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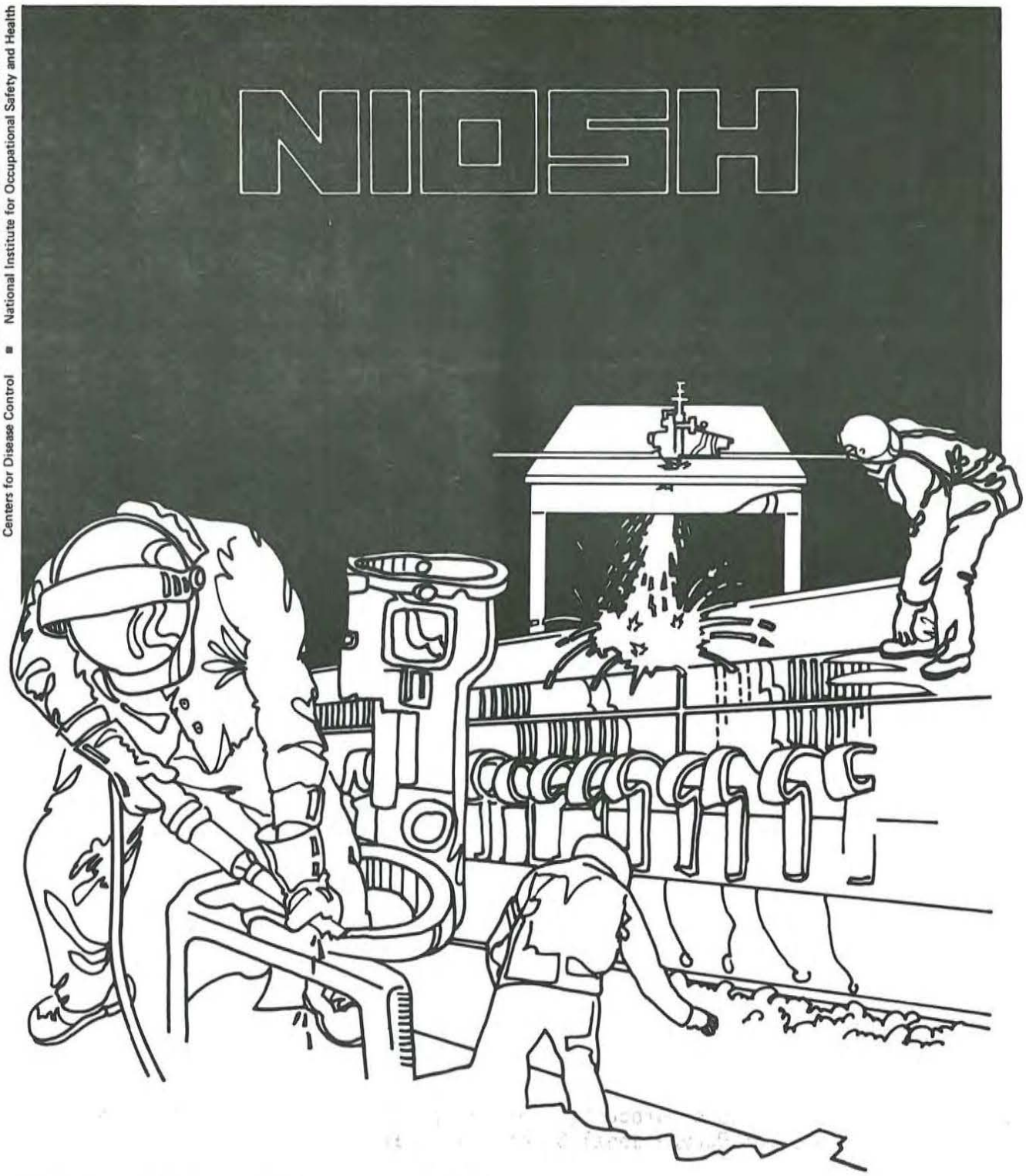

# Health Hazard Evaluation Report

HETA 81-216-894
CENTRAL BANK OF ACADEMY BOULEVARD
COLORADO SPRINGS, COLORADO

## 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.

HETA 81-216-894
JUNE 1981
CENTRAL BANK OF ACADEMY BOULEVARD
COLORADO SPRINGS, COLORADO

NIOSH INVESTIGATOR:
Paul Pryor, I.H.

