FIBROUS GLASS DUST AND INDUSTRIAL HYGIENE SURVEY

OWENS CORNING FIBERGLAS

NEWARK, OHIO

SURVEY CONDUCTED BY:

John M. Dement

Ralph D. Zumwalde

REPORT PREPARED BY:

John M. Dement

Ralph D. Zumwalde

Environmental Investigations Branch
Division of Field Studies and Clinical Investigations
National Institute for Occupational Safety and Health
1014 Broadway
Cincinnati, Ohio 45202

SURVEY DATES:

April 10-14 & 20-21, 1972

PLACE VISITED	:	Owens Corning Fiberglas Newark, Ohio
DATES OF TRIP	:	April 10-14 & 20-21, 1972
PERSONS MAKING TRIP	:	Dr. Joseph Wagoner, S.D. Hyg. William M. Johnson, M.D. John Dement Harry Donaldson Richard Lemen Ralph Zumwalde
PERSONS CONTACTED	:	Jon L. Konzen, M.D. Medical Director Gerald Devitt Chief Industrial Hygienist Thomas Yarkoff Plant Safety Director J.W. Scott Plant Engineer
PURPOSE OF TRIP	:	To make an industrial hygiene survey and evaluate fibrous glass and other potential worker exposures.

INTRODUCTION

During the week of April 10-14, 1972, a fibrous glass dust and industrial hygiene survey was conducted at the Owens Corning Fiberglas, Newark, Ohio facility. Dr. Joseph Wagoner, Dr. William Johnson, Harry M. Donaldson, Richard Lemen, Ralph Zumwalde and John Dement made the initial plant tour on April 10 and John Dement and Ralph Zumwalde remained to continue the survey.

During the week approximately 100 samples were taken in the wool plant, the paint batch house, and the glass batch house. These samples were used to evaluate fibrous glass exposure, silica dust exposure, and exposure to fibrous talc. The following paragraphs describe the Newark facilities which were sampled, along with sample results and recommendations for improvements.

DESCRIPTION OF THE PLANT AND MEDICAL PROGRAMS

The Newark plant of the Owens Corning Fiberglas Corporation is located in the northern section of Newark, Ohio - a town with a population of approximately 60,000 persons. The total labor force of the plant is approximately 2400 people, 2000 of which are blue collar workers. Most areas of the plant are operated 24 hours per day on a four shift basis.

The plant began operation in 1880 as a glass bottle and prescription ware producer. The plant was operating as a glass bottle producer when it was shut down in 1930. In 1934 the plant reopened as the first facility devoted exclusively to the manufacture of fibrous glass. Today the Newark facility occupies some 30 buildings and is considered a construction product plant. Some of the major product lines are as follows:

1. Air Filter Products
2. Insulation Products (Home & Appliance)
3. Fiberglas Pipe Insulation
4. Fiberglas Ceiling Boards
5. Fiberglas Ducts and Duct Insulation
6. Roofing Products and Insulation

Also located at this facility is a glass marble batch operation where glass marbles are made for shipment to other Owens Corning facilities, for the manufacture of fibrous glass. A schematic layout of the plant is given in Figure 1.

The company has in-plant medical facilities, and occupational health consultation is available from corporate headquarters in Toledo, Ohio. Dr. Jon L. Konzen is Medical Director of the Owens Corning Fiberglas Corporation. Dr. Bishop, a local General Practitioner, has been the part-time plant physician for about twenty years. Two registered nurses are on duty during the day in addition to one registered nurse at night.

Chest X-rays (14" x 17") have been taken in the plant's medical department since 1946. Employees receive a chest X-ray at least every two years, and batch area employees and those workers with X-ray abnormalities receive an annual X-ray. Less than one year ago, the plant obtained a spirometer (Jones Pulmonaire II) for determination of $FEV_{1.0}$, FVC and VC. Prediction equations are used from the Veteran Administration Army Cooperative Study.

