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

HEALTH HAZARD EVALUATION DETERMINATION
REPORT NO. 74-107-279

General Electric Company
Silicone Products Department
Waterford, New York

JULY 1976

I. TOXICITY DETERMINATION

It has been determined that although the employees were not exposed to potentially toxic concentrations of benzene and chlorobenzene, as determined by the air concentration measurements conducted during the evaluation during June 17-19, 1975, there exists the possibility that this can occur during malfunctions. This was borne out by the general area air samples collected during the malfunctioning of the separator in the silane area where the additive effects of benzene and chlorobenzene exceeded permissible levels as calculated by the American Conference of Governmental Industrial Hygienist (ACGIH)[1] additive effect method.

Exposure to vinyl chloride in the vinyl chlorosilane area and to airborne particulate containing trace amounts of lead in the molding compound area were not excessive during the above evaluation dates.

Because neither the preliminary questioning by the industrial hygienist, nor this limited mortality study even suggested a medical problem, it was felt that a more complete mortality study was not needed to answer this non-specific request for a health hazard evaluation.

Tables of our findings and recommendations have been offered in the body of the report for the control of environmental exposure of employees to the potentially toxic substances.

II. DISTRIBUTION OF DETERMINATION REPORT

Copies of this Determination Report have been sent to:

a) General Electric Company, Waterford, New York
b) Authorized Representative of Employees
c) U. S. Department of Labor - Region II
d) NIOSH - Region II and Region III

For the purpose of informing the approximately 100 "affected employees", the employer shall promptly "post" for a period of 30 calendar days the Determination Report in a prominent place(s) near where affected employees work.

III. INTRODUCTION

Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U. S. Code 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 (NIOSH), received such a request from a representative of the international union, IUE-AFL-CIO, to which the local union belongs, alleging that the employees were being exposed to many chemicals, one of which was vinyl chloride. The request involved chemical operators, maintenace workers and laboratory technicians.

IV. HEALTH HAZARD EVALUATION

The General Electric plant in Waterford, New York, has been in operation for 27 years and produces "silicone" products, particularly caulking and roofing compounds.

The initial visit to the plant was made by Walter Chrostek, industrial hygienist, on October 29, 1974. Due to the cut back in construction where the products are widely used and an over stock of finished products, an environmental evaluation could not be performed until June, 1975.

Three operations were of concern during this evaluation. They are: 1) vinyl chlorosilane production, 2) pheny chlorosilane and 3) molding compound operations. The first two operations are similar and are operated from one control room.

Silane Reaction Area

Silicon metal is purchased, processed, and put in storage. This material is then preweighed as needed, reacted with various chemicals, separated, dried and stored. One side of the building produces vinyl chlorosilanes. These silanes are then incorporated into other compounds to make a final product. The building is four stories high and mostly open on four sides. The transfer of material is done by pumps and gravity in a closed system.

Exposure to benzene, chlorobenzene and dichlorobenzene could occur in the pheny chlorosilane reaction while vinyl chloride could occur in the vinyl chlorosilane reaction.

Molding Compound Area

The molding compound, manufactured at this plant, is a base polymer containing trace quantities of lead. The materials (filters and resins are pre-weighed in a local exhaust hood. They are then dumped into a mixer. Following a prescribed mixing period, the material is processed and packed in drums.

Medical Program

The plant has had a medical program for 27 years and medical records are available. Prior to April, 1975, vinyl chloride workers received physical examinations and SMA-12 laboratory tests every two years. Since the above date, full range of tests recommended by the Occupational Safety and Health Administration (OSHA) were adopted. Continuous monitoring for vinyl chloride is done in certain areas where there is a potential for exposure. The company takes samples for quality control.

B. Evaluation, Design and Methods

1) Environmental

A walk- through survey was conducted during the initial visit to the plant. Due to the lack of specificity of the health hazard evaluation request, the areas where there was a potential for exposure or where the controls were felt to be inadequate were designated as the sites where the environmental study would be conducted. The areas selected were: the silane reactorplant for vinyl chloride, benzene, chlorobenzene and dichlorobenzene, and the molding compound operation for lead and total particulate.

Air sampling was conducted during June 17-19, 1975.

Personal air samples for benzene, chlorobenzene, dichlorobenzene and vinyl chloride were collected on charcoal tubes at a sampling rate of 50cc/min. These samples were subsequently analyzed by gas chromatograph.

