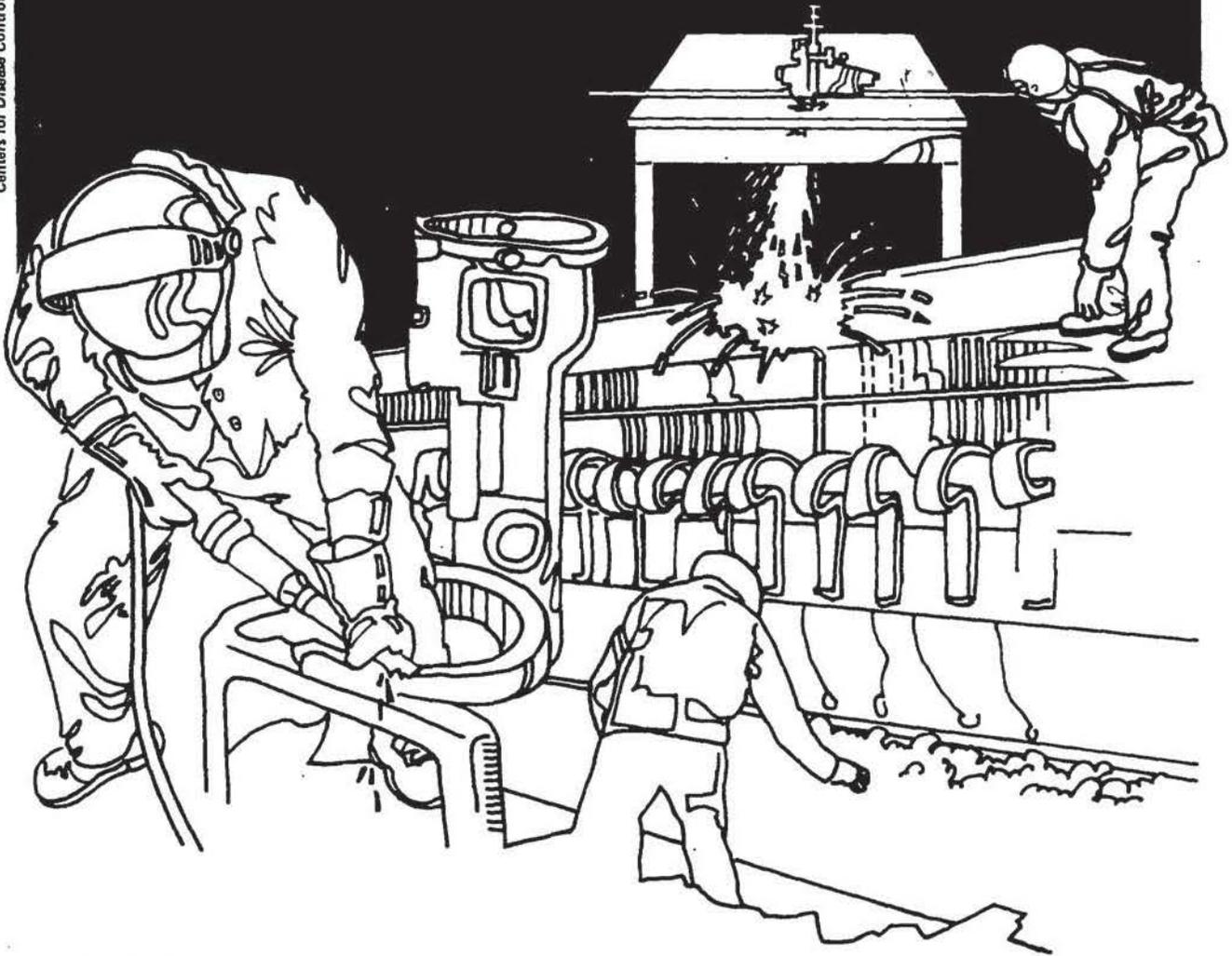


NIOSH



Health Hazard Evaluation Report

HETA 81-456-1075
U.S. BULK MAIL CENTER
ST. LOUIS, MISSOURI

PREFACE

The Hazard Evaluations and Technical Assistance Branch of NIOSH conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from 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 Hazard Evaluations and Technical Assistance Branch also provides, upon request, medical, nursing, and industrial hygiene technical and consultative assistance (TA) to Federal, state, and local agencies; labor; industry and other groups or individuals to control occupational health hazards and to prevent related trauma and disease.

