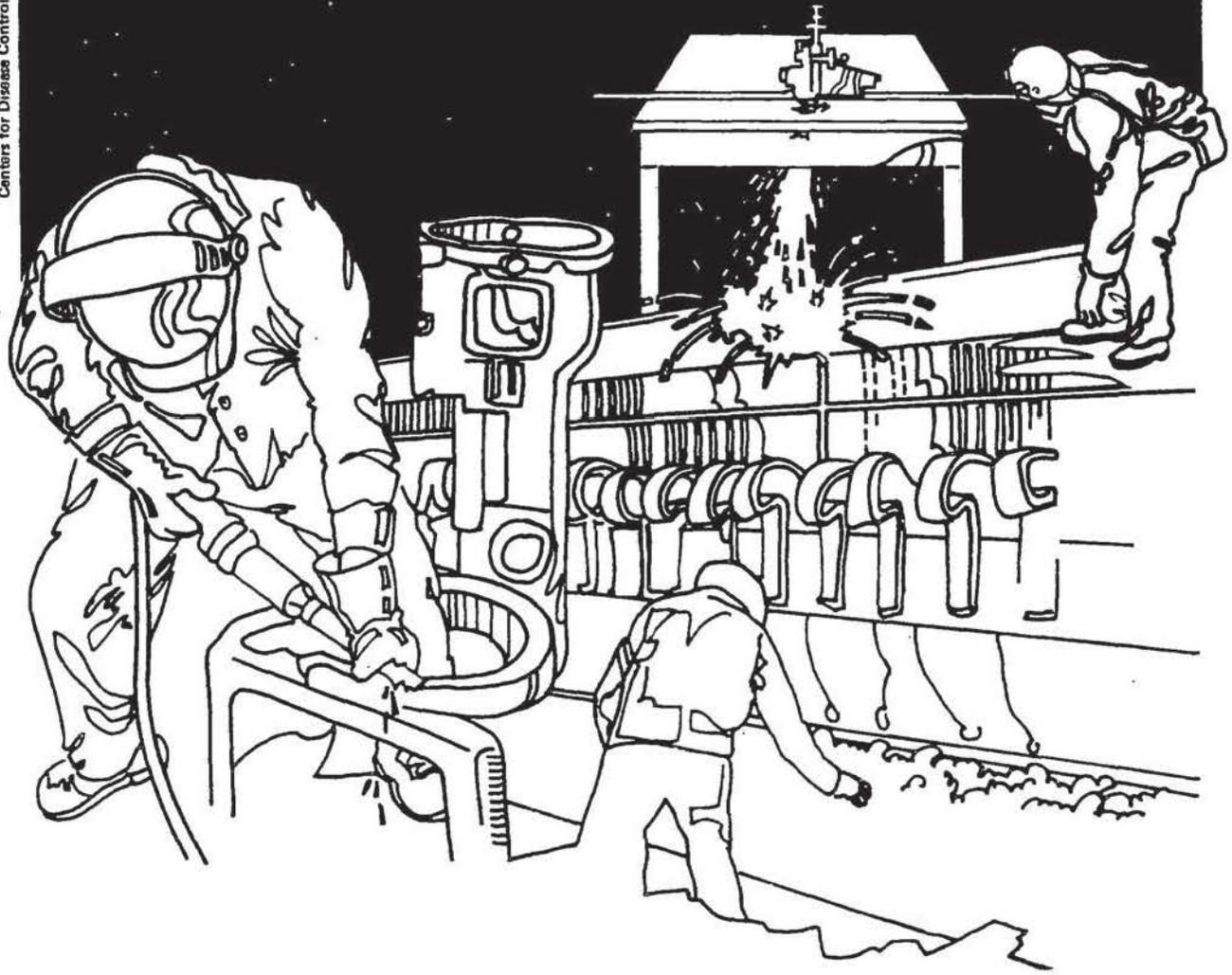


NIOSH



Health Hazard Evaluation Report

HETA 81-471-1032
CENTRAL BANK OF DENVER
DENVER, 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.

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

HETA 81-471-1082
MARCH 1982
CENTRAL BANK OF DENVER
DENVER, COLORADO

NIOSH INVESTIGATOR:
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I. SUMMARY

In September 1981 the National Institute for Occupational Safety and Health (NIOSH) received a request from a representative of Central Bank of Denver, Denver, Colorado, to evaluate exposure to carbon monoxide in the printing, mail, and supply service departments. The departments are located in a subbasement which is adjacent to an underground parking facility.

To evaluate the exposures, an industrial hygiene evaluation was performed on October 5, 1981. Breathing zone and general room air samples were taken in the work environments for determination of exposures to carbon monoxide (CO). The employees were interviewed to determine if they had experienced any health effects which may be related to CO exposures.

Occasional high levels (10-15 parts per million-ppm) of carbon monoxide were found to exist in the parking garage and occasional levels of 6-8 ppm were found in some of the offices. The higher CO levels in the garage were consistently found when automobile movement was at its peak level in the garage. The highest CO levels in the offices were invariably associated with cigarette smoking in the room or adjacent rooms. Personal interviews indicated that some employees had experienced headaches and eye irritation which was thought to be associated with CO contamination which may have been coming from the parking area or the air makeup system. Central Bank made a number of engineering changes on the ventilation system in these departments prior to NIOSH's evaluation and it was felt that these were positive engineering corrections which will reduce and/or eliminate the possibility of further problems.

On the basis of the environmental data, NIOSH concluded that there was no health hazard to carbon monoxide during the survey period. A potential health hazard may have existed prior to Central Bank's engineering changes on the ventilation system. This is, however, impossible to determine since the problem existed before the NIOSH survey. Recommendations on carbon monoxide surveillance/monitoring and ventilation concerns necessary to avoid potential health hazards in the future are included in the Recommendations Section of this report.

