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

HEALTH HAZARD EVALUATION DETERMINATION
REPORT NO. 74-49-191

OWENS-ILLINOIS GLASS COMPANY
ATLANTA, GEORGIA
MAY 1975

I. TOXICITY DETERMINATION

Based on the results of an observational and environmental evaluation conducted by the National Institute for Occupational Safety and Health (NIOSH) on May 7, 8, and 9, 1974, it has been determined that airborne dusts containing free crystalline silica in batch house operations were not toxic in the concentrations used or found. However, there may be a potential health hazard exposure to free-silica dust when maintenance men are servicing and repairing the batch house equipment.

From a review of confidential health questionnaires and readings taken with a sphygmomanometer among the batch house workers, it may be concluded with a reasonable degree of certainty that the population under study does not have an incidence of known hypertension exceeding that expected for a group of its size.

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) Owens-Illinois Glass Company, Atlanta, Georgia
b) Authorized Representative of Employees
c) U. S. Department of Labor - Region IV
d) NIOSH - Region IV

For the purpose of informing the approximately 15 "affected employees" the employer will promptly "post" the Determination Report in a prominent place(s) near where exposed employees work for a period of 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 received a request from an authorized representative of employees regarding exposure to airborne dust from sand, lime, soda ash, sandspar, and slag in the batch house, together with alleged hypertension among batch house workers, at Owens-Illinois Glass Company, Atlanta, Georgia.

IV. HEALTH HAZARD EVALUATION

A. Plant Process

Raw materials are shipped to the Owens-Illinois Plant in railroad cars. The material is transferred by an enclosed conveyor to an elevator where it is directed to either an active storage bin or a reserve bin on top of the batch house. The raw material (sand, limestone, soda ash, sandspar) is transferred by means of a screw feeder into a scale hopper, where additional materials are added. When the batch is completed (approximately 7,000 lbs. of material) it is transferred into a tank where it is thoroughly mixed and transferred to a surge hopper where the material is screen fed into the furnace.

The major operations in the batch house are unloading, weighing, mixing and transferring of raw materials. These operations are in a closed system and are automatically controlled. A mixer operator crew leader and two maintenance men are assigned to the batch house area.

B. Evaluation Design

An initial observational survey of the batch house operation was made on May 7, 1974 to assess the alleged hazard. The alleged health hazard in the batch house was airborne dust from sand, lime, soda ash, sandspar, and slag. Hypertension reportedly existed among batch house workers. On May 8 and 9, 1974 environmental air dust samples were obtained, together with confidential health questionnaires information from 23 Owens-Illinois employees. The questionnaire was specifically designed to evaluate the possibility that an unusual prevalence of hypertension was occurring among batch house workers.

C. Evaluation Methods

On May 8 and 9, 1974 a total of 14 environmental air samples were collected in the batch house: six personal samples for total dust and SiO_2, five general area samples for respirable fraction and SiO_2, and three general area samples for total dust and SiO_2. The personal and general areas samples were collected for total dust and silica on pre weighed PVC filters, using a MSA Model G vacuum pump operated at an air flow rate of 1.5 liters per minute. In addition the respirable fractions were obtained using 1/2" stainless steel cyclone operated at an air flow rate of approximately 9.1 liters per minute. The samples were analyzed by NIOSH's Cincinnati laboratories.

Confidential health questionnaire information and sphygmomanometer data were collected from 23 Owens-Illinois employees by Mrs. Gwen Dekle, Occupational Health Nurse Consultant, Georgia State Department of Health. Since the number of workers in the batch house is far too small for evaluation (6) the survey also included furnace personnel who are supervised and are under the same administrative section as the batch house operators.

D. Evaluation Methods

1. Environmental Criteria

Substance	
Pure Crystalline Silica (respirable dust)(1)	.05 mg/M^3*
Pure Crystalline Silica (total dust)(3)	.15 mg/M^3
Mixture of Silica and nuisance dust (respirable dust)(2)	$\frac{10}{\% SiO_2 + 2}$ mg/M^3
Mixture of Silica and nuisance dust (total dust)(2)	$\frac{30}{\% SiO_2 + 3}$ mg/M^3

Reference

(1) Criteria for a Recommended Standard - Occupational Exposure to Crystalline Silica - NIOSH, 1974.

(2) Threshold Limit Values for Chemical Substances - ACGIH, 1974.

(3) Based on assumption that total dust is normally three times weight of respirable dust.

*Milligrams of particulate per cubic meter of air. Occupational Health Standards for individual substances are established at levels designed to protect workers occupationally exposed on an 8-hour per day, 40 hours per week basis over a normal working life time.

