

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

HEALTH HAZARD EVALUATION DETERMINATION
REPORT NO. 74-1-160
WHITE PASS AND YUKON RAILROAD
SKAGWAY, ALASKA

NOVEMBER 1974

I. TOXICITY DETERMINATION

It has been determined that diesel exhaust gases (NO_2 , SO_2 , CO, aldehydes and total particulates) are not toxic as used or found on May 21-23, 1974, in the leading and trailing train engine cabs while in transit from Skagway, Alaska to Bennett, British Columbia and return. This determination is based on low to non-detectable concentrations of those substances and the absence of medical symptomatology among the employees.

Noise measurements made in the engine room of GE unit # 94 when the fireman was making periodic checks of the equipment was 117 to 118 dBA. This level very likely will cause a noise induced hearing loss. A hearing conservation program should be implemented for the exposed employees which would consist, as a minimum, of wearing of hearing protection while in the engine room. Periodic audiograms should be given to the members of the crew who are exposed to these high noise levels.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of the 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:

- a. White Pass & Yukon Railroad
- b. United Transportation, Union Local 1787
- c. U.S. Department of Labor, Region X
- d. Alaska Department of Labor

For the purposes of informing the 5 to 15 employees, the employer will promptly "post" the Determination Report in a prominent place(s) near where affected employees work 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(s) 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 regarding the train crews' exposure to diesel exhaust gases at the White Pass and Yukon Railroad, Skagway, Alaska.

IV. HEALTH HAZARD EVALUATION

A. Condition of Area

The White Pass and Yukon Railroad operates between Skagway, Alaska and Whitehorse, Yukon Territory. A United States crew operates the trains from Skagway, Alaska to Bennett, British Columbia and back to Skagway,

and a Canadian operates the train on the other portion of the system. During the first twenty one miles out of Skagway, the train climbs from sea level to 2,900 ft. at an average grade of 3.9%. Depending on the train size, anywhere from two to five diesel units are hooked in tandem to pull the train to Bennett. The five-man crew consists of an engineer and fireman in the leading cab; a front brakeman who rides in the trailing cab; and conductor and rear brakeman who ride in the caboose. When the train is in operation, diesel exhaust discharged from the units sometimes enters the cabs where the crew is working.

B. Evaluation Methods and Design

Environmental air samples were collected on May 21-23, 1974, for carbon monoxide, nitrogen dioxide, sulfur dioxide, aldehydes and total particulates. The measurements were made in the general air in both the front and trailing cabs of the diesel units while operating from Skagway to Bennett and return. Noise measurements were also made during these runs.

The units in operation the days of the survey were: May 21, GE 800 HP # 94; May 22, Alco 1200 HP # 101; and May 23, GE 800 HP # 94 (the numbers are for the leading units only, however, if a GE unit was leading, the trailing units were also GE and the same with the Alco units).

Carbon monoxide was sampled continuously in plastic bags with subsequent analysis every 30 minutes using Dräger carbon monoxide detector tubes. Nitrogen dioxide and sulfur dioxide concentrations were measured every 15 to 30 minutes using Dräger detector tubes.

Atmospheric samples for total particulates were collected on 37 mm PVC filters at an air flow of 2.0 liters per minute (lpm). The filters were weighed before and after air sampling. Total aldehydes were collected in a 1% sodium bisulfite and water solution in midjet impingers at an air flow rate of 1 lpm.

Employees were questioned regarding health problems they experienced during the periods the sampling was conducted and their responses were noted.

C. Evaluation Criteria

Diesel exhaust, per se, does not have a standard; however, the individual constituents that diesel exhaust is comprised of do have standards that are applicable. The combined toxic effects of these substances are not known. Because of this fact, individual substances could be at safe levels but toxic effects noted in the worker because of their exposure to the combination of these substances.

The occupational health standards promulgated by the U.S. Department of Labor (Federal Register, June 27, 1974, Title 29, Chapter XVII, Subpart G., Tables G-1, G-2, and G-3) applicable to the individual substances of this evaluation and the recommended levels of the American Conference of Governmental Industrial Hygienists (ACGIH- 1973) and of NIOSH are as follows:

<u>Substance</u>	<u>8-Hour Time Weighted Average</u>		
	U.S. Dept. of Labor Standards	ACGIH Recommended Levels	NIOSH Recommended Levels
aldehydes as formaldehyde	3 ppm *	2 ppm	-----
carbon monoxide	50 ppm	50 ppm	35 ppm
inert dust (total)	15 mg/m ³ **	10 mg/m ³	-----
nitrogen dioxide	5 ppm	5 ppm	-----
sulfur dioxide	5 ppm	5 ppm	2 ppm
noise	90 dBA	85 dBA	85 dBA

The noise standard is variable as it is a function of both exposure time and exposure levels. Noise levels above 115 dBA are not permitted without hearing protection.

