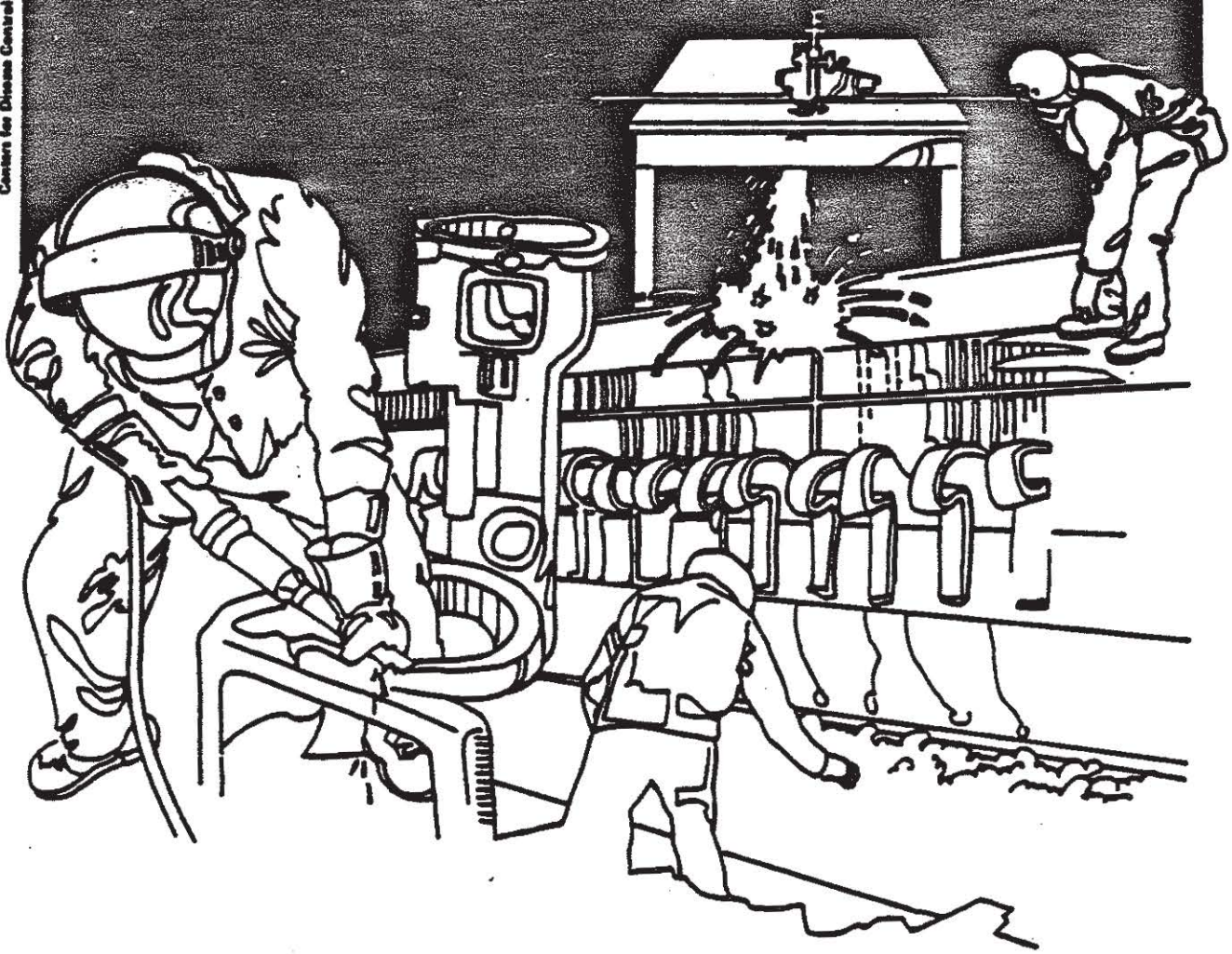
FILE COPY

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES • Public Health Service
Centers for Disease Control • National Institute for Occupational Safety and Health

NIOSH



Health Hazard Evaluation Report

HETA 84-257-1650
DENVER WATER DEPARTMENT
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.