2. Toxic Effects of Substance Investigated [1, 2]
Crystalline Free Silica (SiO_2)

Finely divided silica in the free state can cause an illness called silicosis, a fibrotic disease of the lung.

Silicosis may be recognized either as an acute or chronic process. The acute form (rapidly developing silicosis) may be recognized after 8 to 18 months from the first exposure and probably develops after massive exposure. Patients note severe shortness of breath and rapid breathing and chest X-rays often show fibrosis with no visible typical nodulation of silicosis. Tuberculosis is often present, chronic pulmonary silicosis is a type most often seen in industry, and usually occurs only after years (sometimes 15 to 30) of exposure to silica dust. A chest X-ray will usually detect silicosis in a relatively early stage. However, an uncomplicated case may progress to an advanced stage while showing only symptoms of moderate shortness of breath.

A chest X-ray, together with a case history are basic in making a diagnosis of an early case of silicosis, since the early stages of the disease may be asymptomatic. The chest X-ray is not diagnostic, and needs to be supported by other clinical findings to rule out other diseases.

Prevention is extremely important since treatment is not effective for the pulmonary lesions. Insuring that levels for free silica are below the Federal Standards as well as the NIOSH criteria document recommendation is the best preventive measure.

E. Environmental Results and Discussion

The results of personal and general area samples for respirable dust, total dust, and free silica are presented in Table I. The amount of silica and the corresponding standard was determined for each sample. Of the 14 samples collected, only one isolated case approached the U. S. Department of Labor Standard for free silica. This personal breathing zone sample was worn by a maintenance man who performed repairs on malfunctioning dusty equipment. This operator wore a disposable respirator approved for free silica while performing these services. The fact that a respirator was worn for maintenance operations was not taken into consideration in calculating exposures. It can be assumed that exposures of these persons making proper use of prescribed respiratory protection were materially reduced from the calculated values.

F. Medical Results and Discussion

Confidential health questionnaire information and sphygmomanometer data collected from 23 O-1 employees was reviewed by James B. Lucas, M.D. NIOSH physician. The questionnaire was specifically designed to evaluate the possibility that an unusual prevalence of hypertension was occurring among batch house workers as alleged in the Health Hazard Evaluation request. Since the number of workers in the batch is far too small for evaluation, the survey also included furnace personnel who are part of the same administrative section.

Hypertension is a relative term and has defied an exact definition. Blood pressure fluctuates to some extent in all persons and considerable "normal" variation has been observed when automatic measurements are made over a 24 hour period. It must be realized that single readings taken with a sphygmomanometer under varying circumstances may not reflect the usual arterial pressure in a given person. Blood pressure varies normally with age, race, weight, sex, emotion, exercise, posture and other factors. Naturally, various pathologic states profoundly alter the normal patterns and usually tend to result in increased levels (hypertension). Epidemiologic studies in which large numbers of presumably healthy persons have participated have helped establish "norms" for this physiologic variable. For men aged 16-40, a systolic mean pressure of 129 $\pm$ 13.5 mm Hg (1 standard deviation) has been found. This means that one-sixth of men will "normally" have pressures below 116.5 mm Hg and one-sixth above 143. More detailed observations based on the study of 250,000 healthy Americans, both men and women, showed the following normotensive results:

Age	Systolic Pressure	Diastolic Pressure	Pulse Pressure
20	120	80	40
30	123	82	41
40	126	84	42
50	130	86	44
60	135	89	46

Thus, the old adage that a systolic pressure of 100 plus a person's age marks the upper limit of "normal" for an individual is reasonably accurate since such a figure is between 1 and 2 standard deviations above the mean for that age. Based on this type of epidemiologic information, it has been estimated that perhaps 10 - 15% of our population has sufficiently elevated blood pressure to be considered hypertensive enough to warrant therapy.

With this background in mind the data from Owens-Illinois were examined. Three employees were identified as being known hypertensives and on medication. One of these was noted to be approximately 70-80 pounds over his desirable weight for his age and height. All appeared to be under good medical control with pressures essentially within the normal range. Two of these individuals (non-obese) were 50 years of age. Since they are on anti-hypertensive medication (which may profoundly have lowered their pressures) they have been excluded from the group analysis. Of the 20 remaining individuals, only one was noted to have pressures even suggesting hypertension (146/90 on a single determination). This individual is 39 years old and asymptomatic. The average age for the group is 32. The group systolic pressure averaged 116 and the diastolic averaged 74. This gives an average pulse pressure of 42. Thus, the means for the systolic and diastolic pressures were both approximately 8 mm Hg less than national average figures while the pulse pressure (systolic minus diastolic pressure) was virtually identical with the expected based on the data presented above. Too little data were available to attempt a meaningful statistical correlation between blood pressure and years of O-I employment, but it was noted that the four oldest employees who averaged 50 years of age and 14 years employment had a pressure mean of 118/74, well below normal for their age group.