Pre-employment examinations include a chest X-ray, CBC, urinalysis, serology, pulmonary function, selective audiometry, and a physical examination.

Dr. Bishop claims he has never seen a chest disease case attributed to fibrous glass exposure and asserts that the rate of acute and chronic lung disease in this plant is not excessive. Medical studies of this plant by Dr. George Wright in 1963, the University of Michigan, 1968, and the Industrial Hygiene Foundation in 1969 reported no abnormalities attributed to fibrous glass.

Mechanical dermatitis secondary to fibrous glass occurs but is not considered a problem.

Industrial hygiene for the facility is handled on a corporate basis. Mr. Gerald Devitt serves as the corporate industrial hygienist and is responsible for hygiene matters in all of the Owens Corning facilities.

DESCRIPTION OF THE PROCESSES

Fibrous glass is formed at Newark by either centrifuge forming or air blower forming. At one time, steam blower forming was used but has been discontinued due to advances in technology. Schematic diagrams of the various process are shown in Figure 2.

Charges for the glass furnaces are mixed in a separate batch house. In this batch house, the various raw materials (Table 1) are held in hoppers and carried to the mixer by either conveyer belts or vibrating conveyers. After the materials are throughly mixed, they are lifted by a bucket elevator to a conveyer which carries the batch to the glass melting furnaces.

Centrifuge forming is used in the wool factory to make home and appliance insulation, roofing products, pipe insulation, and ceiling tiles. In this process, glass batch from the batch house is fed into the furnace where boro-silicate glass is formed at temperatures of approximately 2500°F. After the glass is formed, it is fed into a container known as a forehearth where the glass is held at approximately 2250°F. From the forehearth, glass is fed into spinners where centrifugal force is used to force the glass through small holes in the periphery of the spinner thus forming fibers. Upon leaving the spinners, each glass stream is met by an air stream which helps further attenuate the fibers into desired diameters by the pulling force exerted on each glass stream. A typical forming station contains

four spinners with 125,000 to 150,000 cfm of air being drawn through the forming hood.

As the attenuated fibers move away from the spinners, a phenol-formaldehyde binder is applied by a spraying process. The fibers, coated with uncured binder, are then collected on a conveyer. The density of the fiber blanket on the conveyer is controlled by the fiber production rate and the linear speed of the conveyer.

After the glass blanket leaves the forming area, it is conveyed to a curing oven where the resin is cured at temperatures between 400°F and 500°F. Fibrous glass batts which are to be used to make roofing materials or ceiling tiles are also compressed simultaneously during the curing operation.

Following the curing operation, edges are trimmed and vapor barriers of paper or foil may be applied depending on the product desired. Either adhesives or asphalt may be used to bond the paper to the fibrous glass batts or boards. Boards which are to be used for ceiling tiles are covered with a fibrous glass-bonded-mat and painted with a water base paint containing talc, aluminum hydrate, silica, and phenolic resin among other materials.

Air blower forming is used to make the bonded mat which is used on ceiling tiles and to make glass batts which are used to make fibrous glass ducts. The only major difference between air blower and centrifuge forming is the method used in making glass fibers. Operations which follow forming are basically very similar.

Air blower forming uses essentially only a high velocity stream of air to form fibers. In mose cases, high velocity burner flames are used. Within this process, molten glass flows through sieve-like openings in the forehearth to form primary fibers. After leaving the forehearth, these fibers are attenuated into fine fibers by high air velocities. Fiber diameters tend to be smaller than those found in the centrifuge forming.

INSPECTION OF THE PLANT

On April 10, 1972 a walk through tour was made of most of the plants production facilities. From this tour, it was decided to devote sampling efforts to the wool plant and its associated facilities since exposure levels appeared to be somewhat the same in all production areas.

