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. 76-58-342

Frontier Airlines
Denver, Colorado

November 1976

I. TOXICITY DETERMINATION

A health hazard evaluation was conducted by the National Institute for Occupational Safety and Health (NIOSH) on April 26 and May 21, 1976, in the non-destructive laboratory of the Frontier Airlines hangar, Denver, Colorado. At the time of this evaluation, personal breathing zone and general room samples were taken for cyclohexane. All airborne concentrations of cyclohexane were well below the most recent evaluation criteria. A NIOSH medical officer reviewed the confidential employee interview forms taken on all workers. One employee had skin cancer, and this worker was working in the vicinity of low level ultraviolet light. However, the employee's dermatologist said the skin cancer was not likely to be work-related. No health hazards were thought to exist at the time of this evaluation.

II. DISTRIBUTION AND AVAILABILITY

Copies of this hazard evaluation determination report are available upon request from NIOSH, Division of Technical Services, Information Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. Copies have been sent to:

(a) Frontier Airlines
(b) U.S. Department of Labor - Region VIII
(c) NIOSH - Region VIII

For the purpose of informing approximately four affected employees, copies of the report shall be posted in a prominent place accessible to the employees 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 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.

NIOSH received such a request from management of Frontier Airlines, Denver, Colorado, to evaluate the potential hazards associated with exposures to cyclohexane in the non-destructive laboratory of the hangar.

IV. HEALTH HAZARD EVALUATION

A. Plant Process

The non-destructive laboratory receives various parts of the airplane such as landing gears, wheel rims, flap braces, etc., and checks them for cracks caused by stress. These parts are dipped in cyclohexane and then observed under ultraviolet light for cracks and other faults. It is during this process that workers could be exposed to cyclohexane, and personal samples were taken on all workers in this area.

Local exhaust ventilation had recently been installed and was operating with a face velocity of approximately 150 linear feet per minute, which is adequate for this type of operation.

B. Evaluation Design

Personal breathing zone and general room samples were taken on April 26 and May 21, 1976, in the non-destructive laboratory for cyclohexane. Samples were taken for the entire period that the cyclohexane was being used, which ranged from two to four hours.

C. Evaluation Methods

All cyclohexane samples were taken on organic vapor charcoal sampling tubes using a low volume Sipin pump operating at approximately 50 cc per minute and analyzed by gas chromatography.

D. Criteria for Assessing Workroom Concentrations of Air Contaminants

The two sources of criteria used to assess workroom concentrations of air contaminants in this evaluation are: (1) Recommended and proposed threshold limit values (TLV's) and their supporting documentation as set forth by the American Conference of Governmental Industrial Hygienists (ACGIH) (1975) and (2) Occupational Safety and Health Standards (29 CFR 1910.1000), U.S. Department of Labor, as of January 1, 1976.

Substance	Permissible Exposure 8-Hour Time-Weighted Exposure Basis
Cyclohexane	1,050 mg/M^3

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

Occupational health standards are established at levels designed to protect individuals occupationally exposed to toxic substances on an 8-hour per day, 40-hour per week basis over a normal working lifetime.

E. Evaluation Results

1. Environmental Results

On April 26 and May 21, 1976, breathing zone and general room samples were taken throughout the non-destructive laboratory. All sample results were well below the most recent evaluation criteria. Results may be reviewed in Tables I and II.

2. Medical Results

Cyclohexane is absorbed by inhalation. A small fraction is exhaled, and a portion is excreted in the urine unchanged; but most of the cyclohexane that gets into the blood is metabolized and excreted in the urine in the form of glucuronides and sulfates. A concentration of 1,050 mg/M^3 usually produces an odor and is somewhat irritating to the eyes and mucous membranes.[1] The highest concentration measured during this survey was 613 mg/M^3. A review of the confidential employee interview forms by a NIOSH physician raised the question as to whether one of the worker's skin cancer was caused by ultraviolet light. Further investigation showed that the cancer was not of occupational origin. Therefore, it was the conclusion of the NIOSH physician and industrial hygienist that a health hazard did not exist at the time of this evaluation.

V. REFERENCES

Patty, Frank (Editor). Industrial Hygiene and Toxicology, Vol. II, Interscience Publishers, 1963, p 1211.

VI. AUTHORSHIP

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TABLE I

ATMOSPHERIC CONCENTRATIONS OF CYCLOHEXANE

Frontier Airlines
April 26, 1976

Sample Number	Location	Job Classification	Time of Sample	Air Concentrations CYCLOHEXANE (mg/M^3)	Type of Sample
2	Non-destructive laboratory	Magnaflux operator	9:05 - 11:08 A.M.	28	BZ
3	Non-destructive laboratory	----	9:00 - 11:05 A.M.	16	General Room
4	Non-destructive laboratory	----	9:20 - 11:18 A.M.	613	General Room
5	Non-destructive laboratory	Magnaflux operator	9:30 - 11:30 A.M.	8	BZ
11	Non-destructive laboratory	Inspector	7:50 - 10:30 A.M.	9	BZ
12	Non-destructive laboratory	Inspector	7:50 - 10:30 A.M.	16	BZ
14	Non-destructive laboratory	----	7:58 - 11:00 A.M.	43	General Room
			EVALUATION CRITERIA	1,050	
			NIOSH LIMIT OF DETECTION	0.01	

mg/M^3 = approximate milligrams of substance per cubic meter of air
BZ = breathing zone

TABLE II

ATMOSPHERIC CONCENTRATIONS OF CYCLOHEXANE

Frontier Airlines
May 21, 1976

Sample Number	Location	Job Classification	Time of Sample	Air Concentrations CYCLOHEXANE (mg/M^3)	Type of Sample
100	Non-destructive laboratory	Oil sample prep	8:10 - 10:45 A.M.	421	BZ
101	Non-destructive laboratory	Penetrant operator	8:15 - 10:50 A.M.	*	BZ
102	Non-destructive laboratory	Magnaflux operator	8:18 - 10:46 A.M.	14	BZ
103	Non-destructive laboratory	----	8:27 - 10:51 A.M.	33	General Room
			EVALUATION CRITERIA	1,050	
			NIOSH LIMIT OF DETECTION	0.01	

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

BZ = breathing zone

* = below the NIOSH lower limit of detection of 0.01 mg/M^3