

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

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HEALTH HAZARD EVALUATION DETERMINATION REPORT 74-138-208  
FRONTIER AIRLINES  
DENVER, COLORADO

JULY 1975

I. TOXICITY DETERMINATION

A health hazard evaluation was conducted by the National Institute for Occupational Safety and Health (NIOSH) on January 29, 1975, at the Frontier Airlines maintenance hangar. At the time of this evaluation, breathing zone and general room samples were taken for Stoddard solvent, cyclohexanol, butyl cellosolve, and naphthalene. All concentrations were below NIOSH detection limits with the exception of Stoddard solvent. Concentrations of Stoddard solvent during this evaluation posed a definite health hazard. The company was immediately notified of the exceedingly high concentrations and discontinued use of Stoddard solvent immediately. Confidential employee interviews during the initial survey did show that some of the workers were irritated by the Stoddard solvent. The industrial hygienist made an additional visit to question the employees after the Stoddard solvent had been discontinued for approximately a month. All of the employees agreed that they were experiencing no apparent health problems associated with the cleaning of the airplanes.

II. DISTRIBUTION AND AVAILABILITY

Copies of this hazard evaluation determination are available upon request from the Hazard Evaluation Services Branch, NIOSH, U.S. Post Office Building, Room 508, Fifth and Walnut Streets, Cincinnati, Ohio 45202. Copies have been sent to:

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

This report should be posted in a prominent place accessible to the workers for a period of approximately 30 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.

The National Institute for Occupational Safety and Health received such a request from management at Frontier Airlines, Denver, Colorado, to evaluate the potential hazards associated with exposures to solvents contained in a cleaning solution. These solvents were: Cyclohexanol, butyl cellosolve, and naphthalene. During the survey it was also found that Stoddard solvent was used to clean the wheel wells of the airplanes.

#### IV. HEALTH HAZARD EVALUATION

##### A. Plant Process

The maintenance hangar has one section specifically designed for cleaning airplanes. The airplanes are towed into this section of the hangar and are cleaned with solution A (containing cyclohexanol, butyl cellosolve, and naphthalene). The wheel wells of the airplanes have been cleaned with Stoddard solvent, which is no longer used. At present the wheel wells are being cleaned with solution A. The entire cleaning process requires approximately 90 minutes.

##### B. Evaluation Design

Six workers are employed in the airplane cleaning department. Environmental samples were taken on all workers and in areas adjacent to the airplane during an entire cleaning cycle on January 17, 1975. Confidential employee interviews were also completed on each worker. These interviews were reviewed by our Medical Services Branch, where it was decided that additional interviews should be completed on the workers after discontinuing the use of Stoddard solvent. These interviews were completed on May 8 and did not reveal worker complaints.

##### C. Evaluation Methods

All solvent vapor samples were taken on organic vapor sampling tubes and analyzed by gas chromatography at the Western Area Occupational Health Laboratory in Salt Lake City, Utah.

##### 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) (1974); and (2) occupational health standards as promulgated by the U.S. Department of Labor (Federal Register, June 27, 1974, Title 29, Chapter XVII, Subpart G).

In the following tabulation of criteria, the most appropriate value is presented with its reference footnoted.

<u>Substance</u>	<u>Permissible Exposures 8-Hour Time-Weighted Exposure Basis</u>
<sup>1</sup> Stoddard solvent . . . . .	575 mg/M <sup>3</sup> <sup>a</sup>
<sup>2</sup> Naphthalene . . . . .	10 ppm <sup>b</sup>
<sup>3</sup> Cyclohexanol . . . . .	50 ppm
<sup>4</sup> Butyl cellosolve . . . . .	50 ppm

a mg/M<sup>3</sup> = approximate milligrams of substance per cubic meter of air

b ppm = parts of vapor or gas per million parts of contaminated air

<sup>1</sup>Reference: 1974 ACGIH TLV (notice of intended changes).

<sup>2</sup>Reference: 1974 ACGIH TLV and the current OSHA standard.

<sup>3</sup>Reference: 1974 ACGIH TLV and the current OSHA standard.

<sup>4</sup>Reference: 1974 ACGIH TLV and the current OSHA standard.

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

#### E. Evaluation Results, Discussion, and Conclusions

The initial survey, first environmental samples, and confidential employee interviews were taken on January 17, 1975. Results of these samples and interviews clearly illustrated that there were excessive exposures to Stoddard solvent. This information was given to management at Frontier Airlines, and they immediately discontinued use of this solvent. Discontinued use was based on potential health and fire hazards.

Follow-up interviews of selected employees were taken on May 8, 1975. These failed to show complaints that existed during the period Stoddard solvent was used. The NIOSH Industrial Hygienist maintains contact with Frontier Airlines safety personnel in order to be advised of latest usage of cleaning compounds, especially in wheel wells.

Detailed results of atmospheric samples are presented in Tables I and II.

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TABLE I

## ATMOSPHERIC CONCENTRATIONS OF BUTYL CELLOSOLVE, CYCLOHEXANOL, AND NAPHTHALENE

January 17, 1975

Sample Number	Location	Time of Sample (min.)	Atmospheric Concentrations			Type Sample
			Butyl Cellosolve (ppm)	Cyclohexanol (ppm)	Naphthalene (ppm)	
1	Airplane Hangar	60	< 4.0	< 2.0	< 3.0	OBZ (airplane washer)
2	Airplane Hangar	46	< 4.0	< 2.0	< 3.0	OBZ (airplane washer)
3	Airplane Hangar	49	< 4.0	< 2.0	< 3.0	OBZ (airplane washer)
4	Airplane Hangar	43	< 4.0	< 2.0	< 3.0	OBZ (airplane washer)
5	Airplane Hangar	20	< 4.0	< 2.0	< 3.0	GA (east side of hangar)
6	Airplane Hangar	18	< 4.0	< 2.0	< 3.0	GA (east side of hangar)
7	Airplane Hangar	17	< 4.0	< 2.0	< 3.0	GA (north side of hangar)
8	Airplane Hangar	20	< 4.0	< 2.0	< 3.0	GA (north side of hangar)
9	Airplane Hangar	20	< 4.0	< 2.0	< 3.0	GA (west side of hangar)
10	Airplane Hangar	18	< 4.0	< 2.0	< 3.0	GA (west side of hangar)
1974 TLV			50.0	50.0	10.0	

The limits of detection are: Butyl cellosolve, 4.0 ppm; cyclohexanol, 2.0 ppm; and naphthalene, 3.0 ppm.

OBZ = Operator's Breathing Zone

GA = General Area

TABLE II  
 ATMOSPHERIC CONCENTRATIONS OF STODDARD SOLVENT  
 January 17, 1975

Sample Number	Location	Time of Sample (min.)	Atmospheric Conc. Stoddard Solvent (mg/M <sup>3</sup> )	Type Sample
1	(BLANK)	---	---	
2	Airplane Hangar	64	363	OBZ (airplane washer)
3	Airplane Hangar	42	996	OBZ (airplane washer)
4	Airplane Hangar	39	1960	OBZ (airplane washer)
5	Airplane Hangar	40	2080	OBZ (airplane washer)
6	Airplane Hangar	30	2720	GA (adjacent to wheel well)
7	Airplane Hangar	37	8860	OBZ (wheel well cleaner)
8	Airplane Hangar	36	3760	OBZ (wheel well cleaner)
1974 TLV			575	

OBZ = Operator's Breathing Zone

GA = General Area