## I. SUMMARY

In March 1981 the National Institute for Occupational Safety and Health (NIOSH) received a request from a representative of Central Bank of Academy Boulevard, Colorado Springs, Colorado, to evaluate exposure to carbon monoxide in teller drive-up windows at the bank. To evaluate the exposures, an industrial hygiene and medical evaluation was performed. Breathing zone and general room air samples were taken on the workers for determination of exposures to carbon monoxide (CO). The medical evaluation consisted of a medical questionnaire and pre shift/post shift bloods for carboxyhemoglobin (COHb).

Occasional high levels, 35-50 parts per million (ppm), of carbon monoxide were found to exist only in the west teller's drive-up booth. The higher CO levels were consistently found when the tellers made transactions during peak traffic periods; CO entered the teller's work area through the transaction drawer. Pre and post shift COHb levels did not increase substantially during the survey period. The medical questionnaire indicated headaches, dizziness, fatigue, eye irritation, and general irritation consistent with intermittent exposure to auto exhaust fumes.

On the basis of the environmental data NIOSH concluded that there was no hazard to CO during the survey periods. However, a potential health hazard does exist from overexposure to carbon monoxide to those tellers who work in the drive-up booths. This is especially true at the west drive-up booth location. This condition exists due to the lack of proper make-up and exhaust ventilation, as well as air inversion episodes, peak drive-up periods, and heavy transaction days. Any combination of these factors would greatly intensify the possibility of overexposures to carbon monoxide in the west side booth. Recommendations on ventilation, work practices, and medical surveillance procedures necessary to avoid a health hazard are included in the Recommendations section.

KEYWORDS: SIC 6020 (Banking), bank tellers, carbon monoxide, carboxyhemoglobin.

## II. INTRODUCTION

NIOSH received a request from Central Bank of Academy Boulevard in Colorado Springs, Colorado, to determine if there was a health hazard from exposures to carbon monoxide in the drive-up booths at the bank. An environmental evaluation was conducted on April 3, 1981. At the request of the bank, a medical evaluation was also performed by a private medical clinic on March 2 and 6, 1981.

## III. BACKGROUND

Central Bank of Academy Boulevard is open Monday through Friday. There are two drive-up teller booths on each side of the bank building. There are 36 employees who work at this bank and four of these work the drive-up teller booths. The two drive-up booths are referred to as the east and west side booths and each can work two tellers per booth. The east side booth is open from 8:00 a.m. to 6:00 p.m. Monday through Thursday and 7:30 a.m. to 6:30 p.m. on Friday. The west side booth is open from 7:30 a.m. to 5:30 p.m. Monday through Thursday and 7:30 a.m. to 6:30 p.m. on Fridays. The east side booth has three service points--two islands, and one window transaction point. The island transactions are made by pneumatic tubes and the transactions made at the window are made by a box drawer which extends out to the driver's car window. The transactions at the west side booth are made in a similar manner as the east side except that this booth services four points--one window and three islands. The size of the booth rooms are approximately 7 by 20 feet and both have general room ventilation systems. The east side booth is relatively open to the main interior of the bank and, thus, had good air circulation, between 25-30 feet per minute (fpm), within this room. The west side booth, however, is closed on all sides except for an entrance door off a hallway and the air circulation in this room is poor, i.e., between 5-10 fpm, throughout this area.

The source of carbon monoxide exposure into these booths is from the exhaust pipes of the vehicles idling at the window and island locations. The window box transaction points are the main source of exposure when the drawer is brought back to the teller. The primary factors which can contribute to increased levels of carbon monoxide in the booths are: lack of adequate air circulation and exhaust in the booth; the window box drawer; peak drive-up and idling periods from automobiles; heavy transaction periods (cashing pay checks on the first and fifteenth of the month); pre-holidays; and air inversion periods, especially associated with any of the above.

## IV. METHODS AND MATERIALS

### A. Environmental

Carbon monoxide was measured throughout the survey using a direct reading carbon monoxide instrument equipped with a recorder and NIOSH certified detector tubes which are designed to measure 0-50 ppm of carbon monoxide with plus or minus 25% accuracy. Air circulation measurements were determined by using an air velocity meter. NIOSH environmental testing was performed on April 3, 1981.