HETA 84-257-1650
January, 1986
DENVER WATER DEPARTMENT
DENVER, COLORADO

NIOSH INVESTIGATOR:
Paul Pryor, MS, CIH

I. SUMMARY

In April 1984, the National Institute for Occupational Safety and Health (NIOSH) received a request from a representative of the Denver Water Department, Denver, Colorado, to evaluate exposures to asbestos during the cutting of cement pipe. After the initial investigation, it was also determined that noise would be evaluated.

On February 4, 1985, and again, on July 16, 1985, a NIOSH investigator conducted an environmental survey at the Denver Water Department. The survey consisted of collecting breathing zone and general area samples for asbestos and collecting personal samples for noise exposures. Two pipe cutting conditions were evaluated during the survey period. The first condition evaluated was pipe cutting without a water suppression system in use, and the second was with the water suppression system in use during the cutting process. Work practices and techniques were observed and employees were informally interviewed.

Personal samples for asbestos, without the water suppression system in use, ranged from 2.27 to 3.54 fibers per cubic centimeter (f/cc). With the suppression system in use, the asbestos results ranged from 0.43 to 0.76 f/cc which equaled an exposure reduction of over 75 percent. Area samples taken within 10 to 15 feet of the cutting operation, without the use of the water suppression system, ranged from 1.90 to 2.18 f/cc. With the suppression system in use, the results ranged from 0.17 to 0.60 f/cc, a reduction of over 80 percent. All the results were below the OSHA Standard of 2.0 f/cc when using the water suppression system, however; all samples exceeded NIOSH's recommended criteria of 0.1 f/cc.

The personal noise level measurements ranged from 95 to 109 dBA; half of these samples exceeded the NIOSH short-term exposure criteria of 100 dBA for a 1-hour exposure period. The area noise levels taken within 10-15 feet of the cutting operation ranged from 85 to 90 dBA, which were below the NIOSH recommended criteria of 100 dBA for a 1-hour exposure period.

On the basis of the data obtained in this investigation, it has been determined that the employees evaluated in this study were overexposed to both asbestos and noise during the pipe cutting operation. Recommendations to reduce and/or eliminate the exposures are presented in Section VIII of this report.

Keywords: SIC 4941 (Water Supply), cement pipes, asbestos (chrysotile and crocidolite), and noise.

II. INTRODUCTION

In April 1984, NIOSH received a request from the Denver Water Department, Denver, Colorado to evaluate the potential health hazards to employees during the cutting of cement pipes thought to contain asbestos. Following the initial investigation, it was determined that noise was a potential health hazard, and therefore, would also be evaluated. A NIOSH investigator conducted environmental surveys on February 4, 1985, and on July 16, 1985. Survey results and recommendations for reducing asbestos and noise exposures were presented to the employees and management in March, 1985, and again in August, 1985.

III. BACKGROUND

The Denver Water Department is a privately owned municipal water distribution company located in Denver, Colorado. Over the last 75 years the Water Department has developed a water collection system which incorporates moving water from the Rocky Mountains to various holding facilities for both treatment (potable) and recreational services. A large percentage of this water is carried through cement pipes which were thought to be constructed of asbestos materials.

Frequently, during development and maintenance operations, employees will engage in cutting these pipes in order to properly fit the various sections. Over the last few years, the Denver Water Department has instituted a program whereby the employees are required to use saws with a water suppression system. The suppression system is designed, when used properly, to reduce airborne dust generated from pipe cutting processes, and therefore, reduce dust exposures to the employees who perform this work. The water department recommends that this suppression system be used during all cutting operations, however, it was management's opinion that this technique was not used by the majority of the employees during the winter months. This occurs because the water generated during the cutting operation freezes making it very difficult to perform the cutting procedure.

Because of management's concern for increased asbestos exposures to the employees during the winter months, a NIOSH investigator conducted an evaluation of the employees cutting the pipes under both conditions (i.e., with and without the use of the water suppression system). This assessment evaluated actual exposures under both conditions and would illustrate the need for continuous use of the water suppression system under all working conditions.

Since high noise levels were suspected during the cutting procedure, a NIOSH investigator conducted a noise evaluation of the cutting operation to determine if a health hazard did exist.

