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. 78-109-648

GENERAL DYNAMICS - FORT WORTH DIVISION
FORT WORTH, TEXAS

DECEMBER 1979

I. TOXICITY DETERMINATION

Because of a suspected work-related death of an employee of the Penetrant Inspection Department, the National Institute for Occupational Safety and Health (NIOSH) evaluated the work environment and reviewed various records relating to the death.

The following determinations have been based upon: (a) results of environmental air samples collected on September 28, 1978; (b) personal observation of the NIOSH investigator; (c) available toxicity information; (d) employee interviews; and (e) review of the autopsy report, death certificate and Medical Examiner's report concerning a former employee referred to in the Request for Health Hazard Evaluation.

Results of four (4) personal breathing-zone samples showed workroom concentrations of trichloroethylene to be below the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLV); U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) standards; and the NIOSH recommended standard. Because of the insignificant amounts and the nature of other chemicals used within, and adjacent to, the Penetrant Inspection Department, little consideration was given to their potential toxicity. The intermittency of the operation in question, and the actual chemical make-up of the penetrant containing the fluorescent dye being used led to NIOSH's decision to conduct no additional environmental evaluation(s).

Employee interviews with three (3) persons performing duties in the Penetrant Inspection Department, as well as a review of the autopsy report, death certificate and Medical Examiner's report of the former employee, failed to identify obvious work-related health problems in that specific work area. Fluorescent material in the deceased employee's lungs and liver was not identified, but was presumed to be the material he previously used in the performance of his job. There is no histologic evidence that it had any adverse biological effect

in either the liver or lungs. Furthermore there is no histologic evidence of any lung or liver disease attributable to other chemical substances being used in the workplace.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report are currently available upon request from NIOSH, Division of Technical Services, Information Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After ninety (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, Publications Office, at the Cincinnati, Ohio, address. Copies have been sent to:

a) General Dynamics - Fort Worth Division
b) Authorized Representative of Employees
c) U.S. Department of Labor, Region VI
d) NIOSH, Region VI

For purpose of informing the approximately four (4) "affected employees", the employer shall promptly "post" the Determination Report in a prominent place near where exposed 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 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.

NIOSH received such a request from an authorized representative of employees in the workplace regarding the exposure of workers in the Penetrant Inspection Department (#275-1, Task Center 194) to water-washable penetrants, wet/dry developers and other related chemicals/compounds. The request was prompted by the sudden death of an employee whose work involved the use of a mixture containing a fluorescent dye. The issue of occupational exposure was raised as a result of the fluorescent material being found in his lungs and liver.

IV. HEALTH HAZARD EVALUATION

A. Description of Process - Conditions of Use

The Fort Worth Division of General Dynamics is involved in the manufacture of aircraft totally under Government

contract(s), and employs approximately 12,000 personnel. Five (5) persons are employed in the specific area of the request for health hazard evaluation -- namely, the penetrant inspection area which is commonly identified as Task Center 194 in the Main Building. Parts are sprayed with fluorescent penetrant, washed, and then inspected for surface cracks and defects; the operation in question is of an intermittent nature; i.e., 2-3 hours per shift on alternate days.

B. Evaluation Design

1. Environmental Survey

On September 28, 1978, an environmental evaluation of the facility was conducted by NIOSH representative Mr. H. L. Markel, Jr., Regional Industrial Hygienist; and Mr. John Hulla, Industrial Hygienist, Texas State Department of Health.

In order to more fully and adequately evaluate employee exposure to chemicals, environmental air samples were collected within the penetrant inspection area. As the dyes make up only a small percent of the fluorescent penetrant, the constituent of major concern was trichloroethylene.

2. Medical Survey

A NIOSH Medical Officer, Mitchell Singal, M.D., reviewed the autopsy report, death certificate and Medical Examiner's report concerning the death of an employee who had worked within the area in question for a number of years.

C. Evaluation Methods

1. Environmental

Trichloroethylene

Four (4) personal breathing-zone samples were collected by using: (a) low-flow SIPIN, *Model SP-1 personal sampling pumps with standard charcoal tubes at a rate of fifty (50) cubic centimeters per minute; and (b) Mine Safety Appliance*, Model G, battery-operated vacuum pumps with standard charcoal tubes at a rate of one (1) liter per minute.

*Mention of commercial name(s) does not constitute NIOSH endorsement.

All samples were analyzed in accordance with NIOSH Physical and Chemical Analysis Branch Analytical Method #127 -- namely, absorption on charcoal, desorption with carbon disulfide, and use of a gas chromatograph with a flame ionization detector. The limit of detection was determined to be 0.05 micrograms of substance per tube.

2. Medical

As previously stated, NIOSH Medical Officer Mithcell Singal, M.D. reviewed various pieces of medical information related to the death of a former employee.

Employee interviews of current personnel working in the penetrant inspection area were conducted by the industrial hygienist while performing the environmental evaluation.