Personal air samples for total airborne particulate and lead were collected on membrane filters at a sampling rate of 1.7 liter/min. samples were subsequently analyzed gravimetrically for the total particulate and by the NIOSH, P&CAM#173,[2]

On the initial visit of October 29, 1974, Walter J. Chrostek, NIOSH industrial hygienist, administered non-directed medical questionnaires to 17 workers and reviewed the plant's OSHA Form 102. These did not suggest any medical problems. It was also learned that the plant physician was starting a mortality study.

In view of the lack of specificity of the Health Hazard Evaluation request, a mortality study appeared to offer the best answer to the question of whether a hidden hazard might be present. In view of the short period of use of vinyl chloride (10 years), a screening test to give a long range predicition of the likelihood of developing angiosarcoma of the liver was deemed not feasible. The mortality study was carried out in cooperation with the plant physician, Marshall W. Quandt, M.D.

On May 8, 1975, Theodore W. Thoburn, M.D., NIOSH physician, and Pierre Decoufle, Sc.D., NIOSH Chief, Injury Surveillance Branch, Office of Occupational Safety Surveillance and Biometrics, visited the plant.

Copies of death certificates for known deceased workers and ex-workers were obtained from the appropriate offices of vital records for the 12 year period starting in 1963. These were then tabulated by cause and death using the standard international practice regarding the choice of underlying cause of death[3]. Comparison of percent of deaths by cause among white male workers was made to the percentage of deaths by cause among white males in the U.S.A., age 20 years or older as reported in the 1972 Vital Statistics[4].

Because of possible incomplete knowledge of deaths among workers occuring after retirement age, the median age at death for white male workers age 20 to 64 was compared the the median age at death for white males in the U.S.A. for the same ages. To further eliminate extraneous causes, this comparison was limited to deaths caused by other than accidents or intentionally inflected harm.

Copies of most of the death certificates were supplied by the plant physician, along with a list of known deaths. The Illness and Injury Surveillance Branch, Office of Occupational Health Surveillance and Biometrics, NIOSH, obtained another 11 death certificates.

C. Evaluation Criteria

The OSHA standards, relevant to this evaluation as promulgated in the Federal Register (29 CRF, 1910.1000 and 1910.1017), are as follows:

Substance	8-Hour Time Weighted Average
Chlorobenzene	350 mg/m^3*
Vinyl Chloride	1 ppm**
C*** O-Dichlorobenzene	300 mg/m^3
P-Dichlorobenzene	450 mg/m^3

The American Conference of Governmental Industrial Hygienists (ACGIH) has adopted or proposed the following Occupational Health Standard:

Substance	8-Hour Time Weighted Average
Lead	0.15 mg/m^3
Nuisance particulate (less than 1% quartz)	10 mg/m^3
Benzene (Skin)	30 mg/m^3

*mg/m - denotes approximate milligrams of substance per cubic meter of air.

**ppm - denotes parts of vapor or gas per million parts of contaminated air.

***C - denotes "Ceiling Value," an employee's exposure for the substance shall at no time exceed the ceiling value for that substance.

The American Conference of Governmental Industrial Hygienists lists benzene as a substance suspect of oncogenic potential for workers.

Vinyl chloride (the monomer from which PVC is made) is considered a carcinogenic agent. It is an etiological agent in the development of angiosarcoma of the liver (a rare from of liver cancer). As stated in NIOSH's Recommended Standard for Occupational Exposure to Vinyl Chloride, "there is probably no threshold for carcinogenesis although it is possible that with very low concentrations, the latency period might be extended beyond the life expectancy." NIOSH presented these findings to OSHA. Based on the demonstrated evidence of vinyl chloride's carcinogenicity in three animal species (rats, mice and hamsters), and the fact that vinyl chloride had been the causal agent in the cases of liver angiosarcoma found in workers both here and abroad, OSHA has adopted the above permissible exposure limit.

D. Evaluation Results and Discussion

1. Environmental

During the evaluation period of June 17-18, 1975, ten (10) personal and general air samples were taken in the silane reaction area. These samples were analyzed for benzene, chlorobenzene and dichlorobenzene (see Table III).