D. Evaluation Results and Discussion

All of the carbon monoxide and sulfur dioxide air concentration measurements in both cabs were below detectable limits (carbon monoxide - less than 5 ppm, sulfur dioxide - less than 0.5 ppm). The nitrogen dioxide concentrations in the front cabs were all non-detectable (less than 0.1 ppm) while in the trailing cabs they were 0.1 ppm or less. The total particulate levels were all less than 0.5 mg/m³. In the leading unit they averaged 0.18 mg/m³ while in the trailing unit they

* ppm - parts of vapor or gas per million parts of air by volume at 25° C and 760 mm Hg pressure.

** Milligrams of substance per cubic meter of air.

averaged 0.44 mg/m³. The aldehydes were 0.01 ppm or less. These sample results are listed in Table I. These levels were all below the U.S. Department of Labor Standards as well as the ACGIH and NIOSH recommended levels.

All of the above sample concentrations are very low and adverse health effects would not be expected. It is possible, however, under certain weather conditions and load factors for greater amounts of the diesel exhaust to enter the cabs, especially the trailing cab. The superintendent of the rail division for the firm suggested that a possible solution in such a case would be for the front brakeman to ride in the leading cab.

The general comments from the crew was that on occasion their eyes will burn. During our sampling periods, no one reported burning of the eyes or any other adverse health effects.

Noise measurements were taken in the units under various load conditions. These results are listed in Table II. The fireman, on several occasions, went into the engine room on the GE # 94 units. During these periods, the noise levels were 117 or 118 dBA. Whenever anyone is exposed to levels above 115 dBA, hearing protection is required. Hearing protection should be provided and, in addition, periodic audiograms should be given to the train crew. Furthermore, it has also been shown that a hearing damage risk exists when there is a continuous exposure to noise levels above 85 dBA for an 8-hour day. When this occurs, the sound should be reduced to less than 85 dBA or hearing protection provided to the employees.

V. AUTHORSHIP AND ACKNOWLEDGMENT

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TABLE I
ATMOSPHERIC CONCENTRATIONS OF CONTAMINANTS
IN DIESEL ENGINE CABS

Sampling Periods	Units	Sample Location	Nitrogen Dioxide ppm	Sulfur Dioxide ppm	Carbon Monoxide ppm	Total Aldehydes as Formaldehyde ppm	Total Particulates mg/m ³
Skagway to Bennett May 21 10:20 a.m. to 12:30 p.m.	# 94 GE 800 HP	Leading Cab	ND ***	ND ***	ND ***	0.01	0.17
		Trailing Cab	ND	ND	ND	0.01	0.44
Bennett to Skagway May 21 2:05 p.m. to 4:35 p.m.	# 94 GE 800 HP	Leading Cab	ND	ND	ND	0.01	0.17
		Trailing Cab	0.1	ND	ND	0.01	0.44
Skagway To Bennett May 22 10:15 a.m. to 1:00 p.m.	# 101 Alco 1200 HP	Leading Cab	ND	ND	ND	<0.01	0.18
		Trailing Cab	0.1	ND	ND	0.01	0.44
Bennett to Skagway May 23 3:00 p.m. to 5:30 p.m.	# 94 GE 800 HP	Leading Cab	ND	ND	ND	<0.01	0.18
		Trailing Cab	0.1	ND	ND	0.01	0.44

* Parts of gas or vapor per million parts of air

** Milligrams per cubic meter of air

*** Not detectable by the methods used

Nitrogen dioxide - less than 0.1 ppm

Sulfur dioxide - less than 0.5 ppm

Carbon monoxide - less than 5 ppm

TABLE II

NOISE MEASUREMENTS

Unit	Location	Condition	dBA
GE	Engine Room Leading Unit	Up grade	117-118
		Cab Leading Unit	92-94
	Cab Leading Unit	Level grade	83-89
		Down grade	81-84
GE	Engine Room Trailing Unit	Level grade	100-112
		Cab Trailing Unit	84-86
	Cab Trailing Unit	Down grade	87
Alco	Cab Trailing Unit	Up grade Back door open	89-90
		Up grade Back door closed	85
		Level grade	83-85