D. Evaluation Criteria

1. Environmental Standards

The evaluation standards and criteria considered to be applicable to this evaluation are as follows:

a. The Occupational Health Standards as promulgated by the U.S. Department of Labor, Federal Register, May 28, 1975, Title 29, Chapter XVII, Subpart G, Table Z-1 (29 CFR Part 1910.1000),

b. American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV) Committee, 1977, and

c. NIOSH Criteria Documents recommending occupational standards.

Substance	*8-hr. TWA, ACGIH TLV Committee (mg/M^3)	*NIOSH 8 or 10-hr. TWA Recommended Standard (mg/M^3)	*OSHA 8-hr. TWA Standard (mg/M^3)
Trichloroethylene	100	100	100

* Eight or ten-hour time-weighted-average concentration in milligrams of substance per cubic meter of air sampled.

Note: Occupational health exposure limits for individual substances have generally been established at levels designed to protect workers occupationally exposed for eight or ten hours per day, forty (40) hours per week, over a normal working lifetime.

2. Toxic Effects

a. Trichloroethylene [A,B]

Trichloroethylene is a central nervous system depressant. Effects include drowsiness, dizziness, disturbances of vision, impairment of the senses of smell and touch, tremor, impaired coordination, anxiety, confusion, and loss of consciousness. Other effects of trichloroethylene include vomiting, abdominal cramps, cardiac arrhythmias (disturbances of the heartbeat), and respiratory tract irritation. Skin contact can cause irritation and vesicles (small blisters), and prolonged immersion of the hands can result in paralysis of the fingers. Liver and kidney damage have resulted from drinking trichloroethylene. It is possible that such damage may also result from the repeated breathing of air contaminated with trichloroethylene.

Trichloroethylene reduces tolerance to alcoholic beverages. Some individuals who have been exposed to trichloroethylene experience "degreaser's flush" after consuming alcohol. This condition, which lasts only a few hours, and is apparently harmless, consists of red areas of skin on the face, neck, shoulders, and back.

Although trichloroethylene has been shown to cause cancer in mice, there is currently no evidence that it produces cancer in humans. It is, therefore, at most, considered to be a weak carcinogen (cancer-causing agent).

E. Evaluation Results and Discussion

1. Environmental

Results of four (4) personal breathing-zone samples (Table I) showed workroom concentrations of trichloroethylene to be below the ACGIH TLV, the OSHA standard, and the NIOSH recommended standard. Each sample was

analyzed both by gas chromatography/flame ionization detector and gas chromatography/mass spectrophotometry. The chromatogram from each sample was virtually identical and contained a large peak (trichloroethylene) and a second smaller one (toluene).

2. Medical

There was no medical evidence that the death of the former employee was due to any occupational chemical exposure. Since the employee's identity is most likely known to the recipients of this report, medical details unrelated to occupational exposures will not be presented.

Fluorescent pigment was found in pulmonary macrophages and in hepatic Kupffer cells. However, a pulmonary pathologist found no evidence of chemical or viral pneumonitis, chronic pulmonary disease, or damage to the lungs from the fluorescent material in the macrophages. A liver pathologist found no evidence of inflammatory or degenerative changes in the liver parenchyma resulting from the fluorescent material in the Kupffer cells.

Employee interviews with three (3) persons performing duties in the penetrant inspection area failed to identify any obvious work-related health problems.

F. Conclusions

No concentrations in excess of the evaluation criteria used herein for this evaluation were found to exist in the work environment of the plant at the time of this evaluation.

The fluorescent material in the lungs and liver of the former employee was not identified but was presumably the fluorescent material previously used by the deceased at work. Whether it got to the liver via absorption from the lungs or via ingestion of pulmonary mucus is not known. There is no histologic evidence that it had any adverse biological effect in either the liver or the lungs. Furthermore, there is no histologic evidence of any lung or liver disease attributable to other chemical substances.

V. RECOMMENDATIONS

A. The current practice of allowing personnel to consume food and beverage in the penetrant inspection area should be discontinued.

VI. REFERENCES

A. Proctor, N.H., Hughes, J.P.: Chemical Hazards of the Workplace, J.B. Lippincott Company, Philadelphia, 1978, pp. 490-491.

B. National Institute for Occupational Safety and Health: Special Occupational Hazard Review with Control Recommendations -- Trichloroethylene. DHEW (NIOSH) Publication No. 78-130, 1978.

VII. AUTHORSHIP AND ACKNOWLEDGMENT

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Table I
Trichloroethylene Air Concentrations

General Dynamics Company - Fort Worth Division
Fort Worth, Texas

September 28, 1978

Sample No.	*Type of Sample	Location	Sampling Period	**Concentration, mg/M^3
GD-1	P	Dry-Developer-Viewer Area	12:02P - 3:13P	0.07
GD-2	P	Large Spray Room	12:01P - 3:13P	0.07
GD-3	P	Large Spray Room	2:28P - 2:31P	0.12
GD-4	P	Large Spray Room	12:13P - 12:19P	0.05

NIOSH Recommended standard..... 100

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