IV. ENVIRONMENTAL DESIGN AND METHODS

A. Asbestos

The sampling techniques used to evaluate the potential asbestos exposures included analysis of bulk samples by Polarized Light Microscopy (PLM) and dispersion staining techniques to determine the type and percentage of asbestos in the cement pipes.

Airborne asbestos exposures were evaluated using 25 millimeter (mm) mixed cellulose ester filters. These filters were connected to pumps which pulled air through the filters at a flow rate of approximately 1.5 liters per minute (lpm). The pumps operated for an average of one hour and a total volume of approximately 90 to 115 liters was obtained. The analytical method used to evaluate the filter samples was the NIOSH 7400 Method with Phase Contrast Microscopy (PCM). The limit of detection (LOD) was determined to be 0.03 fibers/field or 1500 fibers/filter for the 25mm diameter filters.

A total of four personal samples and four area samples were collected for each of the two conditions sampled, that is, both wet and dry.

B. Noise

Two personal noise level measurements were taken using a Metrosonic noise dosemeter which registers on a memory cell the dose or noise level received during the exposure period. These data can then be displayed as a read-out (hard copy) for each minute at the end of the exposure period. At the end of the sampling period, the read-out describes the accumulated exposure for the hour, as well as the average noise exposure for the overall time period.

Noise levels and sound pressure levels were also evaluated using a Bruel & Kjoer @ (B&K) Precision Sound Level Meter equipped with an octave band analyzer.

V. EVALUATION CRITERIA AND TOXICOLOGY

As a guide to the evaluation of the hazards posed by workplace exposures, NIOSH field staff employ environmental evaluation criteria for assessment of a number of chemical and physical agents. These criteria are intended to suggest levels of exposure to which most workers may be exposed up to 10 hours per day, 40 hours per week for a working lifetime without experiencing adverse health effects. It is, however, important to note that not all workers will be protected from adverse health effects if their exposures are maintained below these levels. A small percentage may experience adverse health effects because of individual susceptibility, a pre-existing medical condition, and/or a hypersensitivity (allergy).

In addition, some hazardous substances may act in combination with other workplace exposures, the general environment, or with medications or personal habits of the worker to produce health effects even if the occupational exposures are controlled at the level set by the evaluation criterion. These combined effects are often not considered in the evaluation criteria. Also, some substances are absorbed by direct contact with the skin and mucous membranes, and thus potentially increase the overall exposure. Finally, evaluation criteria may change over the years as new information on the toxic effects of an agent become available.

The primary sources of environmental evaluation criteria for the work place are: 1) NIOSH Criteria Documents and recommendations, 2) the American Conference of Governmental Industrial Hygienists' (ACGIH) Threshold Limit Values (TLV's), and 3) the U.S. Department of Labor (OSHA) occupational health standards. Often, the NIOSH recommendations and ACGIH TLV's are lower than the corresponding OSHA standards. Both NIOSH recommendations and ACGIH TLV's usually are based on more recent information than are the OSHA standards. The OSHA standards also may be required to take into account the feasibility of controlling exposures in various industries where the agents are used; the NIOSH-recommended standards, by contrast, are based primarily on concerns relating to the prevention of occupational disease. In evaluating the exposure levels and the recommendations for reducing these levels found in this report, it should be noted that industry is legally required to meet those levels specified by an OSHA standard.

A time-weighted average (TWA) exposure refers to the average airborne concentration of a substance during a normal 8 to 10-hour workday. Some substances have recommended short-term exposure limits or ceiling values which are intended to supplement the TWA where there are recognized toxic effects from high short-term exposures. The current criteria and/or standards, as well as the toxicological effects for asbestos and noise are as follows:

A. Asbestos

The carcinogenic potential of asbestos is no longer in doubt; however, there is some uncertainly about the toxicological and morphological properties which determine the carcinogenic potency of various fibers. NIOSH believes that on the basis of available information there is no scientific basis for differentiating between asbestos fiber types for regulatory purposes.

NIOSH has recommended that asbestos be controlled to the lowest detectable limit. It is our contention that there is no safe concentration of exposure to asbestos. Any standard, no matter how low the concentration, will not ensure absolute protection for all workers from developing cancer as a result of their occupational exposure. However, lower concentrations of exposure carry low risks.