Potential Health Hazards:

The following are potential health hazards which were noted during the survey:

1. Fibrous Glass Exposure (Skin & Respiratory)
2. Fibrous Talc and Silica Exposure in the Paint Batch House
3. Talc and Silica Exposure in the Acoustical Tile Spray Painting Operations
4. Silica Exposure in the Batch House
5. High Noise Exposure in Fibrous Glass Forming Areas

Although these could be considered the major hazards, potential exists for exposure to most of the raw materials used. This is especially true in the paint and glass batch areas.

Personal Protection and Safety Program:

The safety program at the plant is operated through a union-management safety committee. Mr. Thomas Yankoff is the plant Safety Director. There are several unions in the plant; however, the National Glass Bottle Blowers Union is by far the largest.

Personal Protection includes the use of safety glasses throughout the plant and hearing protection in some areas. Safety shoes are not required but the plant has a program to aid in their purchase.

Although there are programs for eye and hearing protection, most employees in the plant do not follow these programs. Very few persons wear safety glasses and , in some cases, employees used compressed air to clean off machinery without wearing eye protection.

Ventilation:

A. Wool Plant

The major ventilation system in the wool plant is at the fibrous glass forming stations. Approximately 150,000 cfm are drawn through each forming hood, for a total volume of approximately 1 million cfm in the forming area. Heat generated by the glass furnaces is vented through roof vents over the furnaces. Combustion air is supplied to the furnaces by eleven fans at 500 H.P. each.

Almost all sawing and trimming operations have local exhaust ventilation. These ventilation systems are vented to collectors which were design by the company and are known as "Pennclones". The "Pennclone" is essentially a bag type collector. There are six such collectors for the wool plant with a total design capacity of approximately 90,000 cfm.

There are two paint spray booths located in the wool plant for painting the surfaces of ceiling tiles. These booths have down draft ventilation. The air mover in each system is a propeller fan located in the ductwork. These spray booths are vented to the roof without passing through a collector.

Make-up air for the wool plant is supplied by two large make-up air heaters rated at approximately 1×10^6 BTU/hour each. Approximately 60,000 cfm is re-cycled from "Pennclone" collectors which are located within the building. In spite of this make-up air, Mr. J.W. Scott, the plant engineer, said that the building was generally operated at 1/2" H_2O negative pressure.

B. Glass Batch House

Ventilation for the glass batch house consists of local exhaust ventilation at the discharge of the storage hoppers. These exhaust points are vented to two "Pagborn" dusts collectors rated at approximately 20,000 cfm each.

C. Paint Batch House

In the paint batch house, waterbase paints for acoustical ceiling tiles are mixed in vertical mixers. There are four such mixers located in the room. Ventilation for the mixers consists of 1" slots located

half-way around the back perephery of the mixer opening. The diameters of the mixer openings were approximately four feet. The exhaust air is vented to a "Draco" Type MB-32 Multi-Bag Collector located in the room. Slot velocities were approximately 1500 fpm. Discharge air from the collector is vented back into the room.

Housekeeping:

The general housekeeping was quite good. Each of the production lines in the wool plant is shut down approximately once every six weeks for clean-up and maintenance. Most of the floor cleaning is done with a vacuum sweeper.

An unacceptable cleaning practice noticed during the visit was the frequent use of high pressure compressed air. This was used primarily to clean machines and to blow-off clothing.

SURVEY PROCEDURES

Air sampling at the Newark facility was confined to the wool plant, the glass batch house, the paint batch house, and the acoustical ceiling tile plant. The type of exposures evaluated in each of these areas are as follows:

1. Wool Plant
   - A. Fibrous Glass Exposure
   - B. Silica Dust Exposure from Acoustical Tile Spray Painting
2. Glass Batch House
   - A. Silica Dust Exposure
3. Paint Batch House
   - A. Fibrous Talc Exposure
   - B. Silica Dust Exposure
4. Acoustical Ceiling Tile Plant
   - A. Silica Dust Exposure from Acoustical Tile Spray Painting

Results of these samples are given in Tables 2-5 in the appendix.