Mention of company names or products does not constitute endorsement by the National Institute for Occupational Safety and Health.

HETA 81-456-1075
March 1982
U.S. Bulk Mail Center
St. Louis, Missouri

NIOSH INVESTIGATOR:
Steven A. Lee, IH

I. SUMMARY

In May 1981, the National Institute for Occupational Safety and Health (NIOSH) received a request to evaluate noise and diesel exhaust exposures at the Trailer Yard, from the U.S. Bulk Mail Center, St. Louis, Missouri. Thirteen tractor-trailer operators were employed at the time of the study.

On November 23-24, 1981, a NIOSH investigator conducted industrial hygiene sampling and employee interviews at the Bulk Mail Center. Personal breathing zone samples were collected on drivers and analyzed for particulate and gaseous sulfates and sulfites, nitric oxide, nitrogen dioxide, and carbon monoxide. None of these contaminants were detected in the breathing zones of any of the drivers during the NIOSH survey.

Noise levels were measured and 8-hour average exposures ranged from 80.4 to 84.8 dB (A-weighted scale, slow response) among the four drivers that were sampled. The NIOSH recommended 8-hour average noise limit is 85 dBA. The OSHA permissible exposure limit is 90 dBA.

None of the drivers reported any health problems at the time of the NIOSH survey, but four of the ten that were interviewed said they thought that diesel exhausts caused problems, primarily eye irritation, during hot, windless, summer weather.

NIOSH has determined that hazards from overexposure to diesel exhausts or noise did not exist during the time of the NIOSH survey. Recommendations for further reducing these exposures are included in Section VII.

KEYWORDS: SIC 4311 (U.S. Postal Service), diesel exhausts, carbon monoxide, oxides of nitrogen, noise.

II. INTRODUCTION

In August 1981, NIOSH received a request for a health hazard evaluation at the U.S. Bulk Mail Center, St. Louis, Missouri. The request was submitted by the safety manager of the facility who specifically asked NIOSH to evaluate complaints of eye and respiratory irritation among tractor-trailer operators and to conduct a noise survey.

III. BACKGROUND

The Bulk Mail Center was built in 1975. Thirteen workers are employed in the outdoor trailer yard for moving trailers of mail into and away from docks for loading and unloading of mail. Each driver completes a minimum of 50 docking moves per day, climbing in and out of the tractor each time to hook and unhook trailers.

The diesel-operated "Ottawa Hustler" tractors are six years old and receive regular service maintenance every 12 weeks. The exhaust pipe is terminated low under the rear of the tractor near the rear tires.

IV. METHODS AND MATERIALS

Environmental

NIOSH collected personal breathing-zone, general area, and tractor exhaust air samples on November 23-24, 1981, to evaluate worker's exposure to diesel exhaust contaminants. Four breathing zone samples for sulfates and sulfites, both gaseous and particulate were collected on filters using calibrated personal sampling pumps operating at 2.0 liters per minute for seven hours and analyzed by ion chromatography in accordance with NIOSH Method P&CAM No. 268. Four breathing zone samples for nitric oxide and nitrogen dioxide were collected on sorbent tubes using personal sampling pumps operating at 50 cubic centimeters per minute (cc/min) for seven hours and analyzed by colorimetry according to NIOSH Method No. P&CAM 231. Four personal breathing zone exposures to carbon monoxide were measured by colorimetric long-term detector tubes using calibrated personal sampling pumps operating at 20 cc/min for seven hours.

General area and tractor exhaust air concentrations of carbon monoxide, sulfur dioxide, and oxides of nitrogen were measured using instantaneous, direct-reading, colorimetric detector tubes.

A noise survey was conducted using a General Radio 1982 Precision Sound Level Meter. Four drivers were also selected for eight hour average noise measurements using Metrosonics 301 dosimeters.

Medical

Ten of the thirteen drivers were interviewed on November 23-24, 1981. Non-directed questions about health problems were used to assess any acute symptoms from exposure to diesel exhausts.