NIOSH continues to believe that both asbestos and smoking are independently capable of increasing the risk of lung cancer mortality. When exposure to both occurs, the combined effect, with respect to lung cancer, appears to be multiplicative rather than additive. From the evidence presented, we may conclude that asbestos is a carcinogen capable of causing, independent of smoking, lung cancer and mesothelioma.

Data available to date provide no evidence for the existence of a threshold level. Virtually all levels of asbestos exposure studied to date demonstrated an excess of asbestos-related disease.

Although the present Permissible Exposure Limits (PEL) of OSHA is two fibers per cc as a Time-Weighed Average (TWA), concentrations with a Ceiling Limit (CL) of 10 f/cc, deliberations are, at present, underway to reduce these limits to the order of 0.1 to 0.5 f/cc. For general industrial operations the NIOSH recommended standard (RS) for all forms of asbestos is 0.1 f/cc based on the lowest level detectable by the presently recommended PCM analytical technique. The Veterans Administration permissible exposure limit is 0.005 f/cc, which includes monitoring outside the working area and the final (clearance) sample on the working areas.

B. Noise

OSHA's existing standard for occupational exposure to noise (29 CFR 1910.95) specifies a maximum permissible noise exposure level of 90 dBA for a duration of 8 hours, with higher levels allowed for shorter durations. NIOSH, in its Criteria for a Recommended Standard, proposed a limit of 5 dB less than the OSHA standard (i.e., 85 dBA). The OSHA and NIOSH Time-weighted average noise limits as a function of exposure duration are shown below:

Duration of Exposure (hours/day)	Sound Level, dBA	
	NIOSH	OSHA
16	80	---
8	85	90
4	90	95
2	95	100
1	100	105
1/2	105	110
1/4	110	115*
1/8	115*	---
	---	140 dB**

* No exposure to continuous noise above 115 dBA.

** No exposure to impact or impulse noise above 140 dB peak sound pressure level (SPL).

Noise, commonly defined as unwanted sound, covers the frequency range of sound which is implicated in harmful effects (4000-6000 Hz). Noise can be classified into many different types, including wide-band noise, narrowband noise, and impulse noise. To describe the spectrum of a noise, the audible frequency range is usually divided into eight frequency bands, each one-octave wide, and sound pressure level (SPL) measurements are made in each band using a special sound level meter. A wide-band noise can be found in the weaving room of a textile mill and in jet aircraft operations.

Exposure to high levels of noise may cause temporary and/or permanent hearing loss. The extent of damage depends primarily upon the intensity of the noise and the duration of the exposure. There is abundant epidemiological and laboratory evidence that protracted noise exposure above 90 decibels (dBA) causes hearing loss in a portion of the exposed population.

When workers are exposed to sound levels exceeding the OSHA standard, feasible engineering or administrative controls must be implemented to reduce levels to permissible limits. OSHA has recently issued a hearing conservation amendment to its noise standard. The amendment states that for workers exposed at or above a TWA of 85 dB, noise exposure monitoring, employee education, and audiometric testing will be required. Review of audiograms have to be made by an audiologist, orolaryngologist, or a qualified physician. Employees also must be notified of monitoring results within 21 days. Employee records must be kept by the employer for up to five years after termination of employment. Finally, for those employees exposed to noise levels exceeding 90 dBA for eight hours and/or where audiometric testing results indicate a hearing loss, ear protection must be worn.

Exposure to intense noise causes hearing losses which may be temporary, permanent, or a combination of the two. These impairments are reflected by elevated thresholds of audibility for discrete frequency sounds, with the increase in dB required to hear such sounds being used as a measure of the loss.

Temporary hearing losses, also called auditory fatigue, represent threshold losses which are recoverable after a period of time away from the noise. Such losses may occur after only a few minutes of exposure to intense noise. With prolonged and repeated exposures (months or years) to the same noise level, there may be only partial recovery of the threshold losses, the residual loss being indicative of a developing permanent hearing impairment.

Temporary hearing impairment has been extensively studied in relation to various conditions of noise exposure. Typical industrial noise exposures produce the largest temporary hearing losses at test frequencies of 4,000 and 6,000 Hertz (Hz).

