

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

HEALTH HAZARD EVALUATION DETERMINATION
REPORT NO. 76-37-394

Torwico Electronics
Route 70
Lakewood, New Jersey
May 1977

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I. TOXICITY DETERMINATION

On the basis of environmental air samples collected on April 14 and October 12, 1976, observations of work practices, and available toxicity data, it was determined that at the time of these investigations, the employees were not exposed to hazardous airborne concentrations of solvent vapors released during degreasing and varnish dipping operations. However, to reduce the exposure to these contaminants still further, recommendations are provided at the end of the report.

The health hazard evaluation request was also concerned with contaminants released during brazing operations on a specific group of large transformers which are filled with Westinghouse Gap Filling Compound B-7-300. This request was not assessed since these operations were not in progress during either plant visit. The company has no current orders for these transformers and expects none in the foreseeable future.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this determination report are currently available upon request from NIOSH, Division of Technical Services, Information and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days the report will be available through the National Technical Information Service (NTIS), Springfield, Virginia. Information regarding its availability through NTIS can be obtained from NIOSH, publication office at the Cincinnati address. Copies of this report have been sent to:

- a) Torwico Electronics Inc.
- b) Authorized Representative of Employees
- c) U.S. Department of Labor, Region II
- d) NIOSH, Region II

For the purpose of informing the approximately 150 affected employees, the employer will promptly post the Determination Report in a permanent place(s) readily accessible to workers 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. 699 (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 such a request from an authorized representative of employees of Torwico Electronics Inc. alleging worker exposure to contaminants released during degreasing operations and during brazing operations on epoxy filled transformers. The employees are represented by Local 417 of the International United Electric Workers.

IV. HEALTH HAZARD EVALUATION

A. Description of Operations

The company manufactures transformers. The standard operations of winding, wiring, soldering, brazing, assembling, laminating, encapsulating, varnish dipping, electrical testing, degreasing and spray painting are performed chiefly at work benches arranged in rows in a room measuring approximately 150 ft. by 80 ft. by 10 ft. high.

Degreasing

Degreasing is done either in an electrically heated vapor degreaser or in an open pan located about 5 ft. away. The vapor degreaser measures 30 in. by 22 in. and has a freeboard of 11 in. It is provided with a refrigerant cooling jacket and proper safety thermostats but has no exhaust system. The equipment may be used throughout the day by many of the workers who manually immerse small parts contained in a metal basket. About 30 to 40 gallons of trichlorethylene are used per month. The degreaser is covered when not in use.

At the open pan which contains trichlorethylene at room temperature, the transformer units are brushed with the solvent and racked for further processing. The 13 in. by 10 in. by 2 in. pan is recessed in a 3 in. deep opening provided in a ventilated 60 in. by 28 in. diamond grate table top. This pan which is always kept open, may be utilized several hours a day, generally by one employee.

Varnish Dipping

The transformers are wiped clean with trichlorethylene and dipped in one of several different types of varnish kept in cardboard containers in a room located about 15 feet from the degreasing equipment.

The cleaning and dipping operations are done at an unventilated table or at either of two ventilated tables provided with pipe racks for drip drying the dipped transformers. One of the two ventilated tables is exhausted by a downdraft system, while the other table is ventilated by a canopy hood. Dried varnished transformers are subsequently baked in an electrically heated oven.

All operations in the varnish room are done by two (2) employees over one

full work shift. These employees do not wear gloves while handling the varnishes. They also deposit varnish saturated paper wipes and cardboard containers in an open trash can.

Brazing

The brazing operations under consideration refer to the silver soldering of copper magnet wire to flexible lead wire on a specific group of large transformers that are filled with Westinghouse Gap Filling Compound B-7-300. The gap compound is a thixotropic, thermosetting epoxy material used to fill voids in insulating structures. It is applied by spatula. The catalyst is incorporated in the formulation, and additional catalysts or activators are not needed for curing. There is no cadmium in the silver solder, and no flux is used. These operations were not being performed when the plant visits were made. Furthermore, there were no orders on hand, and the company had no idea when these brazing operations would be done again.

B. Evaluation Design

On April 14, 1976 several preliminary personal and general air samples were collected on charcoal tubes at the vapor degreaser and in the varnish room. At that time the degreaser had to be placed in operation to simulate a typical degreasing cycle, but routine operations were in progress in the varnish room. On the basis of a relatively high trichlorethylene vapor concentration found during the simulated vapor degreasing operation and a medical interview with one of the varnish room workers who alleged both an adverse reaction to trichlorethylene vapor exposure and symptoms of nausea, cough and headache from exposure to varnish vapors, it was decided to conduct additional long term environmental sampling.

On October 12, 1976 more extensive personal and general area charcoal tube samples were taken to determine the workers' exposure to solvent vapors when full scale degreasing and varnishing operations were in progress. The samples were desorbed with carbon disulfide and analyzed by means of a gas chromatograph.

