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

HEALTH HAZARD EVALUATION DETERMINATION
REPORT NO. 73-184-176

PHILADELPHIA QUARTZ COMPANY
CHESTER, PENNSYLVANIA
MARCH 1975

I. TOXICITY DETERMINATION

It has been determined that employees' exposure to ammonia liberated in the generation of Q-cel microspheres in Annex 5 is potentially toxic in the concentrations measured during the evaluation performed on January 17, 1974. This determination is based upon high airborne concentrations of ammonia and the presence of related symptomatology, eye and upper respiratory tract irritation, elicited from employees.

Airborne concentrations of crystalline silica contained in small amounts in Q-cel dust, were found below levels believed to be toxic to workers. Q-cel dust is largely non-respirable and highly alkaline and has reportedly caused burning in the eyes and stuffiness in nasal passages upon heavy loading.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of the 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) Philadelphia Quartz Company
b) Authorized Representative of Employees
c) U. S. Department of Labor - Region III
d) NIOSH - Region III

For the purposes of informing the approximately 5 "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 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. The National Institute for Occupational Safety and Health (NIOSH) received a request from an authorized representative of the employer regarding exposures to dust and ammonia in annex 5C, Philadelphia Quartz Company, Chester, Pennsylvania.

IV. HEALTH HAZARD EVALUATION

A. Decription of Process - Conditions of Use

Philadelphia Quartz Company manufactures and quality tests the following products: frictioniz, hydrophobic silica, Quram 40, 220 and 3365 organic ammonium silicate, and Q-cel inorganic microspheres. The manufacturing of these products with the exception of Q-cel was terminated as of February 1974. After this date the Philadelphia Quartz Company - Chester operations, terminated its research and development activities and now directs its efforts toward production of Q-cel inorganic miscrospheres.

The production of Q-cel requires a borate derivative, silica gel and water. These compounds are mixed, digested, dried, sized and bagged. The Q-cel preparation area is commonly referred to as the feeding area. The feeding and bagging areas located in Annex 5C were evaluated. Q-cel was the only product manufactured during the plant visit.

B. Evaluation Design

An environmental evaluation was made on January 17, 1974. Environmental concentrations of O-cel dust and ammonia from the mixing container were measured and in addition several employees interviewed to elicit occurring symptomatology. Employees preparing Q-cel preparations and bag filling operations were environmentally monitored via breathing zone and general air samples. A laboratory chemical technician who substitutes as a unit operator or bag filler was included in the evaluation.

C. Evaluation Methods

Employees operating the unit and bagging machines potentially exposed to ammonia and O-cel dust were monitored with personal air sampling equipment. Ammonia gas concentrations were measured with Drager direct-reading indicator tubes. Respirable dust concentrations and free silica determinations were made on Q-cel dust air samples collected on Millipore filters. Employees were interviewed privately by the industrial hygienist to elicit any health problems employees believed were associated with their work.

D. Evaluation Criteria

1. Environmental Criteria

A review of the most current toxicological literature indicates that the following environmental exposure levels be used as guides to prevent excessive exposures or hazardous exposures to toxic dusts and gases:

Ammonia - 50 parts per million parts of (ppm)[1] as a ceiling concentration determined by a 5-minute sampling period.

Crystalline Silica Dust[2]

Respirable Fraction: $\frac{10}{\%\ \text{respirable}\ SiO_2 + 2}$ mg/M3*

Total Dust : $\frac{30}{\%\ SiO_2 + 3}$ mg/M3*

*Mg/M3 - milligrams per cubic meter of contaminated air expressed as an 8-hour time-weighted average exposure concentration.

2. Toxic Effects of Substances

Ammonia

Ammonia is used extensively in industry and the production of other chemicals. Ammonia is a strong respiratory irritant.[3] Although the irritating effects serve as an excellent warning of a contaminated atmosphere, sudden accidental sprays or liquid anhydrous ammonia can cause acute respiratory exposure.[4] Vigliani and Zurlo found irritation of the respiratory tract and conjunctivae among workers inhaling 100 ppm, and 20 ppm caused complaints and discomfort in uninured workers.[5]

Q-Cel Dust

Little information is available on the toxicity of this dust. From environmental measurements, it was determined the dust may contain small amounts of free silica. A bulk sample of the dust analyzed for total alkalinity resulted in a ph of 10 (1% solution).

