder by way of the urethra.

UTI commonly causes pain and discomfort at urination as well as increased frequency of urination. Severe cases are usually accompanied by fever, leukocytosis and pyuria. Diagnosis is based on symptoms and physical examination and is confirmed by positive bacteriological urinary culture. It is unlikely that chemical exposure could cause UTI, however, such exposure may cause painful urination and increased frequency due to accumulation of substances with irritating properties in the urine.

Due to the benign nature and course of most cases of UTI it is difficult to obtain information regarding prevalence and incidence in the general population. However, unpublished reports state that most women experince several UTI, especially during their reproductive years and it is estimated that in a sample of the general population 5 % report symptoms that may be due to UTI. Other common causes of symptoms of UTI are urethritis and non-specific cystitis. Females have the highest prevalence and incidence of UTI, although symptoms of UTI are not uncommon among males and are then usually due to prostatitis.

The results obtained during the interviews regarding urinary tract symptoms are summarized in Table 5. Four employees (all women) reported a history of physician-diagnosed urinary tract infections, but none were currently under treatment. Ten employees reported occasional urinary tract symptoms, the most common being increased frequency of urination, however, only three employees reported both painful urination and increased frequency and only one of these employees experienced symptoms once per week or more often. The prevalence of urinary tract symptoms that may have been associated with UTI and incidence of physician-diagnosed urinary tract infection was probably not higher than would be expected in a sample of the general population.

None of the ten female respondents had miscarriages or menstrual irregularities nor had given birth to malformed children since starting work at the plant. Reports were received of one previous employee who had a miscarriage during, or shortly after termination of employment. Efforts to contact this employee by mail and telephone have been unsuccessful.

At the time of the interview 44/54 respondents reported one or several work-related health effects, the most common being nausea and eye and upper respiratory tract irritation. The majority of the employees experienced these health effects at least once per week and some of them daily. The results are summarized in Table 6. No association between particular job description and type and/or severity of symptoms was determined. These findings may indicate deficiencies in ventilation, personal protective equipment or work practices.

VII. RECOMMENDATIONS

1. Most chemicals currently used in the plant have an irritating effect on the skin. Frequent contact of these chemicals with the skin should be minimized by the use of good work practices as well as the utilization of appropriate personal protective equipment such as gloves, clothing and safety glasses, where required.

2. Where possible, solvents should be dispensed from containers which are not totally open to the plant atmosphere.

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X. 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) Gulf-Wandes Corporation
b) Authorized Representative of Employees
c) U.S. Department of Labor, Region VI
d) NIOSH, Region VI
e) Louisiana State Department of Health

For purposes of informing the approximately fifty-four affected employees, a copy of this report shall be posted in a prominent place, accessible to the employees, for a period of thirty (30) calendar days.

Table 1

Personal Sample Breathing-Zone Concentrations of Styrene, Methyl Ethyl Ketone (MEK), Tetrahydrofuran (THF) and Dimethylaniline (DMA)

Gulf-Wandes Corporation
Baton Rouge, Louisiana

April 22, 1980

Location		Sampling Period	(a) Concentration (mg/M^3)			
			Styrene	MEK	THF	DMA
Fabricator	Shop 4	0758-1328	41	<2	<2	<1
Helper	Shop 4	0759-1337	48	<7	<8	<2
Fabricator	Shop 4	0803-1345	16	<4	<5	<1
Fabricator	Shop 4	0805-1340	25	<5	<5	<2
Helper	Shop 2	0844-1300	47	<7	<8	<2
Fabricator	Shop 2	0859-1308	36	<7	<7	<2
Helper	Shop 2	0906-1314	46	<8	<9	<2
Fabricator	Shop 3	0855-1314	106	<8	<8	<2
Fabricator	Shop 3	0915-1354	45	<6	<7	<2
Fabricator	Shop 3	0922-1402	36	<6	<7	<2
Helper	Shop 3	0925-1404	71	<6	<7	<2
Fabricator	Shop 2	1322-1445	150	<10	<11	<3
OSHA, 8-hr. TWA Standard.....			420	590	590	25
OSHA, Ceiling Standard.....			840	---	---	--
NIOSH, 8-10 hr. TWA Recommendation.....			---	590		--
ACGIH, 8-hr. TWA Recommendation.....			420	590	590	25
ACGIH, 8-hr. TWA Proposed			215	---	---	--