V. EVALUATION CRITERIA

Diesel Exhausts

Combustion products of hydrocarbon fuels generally include carbonaceous particulates comprised of various organic and sulfur compounds; and gaseous oxides of carbon, sulfur, and nitrogen. Nitrogen oxides and sulfur dioxide are irritating to the eyes and to the upper respiratory tract. Chronic effects may include rhinitis, dryness of the throat, coughing and pulmonary dysfunction resembling emphysema. Carbon monoxide interferes with the oxygen carrying capacity of the blood. Typical symptoms include headaches, dizziness, drowsiness and nausea. NIOSH currently recommends that exposure to carbon monoxide be limited to 35 parts per million (ppm) as an eight-hour time-weighted average. A ceiling limit of 200 ppm is also recommended. The evaluation criteria of the other substances are listed in Table I.

Noise

Hearing occurs when sound waves cause vibrations of the ear drum, the middle ear bones, and the fluids of the inner ear. The resulting movement of delicate hair cells in the inner ear produces electrical impulses that are transmitted to the brain via the auditory nerve.

During long-term hazardous noise exposure, some of the hair cells of the inner ear may gradually be destroyed. Hair cells do not regenerate. Thus, noise-induced hearing loss, although slow, painless, and insidious at its onset, becomes permanent. Depending on the extent of hearing loss, the resulting communication disability can have serious repercussions on the person's occupational, social, and emotional well-being.

The most common unit of noise measurement is the "decibel" (dB), which is a logarithm of a ratio of two values of power. The logarithmic scale gives smaller and easier to use numerical values than would be possible with a linear scale because the range of acoustic powers used in typical noise measurements is about one-billion-billion to one ($10^{18}:1$).

Due to wide variations in individual susceptibility to noise, compliance with the present OSHA permissible exposure limit of 90 dB(A) has been estimated [by the American Conference of Governmental Industrial Hygienists (ACGIH), Committee on Physical Agents] to protect about 90% of the working population exposed to this level for a normal working lifetime from any significant noise-induced hearing loss. "Significant" hearing loss is that which would impair one's ability to understand normal everyday speech. NIOSH recommends an 8-hour average noise limit of 85 dB(A) so that a larger percentage of workers can be better protected.

Figure I can be used to determine permissible durations of exposure to noise levels above 85 dBA. OSHA requires that no worker shall be exposed in excess of the limit described as line B in Figure I. NIOSH recommends that new installations should be designed with noise control so that the noise exposure does not exceed the limits described in line A in Figure I. For noise exposures consisting of two or more periods of exposure at different levels, the daily noise dose should not exceed unity. Line A or line B, as applicable, should be used in computing the daily noise dose.

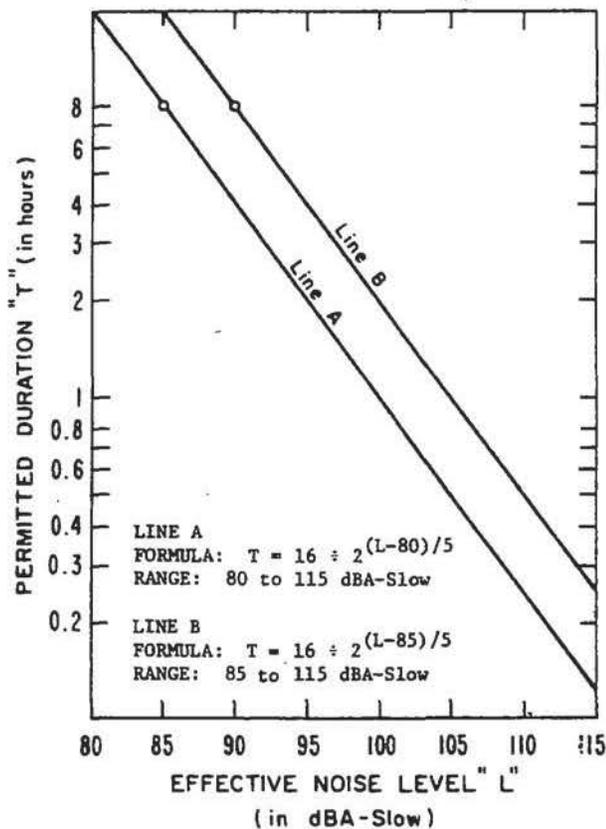


FIGURE I
Permitted Duration vs. Noise Level

VI. RESULTS

Environmental

All personal breathing zone concentrations of particulate and gaseous sulfates and sulfites, nitric oxide, nitrogen dioxide, and carbon monoxide were below the analytical limits of detection (Table II). The lower limits of detection were approximately: 0.12 milligrams per cubic meter (mg/M^3) for sulfates, $0.005 \text{ mg}/\text{M}^3$ for sulfites, $0.05 \text{ mg}/\text{M}^3$ for nitric oxide, $0.005 \text{ mg}/\text{M}^3$ for nitrogen dioxide, and 5 parts per million (ppm) for carbon monoxide.

