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

HEALTH HAZARD EVALUATION DETERMINATION REPORT 72-76-137

GENERAL ELECTRIC COMPANY
HICKORY, NORTH CAROLINA

MAY 1974

I. TOXICITY DETERMINATION

Based on results of medical evaluations conducted by National Institute for Occupational Safety and Health personnel on November 20-22, 1972, it was determined that employees' exposure to xylene, hydrogen chloride and zinc chloride resulted in a definite hazard resulting in eye and upper respiratory tract irritation. Numerous employees complained of eye irritation and all employees in the north half of the sub-assembly area were symptomatic. Some were noted to have injected conjunctivae, while others reported sore throats and frequent headaches.

Environmental sampling conducted on September 20, 1973, following minor ventilation system improvements, revealed workroom air concentrations of substances listed above to be below existing standards. Employee irritation symptoms appeared to be somewhat reduced from those reported during the earlier visit to the plant.

II. DISTRIBUTION AND AVAILABILITY

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:

(1) General Electric Company, Hickory, North Carolina
(2) Authorized Representative of Employees
(3) U.S. Department of Labor - Region IV
(4) NIOSH - Region IV

For the purpose of informing the "affected employees", the employer will promptly "post" the Determination Report in a prominent place(s), near where approximately forty (40) affected employees work, for a period of thirty (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 receipt of 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 National Institute for Occupational Safety and Health received such a request from an authorized representative of employees to evaluate the potential hazard associated with employee exposure to vapors and fumes in the Circuit Breaker Sub-assembly Area.

IV. HEALTH HAZARD EVALUATION

A. Description of Process

General Electric Company, Hickory, North Carolina, produces electrical transformers and their components. The area where hazardous conditions were alleged to exist, namely the Circuit Breaker Sub-assembly Area, is located on the first floor, and consists of a large windowless, rectangular room on the west side of the main, or heavy, manufacturing area. A dark room for developing identification plates is located in the northwest corner of the work area and is referred to as the "etch room". Here plates providing detailed identification and specification information are produced by a modified photo-development process.

Within the sub-assembly area, there are approximately 12-15 persons employed on each of the three work shifts. Various components of circuit breakers are manufactured and assembled in the area under study. The processes involve hand assembly, soldering and brazing. Substances used in the work area included hydrogen chloride, xylene and solder flux (zinc chloride).

B. Study Progress and Design

On November 20-22, 1972, an initial walk-through/medical survey of the facility was conducted by Mr. Harry L. Markel, Jr., and James B. Lucas, M. D. The medical evaluation consisted of conducting interviews with all eleven (11) day-shift workers in the sub-assembly area. Eight (8) of the eleven (11) complained of eye irritation (burning, tearing, etc.). All seven (7) employees located in the north half of the area (which contains both the etch room and soldering/brazing operation) were symptomatic. Three (3) persons were noted to have injected conjunctivae. Two (2) persons reported sore throats and two (2) had frequent headaches. All symptoms were alleviated by leaving the work environment. One (1) employee was noted to be a habitual user of ophthalmic drops to obtain temporary relief from his condition of eye discomfort. Open containers of xylene and hydrogen chloride were observed in the etch room, and two (2) employees in close proximity to this area complained of drowsy sensations. No environmental evaluations were made during the initial visit to the plant.

Because of the eye and upper respiratory tract irritation which existed, plans were made to conduct environmental sampling as a means of further evaluating employee exposure. Sources of the irritation were not exactly known; however, suspected agents were xylene, hydrogen chloride and zinc chloride fumes.

Numerous work stoppages, as well as modifications to the ventilation system, delayed further NIOSH activities until September 20, 1973, when Mr. Markel returned to the facility in question to conduct the previously planned air sampling.As relates to the Circuit Breaker Sub-assembly Area, nineteen (19) general area and three (3) personal air samples were collected for appropriate laboratory analysis. (Note: Employees' reluctance to participate in "personal" monitoring was responsible for the collection of a minimal number of that type sample). No further medical evaluations were made.

C. Evaluation Methods

1. Xylene and Aliphatic Hydrocarbon Solvents Air Sampling.

Work area samples were collected using a battery-operated vacuum pump with organic vapor sampling tubes. Samples were desorbed in carbon disulfide by the NIOSH Western Area Occupational Health Laboratory and analyzed by gas chromatography.

2. Zinc Chloride Fume Air Sampling

Work area samples were collected using a battery-operated vacuum pump and 0.45 μ pore size filters. Filters were extracted with deionized water and the zinc determination performed by atomic absorption.

3. Zinc, Tin and Copper Air Sampling.

Personal and work area samples were collected using a battery-operated vacuum pump and 0.45 μ pore size filters. Filters were dissolved in nitric acid and metals determined by atomic absorption.

4. Hydrogen Chloride Air Sampling.

Personal and work area samples were collected using a battery-operated vacuum pump and midget impingers containing ten (10) milliliters of 0.01 N sodium hydroxide as the absorbing solution. Samples were determined turbidimetrically with silver nitrate.

D. Evaluation Criteria

1. Environmental Standards

The Occupational Health Standards as promulgated by the U. S. Department

of Labor (Title 29, Chapter XVII, Part 1910, Subpart 1910.93, Table G-1) applicable to this survey are as follows:

Substance	8-hour time weighted average p.p.m.*	mg/M^3**	Acceptable Ceiling Concentration p.p.m*	mg/M^3**
Hydrogen Chloride	-	-	-	7
Zinc Oxide Fume	-	5	-	-
Tin	-	2	-	-
Copper Fume	-	0.1	-	-
Zinc Chloride Fume	-	1	-	-
Xylene	100	-	-	-

*p.p.m. - Parts of vapor or gas per million parts of contaminated air by volume at 25°c and 760 millimeters mercury pressure.