The lower limit of sensitivity for dichlorobenzene was less than .005 milligram per sample. All samples were less than this amount. All personal air samples for benzene and chlorobenzene were less than the OSHA and ACGIH permissible levels, however, if the ACGIH formula for additive effects viz.: $\frac{C_1}{T_1} + \frac{C_2}{T_2} = 1$, where C is the concentration measured and T is the permissible exposure level is used, the air concentration during the malfunction concentration during the malfunction would exceed unity (1). See Table I.

Five (5) personal air samples were taken for vinyl chloride in the production area and one (1) area air sample was collected in the control laboratory. The production area samples were collected on two (2) successive days. No malfunctions occurred in vinyl silane reaction area during this evaluation.

The lower limit of detection for vinyl chloride was 0.25 part per million parts of air. All the samples were below the lower limit of detection.

Six (6) personal and area air samples were collected for total airborne contaminant in the molding compound area. These samples were subsequently analyzed for total airborne particulate, and quartz and lead content.

During the initial day of sampling, during this evaluation, the separator on the pheny chlorosilane operation malfunctioned. This necessitated immediate repairs without allowing a reasonable time for dissipation of the solvent vapors. This cleaning up of the spill lasted approximately one-half hour. During this period, one employee was noted working without personal respiratory protection.

The quartz content of the airborne contaminant was less than one (1) percent. The ACGIH standard for inert or nuisance dust was applied.

These samples were also analyzed for lead content. Lead concentrations ranged from non-detected to 0.02 milligram per cubic meter of air, well below the ACGIH standard of 0.15 milligram per cubic meter of air. See Table II.

2. Medical

Table III presents the causes of death for the 39 workers and ex-workers known to have died from 1963 to the present. The percentage of total 1972 deaths of U.S.A. white males age 20+ due to the same cause is given for comparison. For most causes, the numbers are too small for statistical comparison. For all malignancies taken together and for arteriosclerotic heart disease, the differences are not statistically significant. Table IV lists deaths by type of work. There was no grouping of deaths by any particular job.

The median age at death for white males age 20 through 64 was calculated and compared to the median age at death for white U.S.A. males age 20 through 64 dying in 1972. For both groups, the median age at death was 55.5 years. Accidental deaths and homicides were excluded in this calculation. Ages 65 and older were excluded from this calculation as no checks have been made of the completeness of reporting post-retirement deaths. Under-reporting of the post retirement would give the study a lower median age of death than the U.S.A. population.

As no effort was made to assure complete follow-up on ex-workers, this does not represent a complete mortality study. Because workers are covered under a company sponsored health insurance plan and have a vested

pension after 10 years of continuous service, it was felt that the list of deaths would be reasonable complete, particularly for workers still of working age. The group most likely to be incompletely reported would be those with less than 10 years of continuous service. However, these are also the ones with less length of exposure.

E. Conclusion

See summary statement in Section I. Toxicity Determination.

V. DISCUSSION AND RECOMMENDATIONS

Although exposure to all contaminants was below the permissible levels, certain practices were noted during the evaluation which could be improved to further reduce exposure. In the separator area, it was noted that the employees, one without respiratory protective equipment, were working where the solvent was spilled on the floor. The separator should be completely drained, any spills should be cleaned and the exhaust ventilation should be installed in the area and utilized. This would prevent unnecessary excessive exposure during prolonged maintenance periods.

In the molding compound area, although the use of air flow indicator tubes showed to be adequate, some modifications such as capping unused ducts, utilizing the ventilation at the source of contaminant and repairing ruptured ducts are recommended.

In addition the following specific items are recommended.

1. Educate the employees in the proper use and enforce the wearing of respiratory equipment where there is a possibility for excessive exposure to contaminants, such as when emergency maintenance operations are performed.

2. Establish a procedure for proper decontamination of air contaminants prior to the start of maintenance. This was previously discussed under separator area.

3. Establish a maintenance program for all machinery and ventilation systems. This should include periodic repacking of drive shafts on machinery in the molding room.

4. Utilize local exhaust at the point of contaminant generation in the molding compound area.

VI. REFERENCES

1. American Conference of Governmental Industrial Hygienists, Threshold Limit Values for Chemical Substances in the Workroom Environment for 1975.