The sampler used for all of these samples was a Mine Safety Appliance (MSA) permissible personal air sampler operated at a calibrated flow of 1.7 liters per minute. Respirable samples were taken using a 10 mm nylon cyclone[1] in connection with a MSA sampler fitted with a pulsation dampener[2].

Silica dust samples were collected on an MSA 37 mm polyvinyl chloride membrane filter and analyzed for free silica using the method described by Talvitie[3]. Fibrous glass and fibrous talc samples were collected on Millipore Type AA cellulose ester membrane filters and fibers counted under phase contrast illumination at 430X magnification.

CONCLUSIONS AND RECOMMENDATIONS

The following are conclusions drawn from the survey along with recommendations for needed improvements.

1. Although no meaningful safe limit for fibrous glass exposure has been developed, exposure levels in the wool plant appear to be quite low. However, it would be advisable to replace present process operations, using compressed air to clean glass batts, with vacuum systems.

2. Both free silica and fibrous talc exposures are excessive in the paint batch house along with excessive free silica exposure in the glass batch house. Local exhaust ventilation improvements are certainly in order for both of these locations. Until such improvements are installed, paint mixers and batch tenders should be required to wear approved respirators for pneumoconiosis producing dusts.
3. Free silica concentrations at the wool plant acoustical tile spray painting operations are excessive. Ventilation at these spray booths consists of down draft ventilation provided by a propeller type fan. Although these fans are good for large volumes of air at very low static pressures, their air volume drops off sharply when subjected to any resistance. Due to the 1/2" H_2O negative pressure under which the wool plant operates, these fans would be considered quite ineffective. The spray booth should be better enclosed and a more effective air mover used. More make-up air should also be provided in order to have the plant under positive pressure. Until these improvements are implemented, workers in the painting area should be required to wear approved respirators for pneumoconiosis producing dusts.
4. The eye and hearing protection programs at the plant should be more strictly enforced. Eye protection is especially important when considering the abrasive nature of fibrous glass.

REFERENCES

1. Lippmann, M. and W.B. Harris. "Size-selective Samplers for Estimating Respirable Dust Concentrations". Health Physics 8, 155 (1962).

2. LaViolette, P.A. and P.C. Reist. "An Improved Pulsation Dampner for Use with Mass Respirable Sampling Devices". Submitted to American Industrial Hygiene Association Journal.

3. Talvitie, N.A. "Determination of Free Silica: Gravimetric and Spectrophotometric Procedures Applicable to Airborne and Settled Dust". American Industrial Hygiene Association Journal 25, 169, (1964).