From the above it may be concluded with a reasonable degree of certainty that the population under study does not have an incidence of known hypertension exceeding that expected for a group of its size. There also is no data suggesting that the group had higher blood pressures than expected in comparison with the general population. In fact, the group average pressure was somewhat less than that of a cross-section of normal healthy Americans of the same age. In addition, nothing was discerned from the data suggesting that years of Company service predisposed to hypertension.

G. Conclusion

The measured levels of respirable, total dust, and free silica are below the present U. S. Department of Labor Standards except for one isolated case. It can be assumed that the batch house workers under study do not have an incidence of known hypertension exceeding that expected for a group of its size. Based on the information, it has been determined that the concentrations measured during this evaluation are not toxic to exposed employees.

V. RECOMMENDATIONS

1) The policy of wearing prescribed respiratory protection during cleanup and/or maintenance operations should be maintained to preclude exposure to high concentration of silica dust.

2) Continue the practice of applying a mixture of sawdust and a lightweight oil to the floor to absorb the dust, before sweeping. An alternative means of cleaning would be a vacuum system.

3) Medical

a) Medical examinations should be made available to the batch house workers prior to employee placement and at least once each 3 years thereafter. Examinations should include as a minimum:

(1) A medical and occupational history to elicit data on worker exposure to free silica and signs and symptoms of respiratory disease.

(2) A chest roentgenogram (posteroanterior 14" by 17" or 14" by 14") classified according to the 1971 ILO International Classification of Radiographs of Pneumoconioses. [ILO U/C International Classification of Radiographs of Pneumoconioses 1971, Occupational Safety and Health Series 22 (rev). Geneva, International Labor office, 1972]

(3) Pulmonary function tests including forced vital capacity (FVC) and forced expiratory volume at one second (FEV_1) to provide a baseline for evaluation of pulmonary function and to help determine the advisability of the workers using negative- or positive-pressure respirators. It should be noted that pulmonary function tests may vary significantly in various ethnic groups. For example, in black persons, the test values for the FVC should be divided by 0.85 before the percentage value is compared with normal figures.

(4) Body Weight.

(5) Height.

(6) Age.

(7) Initial medical examinations for presently employed workers should be offered within 6 months.

VI. REFERENCES

1. Occupational Diseases - A Guide to Their Recognition: W.M. Gafafer, Editor, USDHEW, PHS, Publication No. 1097, 1964.

2. Occupational Health and Safety: Volume II, International Labour Office, Geneva, MacGraw Hill, New York (1971)

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TABLE I

SUMMARY OF ENVIRONMENTAL RESULTS, etc.

Job Classification and/or Location	Time of Sample Hours	% SiO_2	Atmospheric Conc. - *mg/M^3 Total Particulates Gross Analysis	Total Particulates SiO_2	Resp. Particulates Gross Analysis	Resp. Particulates SiO_2	Type of Sample
1. Scale Area	3.4	7.2			0.8	.06	GA
2. Scale Area	4.0	6.5			0.6	.04	GA
3. Blending Area	6.5	8.9			0.5	.05	GA
4. Blending Area	6.5	4.9	1.2	.06			GA
5. Crew Leader	6.6	N.D.	N.D.	N.D.			BZ
6. Batch Mixer	6.7	N.D.	0.9	N.D.			BZ
**7. Maintenance Man	6.5	0.8	6.1	.05			BZ
8. Scale Area	3.4	6.2	0.9	.06			GA
9. Basement	3.7	2.6			0.4	.01	GA
10. Batch Mixer	3.7	N.D.			N.D.	N.D.	BZ
**11. Maintenance Man	6.6	4.5	1.3	.06			BZ
12. Electrician	6.3	N.D.	N.D.	N.D.			BZ
13. Basement	2.6	1.6	1.8	.03			GA
14. Basement	3.6	3.2	___	___	0.6	.02	GA
Threshold Limit Value		av. 4.6%	3.9	0.15	1.5	.05	

BZ - Personal breathing zone air sample.
GA - General Area.
N.D. - (none detected) result was less than average result for blank sample.
*mg/M^3 - Milligrams of particulate per cubic meter of air.

**Federal Standard for maintenance operator samples = $\frac{30}{2.75 + 2}$ = 6.3 mg/M^3

Average exposure = 3.7 mg/M^3