KEYWORDS: SIC 6020 (Banking), printing and supply personnel, carbon monoxide, carboxyhemoglobin.

II. INTRODUCTION

In September 1981 the National Institute for Occupational Safety and Health (NIOSH) received a request from a representative of Central Bank of Denver, Denver, Colorado, to determine if there was a health hazard from exposure to carbon monoxide (CO) in their printing, supply, and mailroom departments. An environmental evaluation was conducted on October 5, 1981, which included air monitoring for carbon monoxide, evaluation of the ventilation system, and interviews with employees who work in these departments.

III. BACKGROUND

In 1972 Central Bank of Denver moved into a new multi-story structure in downtown Denver, Colorado. Over a period of time a number of departments had to be moved into a third level basement storage area which is adjacent to a subbasement parking lot. Today the printing, supply, and mailroom departments now occupy what was once the storage room. The renovated area is approximately 13,000 square feet and has 12 bays, six on each side, that make up the offices in this area. Prior to the conversion and until October 1, 1981, the only ventilation system feeding this area was the original system which was designed to facilitate the old storage room. Also, the original design had the makeup air system duct located on the ground/street level of the building. This location was on a main street and adjacent to the entrance to the Bank's shipping and receiving area. Frequently during the week both areas had numerous cars, buses, or trucks parked with their engines running within the immediate area of the makeup air duct.

With the increase in employees in the renovated area, as well as the concern that the ventilation system was not adequate and may be entrapping vehicle emissions, Central Bank began monitoring the CO levels in these departments via colorimetric detector tubes. Before October 1981, levels as high as 50-60 parts per million (ppm) of CO had been detected during these measuring periods.

Prior to NIOSH's investigation the Bank redesigned the entire ventilation system in these departments. This included increasing makeup air ducts to each of the offices, increasing the entire system's overall capacity, and moving the main makeup air duct on the street approximately six feet off the ground. At present the system delivers 8-9 air changes per hour to each of the bays. The bank also had the buses which parked adjacent to the makeup air duct moved down the street and required the trucks which parked in the shipping and receiving area to turn off their engines.

IV. ENVIRONMENTAL DESIGN AND METHODS

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.

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), July 1980. 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.

<u>Substance</u>	<u>Permissible Exposure Limits 8-Hour Time-Weighted Average</u>
Carbon Monoxide.....	35.0 ppm (NIOSH) 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 AND CONCLUSIONS

It was determined that low levels (6-10 ppm) of carbon monoxide were found in the printing, mailing, and supply departments which are located in the subbasement/third level of the Central Bank of Denver. (Refer to Table 1.) These levels are well below the OSHA standard and NIOSH health criteria of 50 and 35 ppm respectively and, therefore, are not considered to be a health problem. Also, it is concluded that the CO levels found were due more to smoking rather than vehicle emissions.

During the NIOSH survey informal questioning did elicit complaints of occasional headaches and eye irritation during the work shift. It was also thought that these problems existed prior to the change in the ventilation system which does suggest that carbon monoxide may have been in larger quantities in these departments in the past. This is only speculative, that is, it is difficult for NIOSH to evaluate past conditions and/or exposures and assume that conditions in the past may have produced the symptoms described.

VII. RECOMMENDATIONS

1. The Bank should continue to periodically monitor potential carbon monoxide levels. The most appropriate time to do this would be during the peak morning and mid-afternoon periods. Other considerations would include inversion periods and periods when the delivery traffic in the shipping and receiving area off the main street is at its peak. That is, if there is a larger concentration of deliveries and pickups on Mondays or Fridays or the first of the month versus the end, etc.
2. If the environmental monitoring described above indicates the potential for increased carbon monoxide being entrained in the makeup air system, arrangements should be made to reduce and/or eliminate contamination to this ventilation system.
3. Workers should be informed of the additive effects of cigarette smoke and the problems associated with carbon monoxide and this can be very significant in downtown Denver during inversion periods.

VIII. REFERENCES

1. Industrial Hygiene and Toxicology, second edition, Frank Patty (editor), Interscience Publishers, 1967, Vol. II.

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5. Industrial Ventilation, A Manual of Recommended Practice, American Conference of Governmental Industrial Hygienists, 14th Edition (1976).
6. Occupational Diseases, A Guide to Their Recognition, U.S. Department of Health, Education, and Welfare, Public Health Service Publication (NIOSH) No. 77-181.

IX. AUTHORSHIP AND ACKNOWLEDGMENTS

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X. DISTRIBUTION AND AVAILABILITY

Copies of this report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, 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 Denver.
2. U.S. Department of Labor/OSHA - Region VIII.
3. NIOSH - Region VIII.
4. Colorado State 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
 CARBON MONOXIDE LEVELS

Central bank of Denver
 Denver, Colorado

October 5, 1981

Job/Area Description	Type of Sample	Carbon Monoxide Level (ppm)
Records Department	Personal	7-8*
Records Department	Area	5-6
Records Department	Area	5
Reproduction	Personal	5-7*
Reproduction	Area	7
Reproduction	Area	5
Copy Room	Personal	6-7
Copy Room	Area	6
Copy Room	Area	5
Mail Room	Personal	6-7*
Mail Room	Area	6-7
Mail Room	Area	6-7
Stockroom	Personal	6
Stockroom	Area	6
Stockroom	Area	5
Records	Personal	4-5
Records	Area	4
Records	Area	4

ppm = parts per million

Personal samples were taken using the carbon monoxide meter in the seat or area where the employee sat.

* = Individuals were smoking in these areas.