A P P E N D I X

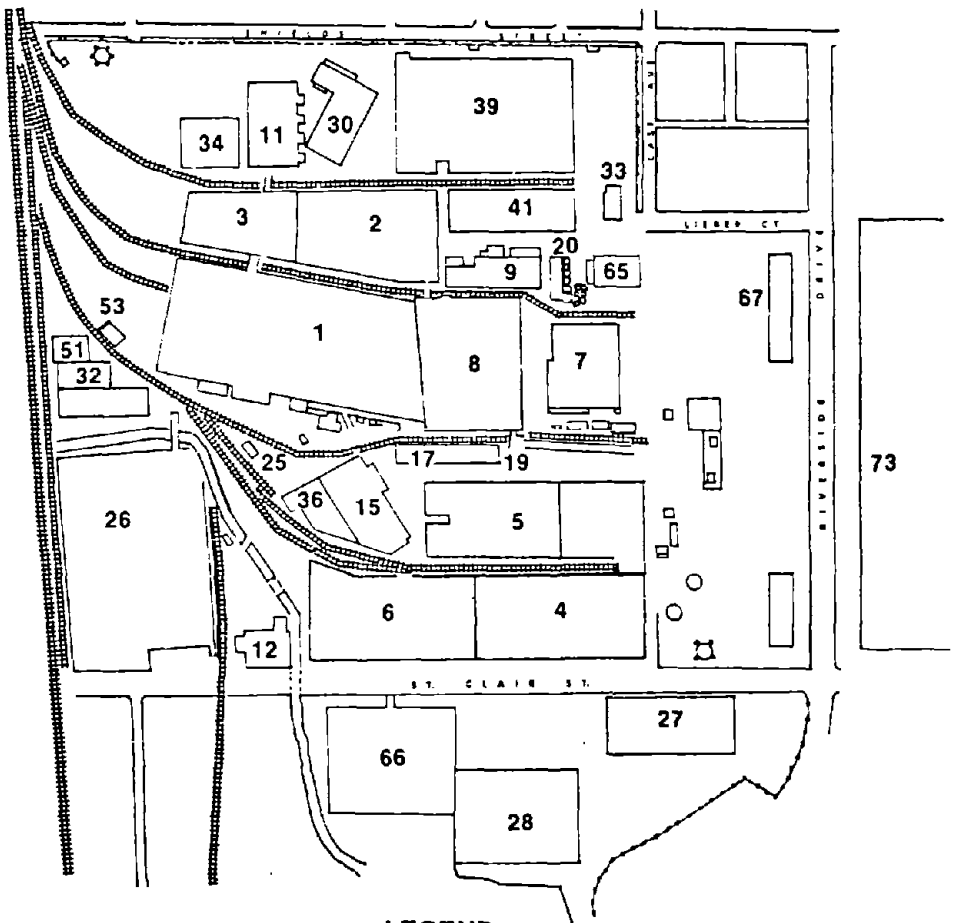
Figures

Tables

FIGURE 1

LOCATION OF THE NEWARK PLANT'S

PRINCIPAL FACILITIES

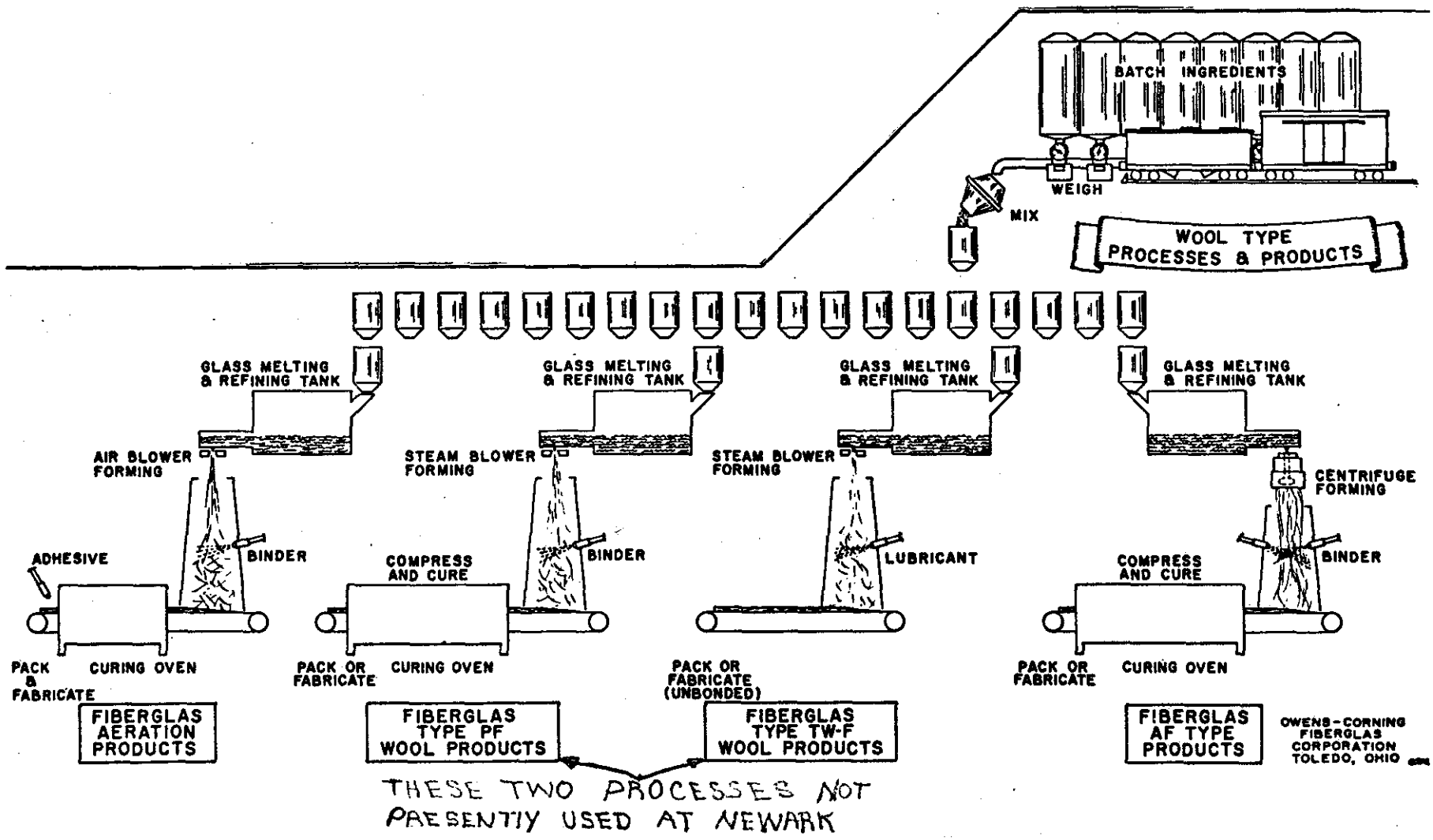


LEGEND

1-8 Wool Factory
2-3 Warehouse and Shipping, R-2 Tile, Cafeteria
4-6 Warehouse and Shipping
5 Aerocor and Acoustical
7 Glass Tech.
9 Power House
11 Marble House
12 Salvage
15-36 Direct Materials Warehouse
17 Compressor Room
19 Wool Batch House
20 Oil and Binder House
25 Asphalt Storage
26 Warehouse and Shipping
27 Machine Parts Mfg. Shop
28 Filter Factory
30 Bonded Mat
32 Brick Shed
33 Main Gatehouse
34 Marble Batch House
39 Administration Offices and Warehouse
41 Maintenance. Engineering and Process Lab
51 Brick Shed
53 Direct Materials
65 Chemical Factory
66 Warehouse
67 Adhesive Factory
73 Warehouse.

FIGURE 2

SCHEMATIC OF WOOL TYPE PROCESSES



THESE TWO PROCESSES NOT PRESENTLY USED AT NEWARK

PUB. NO. 5-GL-1510

LITHO IN U.S.A., MARCH 1960

TABLE I

RAW MATERIALS
USED
AT
OWENS-CORNING
Newark, Ohio

I. Glass Batch House

Material	Container
Sand	Hopper
Nepheline Syerite	Hopper
Rasonite	Hopper
Dolomite	Hopper
Salt Cake	Hopper
Barytes	Hopper
Soda Ash	Hopper
Limestone	Hopper

II. Chemical Factory (Binder & Resin)

Material	Container
Ammonia	Oil House Tanks
Urea Solution	Oil House Tanks
Sulphuric Acid	Oil House Tanks
Barium Monohydrate	Bags
Process Oil	Oil House Tanks
Phenol	Oil House Tanks
Formaldehyde	Oil House Tanks
Dieyandiamide	Bags
Silicone	Tank