B. Medical

Prior to NIOSH's investigation the Denver Clinic, Denver, Colorado, was requested by the bank to review the potential exposure to carbon monoxide. Based on their initial survey it was decided to do biological testing for carboxyhemoglobin levels in potentially affected workers. On March 16, 1981, biologic (blood) samples for carboxyhemoglobin content were drawn from eight (8) employee volunteers at the beginning of their work shift and again at the end of the work shift. Smoking histories from each volunteer were obtained to determine the approximate number of cigarettes smoked between samples.

V. EVALUATION CRITERIA

A. Environmental

Two sources of criteria were used to assess the workroom concentrations: (1) NIOSH criteria for recommended standards, and (2) Occupational Safety and Health Administration (OSHA) standards (29 CFR 1910), January 1979. These criteria 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.

| Substance | Permissible Exposure Limits 8-Hour Time-Weighted Average |
|---|---|
| Carbon Monoxide..... | 35.0 ppm (NIOSH)<br>50.0 ppm (OSHA) |

ppm = parts of vapor or gas per million parts of contaminated air by volume.

B. Toxicological

Carbon Monoxide -- The signs and symptoms of carbon monoxide poisoning may include headache, nausea, vomiting, dizziness, drowsiness, and collapse. In the bloodstream, carbon monoxide rapidly binds to the oxygen-carrying molecule hemoglobin, forming "carboxyhemoglobin" (COHb). When carbon monoxide binds with hemoglobin to form COHb, it reduces the oxygen-carrying capacity of the blood. The more COHb is formed, the more significant the symptoms are. Heart disease may be made worse in workers who have coronary heart disease and are exposed to carbon monoxide concentrations high enough to produce a COHb level greater than 5%. There is also important evidence that exposure to lower carbon monoxide concentrations, producing COHb levels below 5%, affects the nervous system and causes changes in visual alertness, response time, and fine judgment.

Non-smoking, non-exposed persons have an average COHb level of 1%. Cigarette smokers usually have an average COHb level of 2 to 10%. Non-smokers exposed to 50 ppm (50 parts per million of carbon monoxide, the OSHA standard) for six to eight hours have COHb levels of 8 to 10%. Symptoms such as headache and nausea may be

seen above 15%, but usually not at lower levels. At 25%, there may be electrocardiographic evidence of heart effects, and 40% usually results in collapse.

The current OSHA standard for carbon monoxide is 50 ppm. Exposure at this level for 90 minutes may cause chest pain for persons with angina (chest pain related to heart disease); exposure for 2 hours may make leg cramps worse for persons who have leg cramping associated with vascular disease. The effects of carbon monoxide exposure, including the more common symptoms of headache, dizziness, and nausea, are made worse by heavy labor and a high temperature in the work area.

In 1972, after considering all of these factors, NIOSH recommended an exposure limit of 35 ppm for an 8-hour time-weighted average, and a ceiling limit of 200 ppm. This recommendation is based on the concentration necessary to produce a COHb level of not more than 5%. The recommendation does not consider the smoking habits of workers since the COHb levels in smokers has generally been found to be in the 4 to 5% range, but may run as high as 10 to 15% in heavy smokers. Therefore, smokers who already have a blood level of 5%, and then are exposed in a work place with an average concentration of 35 ppm will have a total COHb of about 10%.

## VI. RESULTS

### A. Environmental

High intermittent carbon monoxide levels were found throughout the day in the west side drive-up booth. The background levels were between 8-10 ppm with peaks as high as 50 ppm when the teller pulled back the drawer. There was a total of 16 high levels which ranged from 35-50 ppm. The background levels in the east side drive-up window, as well as throughout the main lobby, were between 5-8 ppm. The peaks found in the east side ranged from 15-20 ppm. Again, these higher levels were found when the teller pulled back the drawer.

It should be noted that during the NIOSH survey the weather conditions outside the bank were very cool and windy. These conditions would be the most favorable for mixing/diluting outside pollutants and, therefore, would be least favorable for collecting contaminants from vehicle emissions into the booths.