2. NIOSH Manual of Analytical Methods.

3. International Classification of Diseases, 1955 Revision, World Health Organization, Geneva, 1957.

4. Vital Statistics of the United States, 1972, Vol. II, Mortality Part B., DHEW, 1975.

5. Federal Register, Vol. 39, No. 125, Part II, Subpart 6, June 27, 1974.

6. NIOSH Recommended Standard for Occupational Exposure to Vinyl Chloride, 1974.

VII. AUTHORSHIP AND ACKNOWLEDGEMENTS

Report Prepared by: Walter J. Chrostek
Industrial Hygienist
Region III

Theodore W. Thoburn, M.D.
Medical Services Branch
Cincinnati, Ohio

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

Environmental Evaluation: Wesley E. Straub
Regional Industrial Hygienist
Region III

Analytical Laboratory Services: Soo Wang Kim
J. C. Holt
J. Lebrizzi

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General Electric Company
Silcone Products Department
Waterford, New York
Silane Reaction Area
Report No. 74-107
Table I
Benzene-Chlorobenzene Air Concentrations
June 17-18, 1975

Job Description	Time (Min)	Air Concentration Benzene	mg/m3* Chlorobenzene	Remarks
Operator-mechanic	440	2.72	105	Operator's Exposure
Phenyl Operator	342	N.D.**	89	Operator's Exposure
Separator Area	34	12.28	329	General Area Air (Breakdown)
Silicone Reactor Operator	302	5.30	N.D.	Operator's Exposure
Control Operator	360	19.4	N.D.	Operator's Exposure
Operator-mechanic	268	4.5	N.D.	Operator's Exposure
Separator Area	260	N.D.	N.D.	General Area Air
Operator-mechanic	180	42.2	N.D.	Operator's Exposure
Phenyl Operator	164	N.D.	N.D.	Operator's Exposure
Phenyl Area	102	270.65	N.D.	General Area Air

All samples were collected during the day shift (8 AM - 4 PM)
*mg/m - denotes milligrams of contaminant per cubic meter of air sampled.
**N.D. - denotes limit of detection - 0.005 milligram per sample for both benzene and chlorobenzene.

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Table II
Airborne Dust-Lead Concentrations
June 18-19, 1975

Job Description	Time (Min)	Total Dust Concentrations* mg/M	Lead Concentrations mg/m	Remarks
June 18, 1975				
Operator	8:27-15:15	3.25	N.D.**	Oper. B.Z.***
Control Operator	8:31-15:00	3.14	N.D.	Oper. B.Z.
Molding Compound Bldg.	8:40-12:40	0.19	N.D.	General Air
Operator	8:34-14:00	9.96	N.D.	Oper. B.Z.
Control Operator	8:35-14:00	7.59	0.02	Oper. B.Z.
Molding Compound Bldg.	8:30-14:00	0.90	N.D.	General Air

*mg/M - denotes milligrams of contaminant per cubic meter of air sampled.
**N.D. - denotes limit of detection less than .0075 milligrams per sample.
***Oper. B.Z. - denotes operator's breathing zone, respirator worn.

TABLE III

CAUSES OF DEATH FOR 39 WORKERS AND EX-WORKERS, 1963-1975

UNDERLYING CAUSE OF DEATH	NO. OF DEATHS	% OF WHITE MALE DEATHS	% OF TOTAL 1972 DEATHS OF USA WHITE MALES AGE 20+ DUE TO THIS CAUSE (REF. 2)
Malignant neoplasm of stomach	1	3	0.04
Malignant neoplasm of large intestine	2	5	1.7
Malignant neoplasm of respiratory system	3	8	5.9
Malignant melanoma of skin	1	3	0.3
Lymphosarcoma	1	3	0.4
TOTAL MALIGNANCIES	8	21.6	18.2
Diabetes mellitus	2	5	1.5
Subarachnoid hemorrage	1	3	0.4
Diseases of the mitral valve and other specified rheumatic heart disease	2	5	0.7
Arteriosclerotic heart disease	16	43.2	39.7
Hypertension with arteriolar nephrosclerosis	2	5	0.3
Nephritis	2	5	
Uremia	1	-	
Motor Vehicle Accident	4	10.8	2.8
Homicide	1		
TOTAL DEATHS	39		
TOTAL WHITE MALE DEATHS	37		

TABLE IV

DEATHS BY TYPE OF WORK, 1963-1975

TYPE OF WORK	NUMBER OF DEATHS	% OF DEATHS
Chemical Operators	4	10
RTV Packers	4	10
Laboratory Technicians	6	15
Shipping	6	15
Maintenance	5	13
Janitorial	3	8
Office Workers	2	5
Salesmen and Marketing	3	8
Managers	6	15
TOTAL DEATHS	39	99