During the second plant visit, the Alnor velometer was used to make air flow measurements of pertinent exhaust systems, and medical questionnaires were administered to eight (8) additional employees who worked in or near the areas under consideration.

C. Evaluation Criteria

Trichlorethylene

The predominant effect of overexposure to trichlorethylene appears to be depression of the central nervous system. Such exposures often result in visual disturbances, mental confusion, fatigue, tremors, dizziness, nausea and vomiting.

Trichlorethylene also has toxic action on the cardiovascular and gastrointestinal systems - ventricular fibrillation and cardiac arrest having been reported following severe exposure to the substance. Cases of injury to the liver and kidney have also been observed.

Effects of trichlorethylene on the skin and eyes include reddening, contact skin burns and generalized dermatitis. Studies have indicated that trichlorethylene is not significantly absorbed through the skin unless it is trapped against the skin as for example under tight clothing.

Recent reports by the National Cancer Institute have indicated that tri-chlorethylene produced liver cancer in test animals.

The permissible concentrations recommended by the National Institute for Occupational Safety and Health (NIOSH) in its 1973 criteria document for trichlorethylene are 100 ppm determined as a time-weighted average (TWA) exposure for an eight (8) hour workday and 150 ppm as a peak concentration. The current U.S. Department of Labor Occupational Safety and Health Administration (OSHA) standard for an eight (8) hour time weighted average exposure to trichlorethylene is also 100 ppm. A permissible ceiling concentration of 200 ppm is also in effect. An October 1975 OSHA proposed revision to the standard would retain the TWA limit of 100 ppm but would reduce the allowable ceiling level to 150 ppm, making it identical to the NIOSH recommendation. The Threshold Limit Value (TLV) currently recommended by the American Conference of Governmental Industrial Hygienists (ACGIH) as the TWA concentration is 100 ppm. In addition, the ACGIH specifies a Short Term Exposure Limit (STEL) for trichlorethylene of 150 ppm. This represents the maximal concentration to which workers can be exposed continuously for a period up to 15 minutes.

Xylene

Xylene is primarily a mucous membrane irritant and may produce some central nervous system depression with symptoms including changes in muscular coordination and reaction time and narcosis. These or other adverse effects have not been reported in the literature for xylene exposures of 100 ppm or less in industrial workers or experimental subjects.

The maximum xylene concentration considered safe for exposure up to 10 hours per day or 40 hours per week is 100 parts of xylene per million parts of air. This value is recommended by both NIOSH and the ACGIH and is also the current OSHA standard. A ceiling concentration of 200 ppm is recommended by NIOSH as a value not to be exceeded for a period up to 10 minutes, while the current ACGIH short term exposure limit value is 150 ppm.

Mineral Spirits, Naphtha

These substances are included in the broad class of materials known as petroleum distillates.

In general exposure to mineral spirits and naphtha does not represent a severe health hazard. The skin may be defatted upon repeated and prolonged contact resulting in chapping and irritation. Acute inhalation effects are largely those of narcosis. Drunkenness, headache and nausea may be evident.

In more severe cases dizziness and unconsciousness, and in some cases convulsions may occur. In addition to these symptoms, irritation of respiratory passages and eyes may be produced.

Chronic poisoning by mineral spirits and naphthas themselves has not been definitely established, although the literature records several alleged cases with central nervous system effects predominating.

The ACGIH does not list a specific TLV for either mineral spirits or naphtha. Approximate values can be obtained from an equation, use of which requires knowledge of both the precise composition and the boiling point of the materials. All of these data are not available so that individual TLV's could not be calculated. It should be noted, however, that the current OSHA standard for a TWA exposure to petroleum distillates is 500 ppm.

D. Evaluation Results and Discussion

Environmental

The degreaser operators, other employees in the vicinity of the degreasing equipment and the varnish room workers were not exposed to trichlorethylene vapors in concentrations which exceed the existing or proposed permissible levels for either peak or time weighted average exposures (Table I).

The specific solvent vapors which were released when transformers were dipped and dried in the varnish room could not be identified by the laboratory from the charcoal tube and bulk samples submitted for analysis. Chemical data sheets obtained from the manufacturer indicate that these vapors were derived chiefly from xylene, naphtha and mineral spirits. In calculating the vapor concentrations which were liberated during routine operations in the varnish room, it was assumed that vapors of only the most toxic component, xylene, were present. Even under these conditions it can be seen that the vapor levels found were well below the existing standard. (Table I)

Ventilation

Velocity measurements at the downdraft exhaust system provided for the degreasing pan revealed velocities ranging from 50 to 200 fpm through the openings in the table top. It was noted that the degreasing operations were performed on only a relatively small area of the grate.