**mg/M^3 - Milligrams of substance per cubic meter of air sampled.

E. Evaluation Results and Discussion

The results of the nineteen (19) general area and three (3) personal air samples collected in the Circuit Breaker Sub-assembly Area are shown in Tables 1 through 4. All results indicate air concentrations to be well below the applicable standard(s). It is pointed out, however, that environmental sampling (September, 1973) was not conducted concurrent with medical evaluation (November, 1972); thus employee exposure must be considered as an estimate. Environmental sampling was also conducted following the period when minor improvements were made on the ventilation system in the concerned area.

While the majority of employees felt that conditions had improved (between November, 1972, and September, 1973) in the brazing area, others in adjacent areas complained that occasional irritation still occurred. In the brazing area, observed cross-ventilation and air currents could quite likely reduce the efficiency of the local exhaust system, and thus produce localized effects for the individual(s) manning work stations in that area.

The alleged hazard, as reported on the original Request for Health Hazard Evaluation, related to the evaluation of employee exposure to various compounds (xylene, hydrogen chloride, zinc chloride, metals) within the Circuit Breaker Sub-assembly Area.

By mutual agreement of management and Union, eight (8) general area air samples were, however, collected in the epoxy/mold release area to similarly evaluate the exposure of some four (4) employees to a mold release agent containing aliphatic and hydrocarbon solvents. Table 5 shows the concentrations found in said work area to be below the manufacturer's recommended threshold limit value of 300 parts per million. Personal interviews conducted with persons performing duties in the immediate area revealed occasional eye irritation and upper respiratory tract discomfort.

F. Recommendations

1. Locally exhausted areas should, where practical and possible, be guarded against cross-drafts as a means of preventing/minimizing ultimate eye and/or upper respiratory irritation to concerned workers.

2. Air velocity measurements revealed the capture velocity of the "duct" where shafts for multi-series switches are drilled to be inadequate to control fugitive fiber glass particles emitted from the operation. Consideration should be given to modifying this specific local exhaust collection point so as to improve the collection efficiency and ultimately reduce employee exposure to a potentially hazardous material.

3. Local exhaust ventilation should similarly be improved in the epoxy room to reduce employee exposure to aliphatic hydrocarbon solvents which are currently being used.

V. AUTHORSHIP AND ACKNOWLEDGEMENT

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VI. TABLES

Table 1. Xylene Air Sampling Data

Circuit Breaker Sub-assembly Area - Etch Room

Sample Number	Type of Sample	Sampling Period (minutes)	Concentration (p.p.m.)*
14276	General Area	60	39
14270	General Area	60	29
14271	General Area	66	25
14269	General Area	75	$\leq$ 0.5
14274	General Area	94	9
14273	General Area	95	20
14272	General Area	95	0.5

Samples 14269 and 14272 were collected immediately outside the etch room.

Samples 14270 and 14273 were collected directly above the developing station.

Samples 14271 and 14274 were collected at the west end of the etch room (North Side)

Sample 14276 was collected at the nameplate cleaning station in the southeast part of the etch room.

*p.p.m. = parts of vapor or gas per million parts of contaminated air by volume @25°c and 760 mm mercury pressure

Table 2. Hydrogen Chloride Air Sampling Data

Circuit Breaker Sub-assembly Area

Sample Number	Type of Sample	Sampling Period (minutes)	Concentration (mg/M^3) *
14228	Personal	180	< 0.35
14229	General Area	195	< 0.35
14230	General Area	193	< 0.35
14231	General Area	185	< 0.35
14232	General Area	52	< 0.35
14233	General Area	51	< 0.35
14234	Personal	50	< 0.35
14235	General Area	50	< 0.35

*mg/M^3 = milligrams of substance per cubic meter of air sampled

Table 3. Zinc Chloride Fume Air Sampling Data

Circuit Breaker Sub-assembly Area

Sample Number	Type of Sample	Sampling Period (minutes)	Concentration (mg/M^3)*
14293	General Area	170	$\leq$ 0.01
14294	General Area	169	$\leq$ 0.01
14291	General Area	168	$\leq$ 0.01
14290	General Area	165	0.03
14292	General Area	125	$\leq$ 0.01

*mg/M^3 - milligrams of substance per cubic meter of air sampled

Table 4. Metals Air Sampling Data

Circuit Breaker Sub-assembly Area - Resistence Welding

Sample Number	Type of Sample	Sampling Period (minutes)	Concentration (mg/M^3) Zinc	Tin	Copper
14287	Personal	90	$\leq$ 0.01	$\leq$ 0.2	$\leq$ 0.005
14288	General Area	90	$\leq$ 0.01	$\leq$ 0.2	0.002

*mg/M^3 - milligrams of substance per cubic meter of air sampled

Table 5. Aliphatic Hydrocarbon Solvent Air Sampling Data

Epoxy Room (Mold Release Area)

Sample Number	Type of Sample	Sampling Period (minutes)	Concentration (mg/M^3) *
14278	General Area	55	198
14277	General Area	55	247
14282	General Area	78	289
14281	General Area	78	126
14279	General Area	65	552
14280	General Area	64	447
14284	General Area	64	118
14283	General Area	63	95

*mg/M^3 - milligrams of substance per cubic meter of air sampled.