Likewise, no carbon monoxide, sulfur dioxide, or oxides of nitrogen could be detected by direct-reading colorimetric measurements taken in and around the tractor cab.

Direct exhaust colorimetric measurements for carbon monoxide ranged from 200 to 300 ppm, but no sulfur dioxide or oxides of nitrogen were detected from engines at normal operating temperatures. One cold and visibly smoky engine was found to be emitting 10 ppm of nitrogen oxides and 700 ppm carbon monoxide.

Drivers were exposed to 8-hour average noise levels ranging from 80.4 to 84.8 dBA with a mean of 83.1 dBA (Table III). Noise levels inside the tractor cab were about 83 dBA when the engine was idling and 89 dBA when operating at 2000 rpm (Table IV).

Medical

Four of the ten drivers that were interviewed indicated that diesel exhausts had caused some health problems at work. All four complained of burning and itching eyes. Additional symptoms included headaches, nausea and sinus problems (Table V). The other six workers mentioned that they thought the smell of diesel exhausts was annoying, but they reported no adverse health effects.

None of the drivers reported any health problems present during the time of the NIOSH survey. Symptoms reportedly occur most often during hot summer weather, particularly when the humidity is high and very little wind is blowing.

Several of the drivers offered the suggestion that fewer health problems might occur if the tractor exhaust pipes were terminated high above the cab instead of their present configuration low behind the cab.

VII. CONCLUSIONS/RECOMMENDATIONS

Diesel Exhausts

Based on the results of the environmental and interview evaluations, there were no health problems associated with diesel exhausts at the time of the NIOSH survey. The possibility of seasonal, weather-related problems deserves further attention but it seems unlikely that gaseous contaminants from well-maintained tractors operating outdoors could reach hazardous concentrations even under the most stagnant weather conditions. Diesel combustion particulates, however, can become excessive, particularly in enclosed areas, and these could be a likely cause of eye and respiratory irritation in the trailer yard on windless days. Various exhaust pipe locations should be investigated under realistic working conditions to determine which configuration is best for directing exhaust particles away from the driver.

Since cold diesel engines were found to emit considerably greater amounts of contaminants than warm engines, NIOSH recommends that tractors be started and allowed to thoroughly warm-up in an area that is well away from and downwind from the docking area. Regular maintenance of tractors is also important for controlling emissions. A properly tuned diesel engine relies upon lean fuel settings to prevent excessive emissions due to the inefficient burning of fuel.

Noise

Drivers were exposed to noise levels that closely approached the NIOSH recommended limit, thus, a noise monitoring program is recommended. In the event that noise levels ever exceed 85 dBA, it would be necessary to adopt a hearing conservation program as discussed in the NIOSH Recommendations for a Noise Standard [chapter 1 of Criteria for a Recommended Standard - Occupational Exposure to Noise, (HSM) document no. 73-11001]. Procedures for taking noise measurements, audiometric testing, work practices, and personal hearing protection are thoroughly discussed in the NIOSH Recommended Standard.

It is interesting to note that one driver was consistently exposed to significantly lower noise levels (3 to 4 dB) than the other drivers that were monitored. This difference was attributed to a smoother and less aggressive driving technique whereby work was conducted more efficiently at consistently slower engine operating speeds. Such work practices should be considered as an effective means of reducing noise exposures.

VIII. AUTHORSHIP AND ACKNOWLEDGEMENTS

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IX. DISTRIBUTION AND AVAILABILITY OF REPORT

Copies of this report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days, the report will be available through the National Technical Information Service (NTIS), 5285 Port Royal, Springfield, Virginia 22161. Information regarding its availability through NTIS can be obtained from NIOSH Publications Office at the Cincinnati address. Copies of this report have been sent to:

1. St. Louis Bulk Mail Center
2. American Postal Workers Union
3. U.S. Department of Labor, Region VII
4. NIOSH, Region VII

For the purpose of informing affected employees, copies of this report shall be posted by the employer in a prominent place accessible to the employees for a period of 30 calendar days.