(a) - mg/M^3 = milligrams of substance per cubic meter of air sampled

Table 2

Personal Sample Breathing-Zone Concentrations of
Acetone and Methylene Chloride

Gulf-Wandes Corporation
Baton Rouge, Louisiana

April 22, 1980

Location		Sampling Period	(a) Concentration (mg/M^3)	
			Acetone	Methylene Chloride
Fabricator	Shop 2	1310-1435	130	*
Helper	Shop 2	1315-1440	98	*
Fabricator	Shop 2	1321-1450	183	*
Fabricator	Shop 4	1331-1525	23	*
Helper	Shop 4	1337-1455	104	*
Fabricator	Shop 4	1346-1515	71	*
Fabricator	Shop 4	1341-1505	107	*
Fabricator	Shop 3	1355-1435	37	59
Fabricator	Shop 3	1403-1545	79	*
Helper	Shop 3	1405-1546	79	*

OSHA, 8-10 hr. TWA Standard.....	2400	1750
OHSA, Ceiling Standard.....	---	3500
NIOSH, 8-10 hr. TWA Recommendation.....	---	261
ACGIH, 8-10 hr. TWA Recommendation.....	2400	---
ACGIH, 8-10 hr. TWA Proposed.....	1780	---

(a) - mg/M^3 = milligrams of substance per cubic meter of air sampled

* - Below lower limit of detection of analytical method (2 mg/sample) for the specific compound.

Table 3

Personal Sample Breathing-Zone Concentrations of
Benzoyl Peroxide (BPO)

Gulf-Wandes Corporation
Baton Rouge, Louisiana

April 22, 1980

Location	Sampling Period	(a) Concentration (mg/M^3)
Fabricator - Shop 2	0945-1300	*
Fabricator - Shop 3	0853-1300	*
Fabricator - Shop 2	0901-1308	*

OSHA, 8-hr. TWA Standard	5
NIOSH, 10-hr. TWA Recommendation	5
ACGIH, 8-hr. TWA Recommendation	5

(a) - mg/M^3 = milligrams of substance per cubic meter of air sampled

* - Below lower limit of detection of analytical method (0.002 mg/sample) for the specific compound.

Table 4

Personal Sample Breathing-Zone Concentrations of Fibrous Glass

Gulf-Wandes Corporation
Baton Rouge, Louisiana

April 22, 1980

Location		Sampling Period	Concentration (fibers per cubic centimeter)
Fabricator	Shop 2	0833-1015	0.03
Helper	Shop 3	1356-1515	0.04

NIOSH 8-10 hour recommended TWA..... 3.0

Table 5

Current Urinary Tract Symptoms Reported During Interviews
With Production Area Employees (54 respondents)

Gulf-Wandes Corporation
Baton Rouge, Louisiana

April 22, 1980

	# of respondents reporting symptom	Frequency of symptom	
		Once per week or more often	Less than once per week
Pain, discomfort and increased frequency	3	1	2
Pain and discomfort	2	0	2
Increased frequency	5	3	2

Table 6

Work-Related Health Effects Reported During Interviews With Production Area Employees (54 respondents)

Gulf-Wandes Corporation
Baton Rouge, Louisiana

April 22, 1980

	# of respondents reporting symptom	Frequency of symptom	
		Once per week or more often	Less than once per week
Eye Irritation	21	15	6
Throat Irritation	13	10	3
Stuffed-up Nose	35	26	9
Nausea	20	11	9