Crystalline Silica (Quartz)

Inhalation of extreme concentrations of particles of one micron or less may lead to a diffuse, fulminating lung fibrosis in a few months. However, development of the usual chronic type of silicosis takes many years. Effects of repeated inhalations of silica dust are cumulative and essentially irreversible. The disease is characterized by an initial increase in pulmonary density. While silicosis seldom produces death, common complications include tuberculosis, chronic bronchitis and other bacterial infections.[6]

E. Evaluation Results and Discussions

1. Environmental

Respirable dust air samples were collected in the breathing zone of three employees and in two general area locations. The average sampling time was seven hours. Respirable dust concentrations ranged from 0.1 - 1.4 milligrams per cubic meter. (See Table I)

The formula in Section IV, D is used in determining the permissible free silica exposure level. The high volume dust sample was selected for determining the per cent of free silica since a high dust load was necessary to make the free silica determination. The content of free silica in the high volume sample area was 1.0 per cent. Using this per cent of free silica, a calculated respirable dust concentration 3.3 milligrams per cubic feet was determined. The airborne respirable dust concentrations obtained were all below this permissible level.

Large quantities of settled, non-respirable dust observed on the floor and equipment indicate that engineering dust controls and proper bag filling and handling procedures are needed to minimize waste and preclude possible reentrainment of dust into the air.

The nitrogenous substance added to each batch preparation of Q-cel releases ammonia gas during its initial contact with hot water. Drager detector tubes were used to measure ammonia gas concentrations. A time period of the twelve minutes required to carry out the process starting with the addition of the nitrogenous compound to the hot water was monitored. During the sampling period ammonia concentrations at the weighing station ranged from 20 - 200 ppm, and at the cat walk near the vibrator, 20 - 350 ppm. At the time of the survey, ammonia concentrations appeared to be typical of those occurring with Q-cel batch preparation.

2. Medical Interviews

Six employees (semi-works operators) working in areas of maximal Q-cel dust or ammonia gas exposure were interviewed. Each interview was begun in a non-directive manner to elicit health complaints and and general information regarding working conditions. Following this each interviewed worker was specifically questioned regarding eye, nose and throat irritation due to their work environment.

Five individuals related histories consistent with exposures to ammonia gas and Q-cel dust. Most of the employees reported symptoms of eye burning, tearing and/or irritation of the upper respiratory system due to exposure to ammonia. Eye burning and nasal stuffiness occurred from excessive dust exposures; symptoms ceased after an hour or two away from the environment.

V. RECOMMENDATIONS

To preclude Q-cel waste and eliminate potential health hazard, it is suggested that:

1. Local exhaust ventilation to the mixing tank be provided to control high concentrations of ammonia. If local ventilation is not feasible, general ventilation should be provided.

2. The present bag-filling spout be replaced with a spout that will avoid spilling Q-cel dust when the filled bag is removed.

3. Housekeeping be improved.

VI. REFERENCES

1. Criteria for a recommended standard.. Occupational Exposure to Ammonia, HEW Publication No. (NIOSH) 74-136, 1974.

2. U.S. Department of Labor, Occupational Safety and Health Standards, Section 1910.93, Federal Register, June 27, 1974.

3. Patty W.P. Industrial Hygiene and Toxicology, Vol. II, p. 859, Interscience Publishers, Division of John Wiley & Sons, Inc., New York.

4. Anhydrous Ammonia, Hygiene Guide Series (Revision 1970). American Industrial Hygiene Association, 14125 Prevost Street, Detroit, Mighigan 48227.

5. Documentation of the Threshold Limit Values of Substances in Workroom Air, American Conference of Industrial Hygienists, Third Edition, 1971.

6. Silica, Hygiene Guide Series. American Industrial Hygiene Association, 14125 Prevost Street, Detroit, Michigan 48227.

VII. AUTHORSHIP AND ACKNOWLEGEMENT

Report Prepared By : Henry Ramos
Industrial Hygienist
Hazard Evaluation Services Branch
Cincinnati, Ohio

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

Acknowledgment

Environmental Evaluation: Walter Chrostek
Industrial Hygienist
Region III - Philadelphia, Pa.

Laboratory Analysis: A. W. Smallwood
C. H. Moore
M. T. Abell
Division of Laboratories and Criteria Development

SUMMARY OF AIR SAMPLE CONCENTRATIONS
PHILADELPHIA QUARTZ COMPANY
CHESTER, PENNSYLVANIA
JANUARY 1974

Sample No.	Location	Type of Sample	Sampling Volume	Concentration mg/M3* Respirable Dust	Free Silica
31	Bagging Area	Personal	612	0.6	
39	Laboratory	Personal	636	0.1	
40	Feeding Area	Personal	604	0.6	
37	Adjacent Bagging Operation	General Area	675	0.3	
34	Near Storage Tanks	General Area (High Volume)	4,176	1.4	1.0%

Permissible Level based upon 1% Free Silica: 3.3 mg/M^3

Location	Type of Sample	Substance	Concentration
Weighing Area	Detector Tubes	Ammonia	20 - 200 ppm**
Catwalk	Detector Tubes	Ammonia	20 - 350 ppm

Permissible level - 50 ppm (ceiling)

* Milligrams of particulate per cubic meter of air

** Parts of vapor or gas per million parts of contaminated air by volume at 25°C and 760 mm Hg. pressure.