The actual pattern of loss depends upon the spectrum of the noise itself. The greatest portion of the loss occurs within the first two hours of exposure. Recovery from such losses is greatest within one or two hours after exposure. The amount of temporary hearing loss from a given amount of noise varies considerably from individual to individual. For example, losses at a given frequency due to noise intensities of 100 dBA may range from 0 to more than 30 dBA.

Low frequency noise below 300 Hz must be considerably more intense than middle or high frequency noise to produce significant threshold losses.

Considerably fewer temporary hearing losses result from intermittent than from continuous noise exposure even though the total amount of noise exposure is the same in both instances.

Physiologic reactions to a noise of sudden onset represent a typical startle pattern. There is a rise in blood pressure, an increase in sweating, an increase in heart rate, changes in breathing, and sharp contractions of the muscles over the whole body. These changes are often regarded as an emergency reaction of the body, increasing the effectiveness of muscular exertion which may be required. However desirable in emergencies, these changes are not desirable for long periods since they could interfere with other necessary activities. Fortunately, these physiologic reactions subside with repeated presentations of the noise.

For performance on a task to remain unimpaired by noise, man must exert greater effort than would be necessary under quiet conditions. When measures of energy expenditure--for example, oxygen consumption and heart rate--are made during the early stages of work under noisy conditions, they show variations which are indicative of increased effort. Measurements in later stages under continued exposure, however, show responses return to their normal level.

VI. RESULTS AND DISCUSSION

Employee exposures to asbestos and noise were evaluated by NIOSH. The following are the results of NIOSH's study.

A. Asbestos

Two pipe cutting conditions were evaluated. The first condition evaluated the potential exposure to asbestos while the employees performed the cutting operation without the use of the water suppression system. The results obtained under this condition showed overexposures to the employees when compared to either the OSHA Standard or the NIOSH criteria (refer to Table 1). These results ranged from 2.27 to 3.54 f/cc, and the area air samples collected ranged from 1.90 to 2.18 f/cc.

The second condition evaluated studied the potential exposures to employees when the water suppression system was used during the cutting operation. The personal results obtained during this condition ranged from 0.43 to 0.76 f/cc and the area samples ranged from 0.17 to 0.60 f/cc. Although these results did not exceed the current OSHA Standard of 2.0 f/cc, they did exceed NIOSH's recommended criteria of 0.1 f/cc.

When comparing the two cutting conditions, it becomes apparent that the use of the water suppression system should be mandatory during all cutting conditions where cement pipes are suspected of containing asbestos. That is, when the suppression system is used, over 75 percent of the asbestos exposure is reduced. It should be noted, however, that this control method should not preclude the use of respirators during any cement pipe cutting operation.

B. Noise

Four personal noise samples were taken to evaluate the exposures to the equipment operators and two exceeded the current NIOSH noise criteria for the time period evaluated (i.e., 100 dBA for a Short term 1-hour TWA exposure). These excursions were found on the cutter operator, and the results ranged from 108 to 109 dBA. Four noise measurements (range 85-90 dBA), taken within 10 to 15 feet of the cutting operation using a hand held dosimeter were all below the NIOSH criteria of 100 dBA for the 1-hour exposure period evaluated (refer to Table 2).

VII. CONCLUSIONS

A. Asbestos

It was concluded that a health hazard from asbestos exposures did exist to those involved in the cutting operation. These exposures decreased as much as 75 percent when the employees performed the cutting operation with the use of the dust suppression system. It was also determined by the area samples collected, that employees who work in the immediate cutting area (10 to 15 fifteen feet) and who work down-wind of the cutting operation are also at risk to asbestos exposures.

It was also concluded that the employees were not adequately protected during either of the two cutting conditions evaluated by NIOSH. That is, the respirators used were not NIOSH/MSHA approved for asbestos; the available personal protective clothing was not being used as effectively as it should; and additional protective clothing should be incorporated into the company's asbestos handling program.

B. Noise

It was concluded that a health hazard from exposures to noise existed to the employee who performs the pipe cutting. Other employees who work around this cutting operation were also exposed to evaluated noise levels, but did not exceed the criteria for the time period evaluated.