III. Adhesive Factory

Material	Container
Cyclohexane - Toluene	-----
Cyclohexane - Hexasol - Toluene	-----
Neoprene	Bag
Pariol	Drum
Phenolic Resin	Bag
Nitrogen	Tank
Methylene Chloride	-----
Propylene Oxide	-----

IV. Paint Batch House

Material	Container
Hydrated Alumina	Bag
Neoprene Latex	Drum
Alsilate - O Clay	Bag
Talc	Bag
Wallastonite P-1	Bag

TABLE I
(continued)

V. Marble Batch

Material	Container
Mississippi Limestone	Bag
Nephelene Syerite	Bag
Sand	Bag
Dolomite	Bag

IV. Wool Factory

Material	Container
Asphalt	Outside Tank
Charge From Glass Batch	Hopper
Paint From Paint Batch	Pumped
Binder & Resin From Chemical Factory	Pumped

TABLE 2

FIBROUS GLASS EXPOSURE
IN
WOOL PLANT
OWENS CORNING
Newark Ohio

JOB OR SAMPLE TYPE	SAMPLE #	SAMPLE TIME (minutes)	FIBER CONCENTRATION FIBERS ≤10μ IN DIAMETER/ML
Breathing Zone at Furnace Room	18-AA	151	0.00
Hot Repairman	13-AA	197	0.03
Hot Repairman	14-AA	196	0.09
Hot Repairman	15-AA	191	0.03
	Samples on C-4 Line		
Breathing Zone at Forehearth	16-AA	149	0.06
Machine Tender	5-AA	286	0.05
Selector Packer	1-AA	308	0.01
Selector Packer	2-AA	295	0.04
Selector Packer	3-AA	294	0.04
Selector Packer	4-AA	245	0.03
Group Leader	6-AA	290	0.02
Paper Pit Operator	7-AA	277	0.04
Breathing Zone at Cutter	9-AA	311	0.03
Breathing Zone in Paper PIt	11-AA	311	0.02
	Samples on D-5 Line		
Machine Tender	19	145	0.05
Selector Packer	13	280	0.03
Selector Packer	14	260	0.03
Selector Packer	15	158	0.09
Selector Packer	16	251	0.03
Selector Packer	18	146	0.10
Breathing Zone in Paper Pit	12-AA	297	0.04
	Samples on D-6 Line		
Talley Man	7	85	0.08
Saw Operator	8	81	0.17
Chopper Man	9	64	0.08
Selector Packer	1	87	0.08
Selector Packer	2	86	0.06
Selector Packer	3	73	0.07
Selector Packer	4	79	0.09
Selector Packer	5	84	0.10
Selector Packer	6	84	0.15
Selector Packer	10	73	0.07
Selector Packer	11	73	0.07
Selector Packer	12	71	0.05

TABLE 2

JOB OR SAMPLE TYPE	SAMPLE #	SAMPLE TIME (minutes)	FIBER CONCENTRATION FIBERS <10μ IN DIAMETER/ML
	Samples on F-5 & F-6 Lines		
Paper Pit Operator	B-AA	291	0.05
Chopper Tender	31	60	0.15
Breathing Zone at Chopper	34	55	0.07
Stacker (F-6)	27	80	0.06
Selector Packer	28	70	0.08
Selector Packer	29	68	0.08
Selector Packer	30	65	0.83
Selector Packer	33	56	0.06
Folder	32	55	0.13
Breathing Zone at F-6 Forehearth	12-AA	148	0.04
	Samples in Wool Re-Conditioning		
Group Leader	26	128	0.11
Cleaner	22	132	0.14
Waste Feeder	20	140	0.06
Packer	21	133	0.05
Packer	23	130	0.01
Packer	24	130	0.07
Packer	25	124	0.04