TABLE I

EVALUATION CRITERIA

ST. LOUIS BULK MAIL CENTER
ST. LOUIS, MISSOURI

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| <u>Substance</u> | <u>NIOSH Recommended Exposure Limits</u> | <u>Health Effects</u> | <u>OSHA Standard</u> |
|------------------|---------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| Sulfur Dioxide | 5 mg/M ³ , 10-hr TWA | eye and respiratory irritation, rhinitis, dry throat and coughing | 12 mg/M ³ , 8-hr TWA |
| Nitric Oxide | 30 mg/M ³ , 10-hr TWA | eye and respiratory irritation | 30 mg/M ³ , 8-hr TWA |
| Nitrogen Dioxide | 2 mg/M ³ , 15-min ceiling | respiratory irritation; methemoglobinemia at high concentrations producing cyanosis, chills, fever, headache, and nausea | 10 mg/M ³ , 8-hr TWA |
| Carbon Monoxide | 35 ppm, 10-hr TWA 200 ppm, peak exposure limit | carboxyhemoglobinemia resulting in tissue hypoxia. Symptoms include headache, dizziness, drowsiness, nausea and vomiting | 50 ppm, 8-hr TWA |

TABLE II
RESULTS OF PERSONAL BREATHING ZONE SAMPLES

ST. LOUIS BULK MAIL CENTER
ST. LOUIS, MISSOURI

November 23-24, 1981

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| <u>Sampling Time</u> | <u>Carbon Monoxide</u> | <u>Nitric Oxide</u> | <u>Nitrogen Dioxide</u> | <u>Particulate Sulfate</u> | <u>Gaseous Sulfate</u> | <u>Particulate Sulfite</u> | <u>Gaseous Sulfite</u> |
|----------------------|------------------------|---------------------|-------------------------|----------------------------|------------------------|----------------------------|------------------------|
| 16:05-20:40 | N.D. | N.D. | N.D. | - | - | - | - |
| 17:20-22:05 | N.D. | - | - | N.D. | N.D. | N.D. | N.D. |
| 6:05-13:25 | N.D. | N.D. | N.D. | - | - | - | - |
| 6:30-13:45 | N.D. | - | - | N.D. | N.D. | N.D. | N.D. |
| 16:20-22:05 | - | - | - | N.D. | N.D. | N.D. | N.D. |
| 16:25-22:05 | - | N.D. | N.D. | - | - | - | - |
| 7:30-14:30 | - | N.D. | N.D. | - | - | - | - |
| 6:08-13:45 | - | - | - | N.D. | N.D. | N.D. | N.D. |

N.D. = none detected
(-) = not sampled

TABLE III

PERSONAL 8-HOUR AVERAGE NOISE EXPOSURES* IN dB
(A-WEIGHTED SCALE, SLOW RESPONSE)

ST. LOUIS BULK MAIL CENTER, TRAILER YARD
ST. LOUIS, MISSOURI

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| <u>Tractor No.</u> | <u>Sampling Time</u> | <u>dB(A)</u> |
|------------------------------|----------------------|--------------|
| 5690120 | 6:05-13:25 | 83.6 |
| 5690072 | 6:07-13:45 | 80.4 |
| 56900118 | 6:30-13:30 | 84.8 |
| 5690070 | 7:30-14:30 | 83.6 |
| * NIOSH Recommended Standard | | 85.0 |

TABLE IV

AVERAGE AREA NOISE LEVELS

| <u>Location</u> | <u>Idle Engine</u> | <u>Normal Operating Speed (about 2000 rpm)</u> |
|------------------------------------------------|--------------------|----------------------------------------------------|
| inside cab | 83 dBA | 89 dBA |
| behind cab (hooking and unhooking trailers) | 85 dBA | 95 dBA |
| 1 foot distance from top of engine | 90 dBA | 100 dBA |

TABLE V
PREVALENCE OF REPORTED SYMPTOMS AMONG 10 EMPLOYEES

ST. LOUIS BULK MAIL CENTER
ST. LOUIS, MISSOURI

November 23, 1981

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| <u>Symptom</u> | <u>Number</u> | <u>Percent</u> |
|-------------------------------------|---------------|----------------|
| eye irritation | 4 | 40 |
| sinus problems/breathing difficulty | 3 | 30 |
| headache | 2 | 20 |
| nausea | 1 | 10 |