### B. Medical

During the NIOSH survey informal questioning elicited complaints of occasional headaches, dizziness, and fatigue during the work shift from some of the tellers.

The following medical results were provided to NIOSH by the Denver Clinic. When cigarette consumption was correlated with carboxyhemoglobin levels all eight volunteers were well within the expected normal range for individuals living in suburban environment in the absence of significant occupational exposures. The specific results are listed in Table 1.

## VII. DISCUSSION AND CONCLUSIONS

A health hazard did not exist on either of those days that the private consulting groups or NIOSH performed their investigation for potential exposure to carbon monoxide. However, complaints regarding headaches, dizziness, and fatigue may be attributable to carbon monoxide. These symptoms could increase during situations like those described in Section III, Background, of this report.

Carboxyhemoglobin (COHb) levels in all eight volunteers were within the expected normal levels when smoking histories were taken into consideration. The current OSHA standard for an eight hour occupational exposure of 50 ppm would be expected to create an average of 8-10% saturation of COHb in normal non-smokers exposed to that amount over the work day. Symptomatology of excessive COHb levels generally do not occur in normal individuals until 10% COHb levels are reached. No employee tested exceeded this level despite the heavy volume of traffic during the day of testing and regardless of smoking history. Only one employee exceeded 5% COHb prior to beginning work. On the basis of this data there is no evidence of significant occupational exposure to CO on the day of testing.

## VIII. RECOMMENDATIONS

1. Workers should be informed of the additive effects of cigarette smoke and occupational sources of CO.

2. Additional and/or increased make-up air should be installed in the west drive-up booth. This could be instituted by increasing the flow from the present duct or by adding additional make-up air ducts in this room. Also, a fan should be used and directed towards the transaction drawer in order to increase mixing at this point. Therefore, during periods when the tellers perceive irritation from auto emissions this could be used to reduce and/or eliminate this irritating problem.

3. A means to divert traffic from the west drive-up to the east drive-up area would reduce the congestion that was noted during the surveys. This could then reduce the amount of emission on the west side.

4. Smoking should be prohibited in all booths.

5. A detector device was purchased by the bank to evaluate CO and this should be used especially during periods which could increase emissions into the booths.

## IX. REFERENCES

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4. Encyclopedia of Occupational Health and Safety, International Labor Office, McGraw-Hill Book Company, New York.

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## X. AUTHORSHIP AND ACKNOWLEDGMENTS

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*NIOSH would like to extend its appreciation to the Denver Clinic, and especially Dr. John C. Harris, Director of Occupational and Environmental Health, for their assistance in this investigation and the medical data provided.

## XI. DISTRIBUTION AND AVAILABILITY

Copies of this report are currently available upon request from NIOSH, Division of Technical Services, Information Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 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 address.

Copies of this report have been sent to:

1. Central Bank of Academy Boulevard.
2. U.S. Department of Labor/OSHA - Region VIII.
3. NIOSH - Region VIII.

4. Colorado Department of Health.
5. State Designated Agency.

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

TABLE 1

Percent Carboxyhemoglobin of Bank Workers

Central Bank of Academy Boulevard
Colorado Springs, Colorado

March 16, 1981

NON-SMOKERS:
(Normal range less than 1.5% saturation)

| Pt# | A.M. Specimen | P.M. Specimen |
|---|---|---|
| 1 | 0.4% sat. | 0.9% sat. |
| 2 | 0.6% sat. | 0.8% sat. |
| 3 | 0.8% sat. | 1.1% sat. |
| 4 | 0.3% sat. | 0.9% sat. |
| 5 | 0.8% sat. | 1.2% sat. |

SMOKERS:
(Normal range less than 5% for moderate smokers and less than 9% for heavy smokers)

| Pt# | A.M. Specimen | # Cigarettes smoked | P.M. Specimen | # Cigarettes Smoked Since A.M. Specimen |
|---|---|---|---|---|
| 6 | 2.4% sat. | 1 | 3.0% sat. | 4 |
| 7 | 3.3% sat. | 5 | 3.5% sat. | 9 |
| 8 | 5.4% sat. | 3 | 8.6% sat. | 10 |

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