TABLE 3

GLASS BATCH HOUSE EXPOSURE
TO
FREE SILICA
OWENS CORNING
Newark Ohio*

TYPE OF SAMPLE	SAMPLE #	AIR VOL. M^3	SAMPLE WT. (Mg)	TOTAL CONC. Mg/M^3	SiO_2 CONC. Mg/M^3
Personal Sample (Batch Tender)	17	.17	1.1	6.5	0.76
Personal Sample (Batch Tender)	18	.31	1.4	4.6	0.65
Total Dust Breathing Zone in Hopper Room	20	.29	1.5	5.1	0.55
Respirable Dust Breathing Zone in Hopper Room	22	.09	0.4	4.3	0.11
Respirable Dust Breathing Zone in Hopper Room	23	.48	0.8	1.7	0.46
Respirable Dust Breathing Zone in Hopper Room	24	.47	0.6	1.3	0.19
Respirable Dust Breathing Zone in Mixer Room	25	.48	1.3	2.8	0.49

* *No respirators were worn during any of this sampling*

1 *Allowable free SiO_2 concentrations are 0.1 mg/m^3 for respirable dust and 0.3 mg/m^3 for total dust*

TABLE 4

PAINT HOUSE EXPOSURES
TO
FREE SILICA AND FIBROUS TALC
OWENS CORNING
Newark Ohio*

Silica

TYPE OF SAMPLE	SAMPLE #	AIR VOL. M^3	SAMPLE WT. (Mg)	TOTAL CONC. (Mg/M^3)	SiO_2 CONC. Mg/M^3
Personal Sample (Paint Mixer)	15	.20	0.6	3.0	0.2
Personal Sample (Paint Mixer)	16	.20	1.4	7.0	1.1
General Air (Total Dust)	35	.33	1.2	3.7	0.3
General Air (Respirable Dust)	34	.33	0.6	1.8	0.3
General Air (Total Dust)	42	.07	0.4	5.6	0.1

Fibrous Talc During Talc Mixing

SAMPLE TYPE	SAMPLE #	AIR FLOW Liters/Min.	SAMPLE TIME (minutes)	FIBER CONC. FIBERS >5μ/ml
Personal Sample (Talc Mixing)	19	1.7	9	9.9
Personal Sample (Talc Mixing)	20	1.7	17	32.0
Personal Sample (Talc Mixing)	35	1.7	17	30.5
Personal Sample (Talc Mixing)	36	1.7	11	4.5
Personal Sample (Talc Mixing)	37	1.7	15	6.3
Personal Sample (Talc Mixing)	38	1.7	22	12.0
Personal Sample (Talc Mixing)	39	1.7	6	5.2
Personal Sample (Talc Mixing)	40	1.7	8	9.1

* *No respirators were worn during any of this sampling*

TABLE 5

EXPOSURE TO FREE SILICA
FROM
ACOUSTICAL TILE SPRAY PAINTING*

TYPE OF SAMPLE	SAMPLE #	AIR VOL. M^3	SAMPLE WT. (Mg)	TOTAL CONC. Mg/M^3	SiO_2 CONC. Mg/M^3
Acoustical Tile Department					
Total Dust Breathing Zone	26	.46	0.5	1.1	0.15
Total Dust Breathing Zone	29	.43	4.4	10.3	1.00
Respirable Dust Breathing Zone	28	.43	0.7	1.6	0.13
Total Dust Breathing Zone	30	.29	1.8	6.0	0.21
Respirable Dust Breathing Zone	31	.41	0.4	1.0	0.20
Wool Plant-Acoustical Tile					
Respirable Dust Breathing Zone	36	.23	0.5	2.2	0.60
Total Dust Breathing Zone	37	.23	8.2	35.7	6.10
Total Dust Breathing Zone	39	.23	3.7	16.4	2.12
Total Dust Breathing Zone	40	.18	4.1	22.8	1.09
Respirable Dust Breathing Zone	41	.18	0.3	1.6	0.76

* *No respirators were worn during any of this sampling. X-ray diffraction of a dehydrated paint bulk sample found 26% free SiO_2 by weight.*