In the varnish room, at the downdraft table, the air velocity through the diamond grate table top openings was found to be 100-150 fpm. There was no measurable air flow at the pipe rack positioned about three (3) ft. above the table top. Much of the grate was covered with containers and trays as well as with paper for collecting varnish drippings. Some of the grate openings were also clogged with dirt.

At the canopy hood there was no measurable air flow in the hood face or at the pipe rack located 18 in. below the hood opening.

Medical

The results of the employee medical interviews revealed that of the ten (10) workers questioned, one complained of headache, nausea and coughing from exposure to varnishes. Four other workers stated that at one time they had developed skin rashes from contact with either trichlorethylene or epoxies. The company has recorded cases of occupational skin disease but thought the problem had been eliminated by the provision of adequate cleaning facilities and the re-emphasis of personal hygiene measures.

V. Recommendations

1. Although the airborne concentrations of trichlorethylene and varnish solvent vapors were within the permissible limits, recommendations are given below in view of the carcinogenic potential of trichloroethylene and in the interests of improving conditions further.
 - a. The degreasing pan should be covered when not in use.
 - b. The unused portion of the table grate adjacent to the degreasing pan should be covered to increase the air flow through the remaining openings.
 - c. The hoods in the varnish room should be converted into partial enclosures having front openings only as large as necessary to perform the operations. These hoods should be exhausted at the top or rear at a rate sufficient to maintain an average velocity of at least 50 fpm through the front openings. Baffles or multiple exhaust connections may be required to insure proper air distribution.
 - d. All solvent cleaning and varnish dipping operations in the varnish dip room should be done at one of the ventilated work tables.
 - e. Solvent and varnish contaminated waste paper and containers should be stored in covered receptacles prior to disposal.
2. All employees handling organic solvents, varnish or epoxies should be provided with and wear gloves resistant to these substances.
3. In view of the skin disorders experienced by plant employees, a medical appraisal, particularly of the epoxy workers, may be warranted.

VI. References

1. Criteria for a Recommended Standard, Occupational Exposure to Trichlorethylene, 1973 NIOSH
2. Trichloroethylene, Proposed Occupational Exposure Standard, U.S. Dept. of Labor, OSHA, Federal Register, Oct. 20, 1975
3. Carcinogenesis Bioassay of Trichloroethylene, 1976 U.S. Govt. Printing Office, Washington, D.C., Pub. No. NCI CG-TR-2
4. Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment with Intended Changes for 1976, ACGIH

5. U.S. Department of Labor, Occupational Safety and Health Standards, Federal Register Title 29, Part 1910.1000.
6. Criteria for a Recommended Standard, Occupational Exposure to Xylene, 1975 NIOSH
7. Hygiene Guide Series, Petroleum Naphtha, American Industrial Hygiene Association, July-August 1963

VII. Authorship and Acknowledgements

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Table I

Airborne Concentrations of Solvent Vapors

Torwico Electronics Inc.
Lakewood, New Jersey

<u>Sampling Location</u>	<u>Sample Period</u>	<u>Sample Volume (liters)</u>	<u>Concentration - ppm</u>		<u>Solvent Vapors AC 24 Varnish</u>
			<u>Trichloro-ethylene</u>	<u>Solvent Vapors BC 325 Varnish</u>	
B.Z. Degreasing at open pan and vapor degreaser-S.V.	0828-1110	16.2	40	-----	-----
B.Z. Solderer - 5 ft. from degreaser	0839-0919 1050-1234	14.4	17	-----	-----
G.A. Degreaser Area- 2 ft. from degreaser	0846-1229	223	12	-----	-----
G.A. Degreaser Area- 7 ft. from degreaser	0851-1229	218	8	-----	-----
B.Z. Peak - Degreasing at open pan - S.V.	0947-1002	15	63	-----	-----
B.Z. Cleaning transformers with trichloro-ethylene in varnish room - H.K.	1028-1232	11.5	32	9	< 0.2
G.A. Varnish room	1032-1236	124	1	0.5	< 0.02
B.Z. Peak-Dipping and drying in varnish room - T.M.	1123-1138	15	68	4	< 0.2
G.A. Varnish room	1310-1625	195	8	3	< 0.02
B.Z. Dipping and drying in varnish room - T.M.	1315-1625	17.6	15	8	< 0.2
B.Z. Dipping and drying in varnish room - H.K.	1418-1623	12.5	10	11	< 0.3

<u>Sampling Location</u>	<u>Sample Period</u>	<u>Sample Volume</u>	<u>Concentration - ppm</u>		
			<u>Trichloro-ethylene</u>	<u>Solvent Vapors BC 325 Varnish</u>	<u>Solvent Vapors AC 24 Varnish</u>
B.Z. Peak-Dipping and drying in varnish room - H.K.	1425-1440	15	7	4	<0.2
B.Z. Peak-Dipping and drying in varnish room - T.M.	1553-1608	15	8	4	<0.2