VIII. RECOMMENDATIONS

In view of the findings of NIOSH's environmental study, as well as personal communications with individuals at the Denver Water Department, Denver, Colorado, the following recommendations are made to assist in providing a better work environment for the concerned employees:

A. Asbestos

Although the asbestos levels are reduced substantially by the dust suppression system, it is our opinion that a health hazard still exists from exposures to asbestos. Therefore, a complete asbestos control program should be developed for all the employees who work in areas where pipe cutting is performed. The following items should be included in the company's asbestos program:

1. Engineering controls are the preferred method for decreasing potential exposures to toxic substances and should be used when possible. Therefore, it is recommended that the company require the use of the water suppression system regardless of the time of year.

2. In order to further protect the employees who perform the pipe cutting process or work around this operation, the following recommendations should be included in the company's asbestos program:

a. Respiratory Protection: Respirators are necessary when the exposures exceed either standards or evaluation criteria. Respirators should not be considered a primary control and should only be used in conjunction with the engineering controls described earlier. For the asbestos exposures evaluated in this study, three types of respirators are approved. The first is a NIOSH/MSHA approved negative pressure-type respirator (half or full face) with a high efficiency pre-filter for asbestos levels below the current OSHA Standard. It should be noted that NIOSH currently recommends against the single-use, disposable type respirators while working around asbestos.

The last two respirators include the approved NIOSH/MSHA, powered-air purifying respirator and the NIOSH/MSHA Type-C supplied-air respirator. These two respirators are intended for use during emergencies or during exposure to asbestos levels which exceed the current OSHA Standard. The reader is referred to OSHA 1910.1001 for further information on this regulation.

When reviewing the respirators described above, it becomes apparent that the half or full-face respirator is the better choice. However, these can only be used if the dust suppression system is used routinely.

It should be also understood that under OSHA 1910.134, if it has been determined that respirators must be worn, a complete program of selection, maintenance, and fit testing of the respirators are required.

b. Environmental Monitoring: Environmental air monitoring, similar to that performed in this investigation, is required during periods when an exposure is known to occur or in areas where the exposure level is unknown. The reader is referred to OSHA 1910.1001 for further details on monitoring frequency and requirements.

c. Medical Monitoring and Surveillance: Medical monitoring is recommended if the employee has worked or will be working in an environment where an asbestos exposure has been suspected or known to exist. A pre-placement comprehensive medical examination should be given to these employees. This should include, as a minimum, a chest roentgenogram (posterior-anterior 14 X 17 inches), a history to elicit symptomatology of respiratory disease, and pulmonary function tests to include forced vital capacity (FVC) and forced expiratory volume at one second ($FEV_{1.0}$).

Medical surveillance of these employees should be started as soon as possible if it has not been to date. This should include annual examinations with each of the tests described as part of this exam.

d. Education and Training: Education and training is essential in maintaining a good asbestos control program. Each of the recommendations described in this report, as well as any other current or future issues and techniques to improve asbestos handling, should be apart of your program.

e. Personal Hygiene: Attention to personal cleanliness and avoiding asbestos contamination while eating, drinking, and using tobacco products is essential in reducing exposures. It should also be pointed out that a person who is a smoker and has been exposed to asbestos in the past stands a fifty-five times (55X) greater chance of contracting an asbestos related diseases (NIOSH - Congressional Testimony, March 21, 1984).

f. Record Keeping: All personal and environmental air sampling data, as well as medical records, should be retained for at least 20 years as required under OSHA 1910.1001.

g. Other Concerns: Additional considerations which should be part of the asbestos program include the use of special techniques to reduce asbestos exposures during pipe cutting in rooms or vaults. These include the use of vacuum systems required for asbestos decontamination, that is, High Efficiency Particulate Absolute (HEPA) filters. Other OSHA and EPA requirements include proper containerization, labeling, and disposal of all materials potentially latent with asbestos.

B. Noise

Based on the results obtained in our noise survey the following recommendations should be included in the company's hearing protection program:

1. Hearing protective devices should be worn by the pipe cutting operator. The pipe cutting operator's assistant should also wear hearing protectors if he will be working within five feet of the cutting process.

2. To insure that full personal protection is being provided during those periods of high noise exposures, the Environmental Protection Agency's Noise Reduction Ratings (NRR) should be applied when selecting hearing protection. Each protective device (ear plugs or muffs) has a NRR rating which, for that particular type and model, describes what percent of noise attenuation may be obtained.

3. Personal noise monitoring should be performed periodically during the pipe cutting operation. This should be performed on the cutting operator, as well as the other employees who assist and/or work in the immediate area, in order to assure that their exposures are within acceptable limits.

4. The company should implement an educational program to instruct new employees on the hazards of noise exposures for those conditions evaluated. Special attention should be placed on the need for protection during short term exposure periods where high noise levels are known to exist, such as pipe cutting.

IX. REFERENCES

1. Asbestos 1910.1001, Occupational Safety and Health Standards for General Industry (29 CFR Part 1910), July 1, 1980.

2. OSHA Informational Package on Asbestos (contains Proposed Rule change - April 10, 1984, pamphlets and other asbestos information).

3. National Emission Standard for Hazardous Air Pollutants-Asbestos (Revised) Federal Register, Vol. 49, No. 67, April 5, 1984.

4. U.S. Department of Health, Education, and Welfare. Occupational Diseases, A Guide to Their Recognition, Public Health Service Publication (NIOSH) No. 77.181.

5. Handbook of Noise Measurement, seventh edition, Arnold Peterson and Ervin Gross, 1974.

6. Proctor, N.H. and Hughs, J.P., Chemical Hazards of the Workplace, J.P. Lippincott Company, Philadelphia, 1978.

7. National Institute for Occupational Safety and Health/Occupational Safety and Health Administration. Occupational Safety and Health Guidelines for Chemical Hazards. NIOSH/Publication No. 81-123, Jan. 1981.

8. American Conference of Governmental Industrial Hygienists, Documentation of the Threshold Limit Values for Substances in the Workroom Air, updated periodically.

9. American Conference of Governmental Industrial Hygienists, Threshold Limit Values (TLV's) for Chemical Substances and Physical Agents in the Workroom Environment, 1983-84.

10. Workplace Exposure to Asbestos. Review and Recommendations. NIOSH. November, 1980. pp 39 DHHS (NIOSH) Pub. 81-103. GPO No. 017-033-03376-9. Available from GPO.

Note: Presents the conclusions and recommendations of a joint NIOSH/OSHA committee formed to review the scientific information concerning asbestos-related diseases and to assess the adequacy of the current OSHA standard. Includes information on sampling and analysis of airborne asbestos, current standards, recommended standards, and medical surveillance programs. Bibliography.

11. Congressional Testimony - National Institute for Occupational Safety and Health (NIOSH) before the subcommittee on Public Buildings and Grounds Committee on Public Works and Transportation, U.S. House of Representatives; March 21, 1984.

X. AUTHORSHIP AND ACKNOWLEDGMENTS

Report Prepared By:

Paul Pryor, M.S., CIH
Industrial Hygienist
NIOSH - Region VIII
Denver, Colorado

Originating Office:

Hazard Evaluation and
Technical Assistance Branch
(HETAB)
Division of Surveillance,
Hazard Evaluations, and Field
Studies (DSHEFS) NIOSH
Cincinnati, Ohio

Report Typed By:

Secretary
NIOSH - Region VIII
Denver, Colorado

NIOSH is thankful to the employees at Denver Water Department for their cooperation and assistance with this Health Hazard Evaluation. The information gathered from this study will not only assist in maintaining the health and safety of those persons working here, but also other facilities that perform similar operations.

XI. DISTRIBUTION AND AVAILABILITY

Copies of this report are currently available upon request from NIOSH, Division of Standard 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. Denver Water Department, Denver, Colorado
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 I

Breathing Zone and Area
Concentrations for Asbestos

Denver Water Department
Denver, Colorado

November, 1985

Job/Sample Description	Sampling Time	Asbestos Fibers/cc
Asbestos Samples Without Water Suppression		
Cutter Operator	1:30-2:30	3.36
Cutter Operator	1:30-2:30	3.54
Assistant	1:30-2:30	2.45
Assistant	1:30-2:30	2.27
Area 1	1:30-2:40	*
Area 2	1:30-2:40	*
Area 3	1:30-2:40	2.18
Area 4	1:30-2:40	1.90
Asbestos Samples With Water Suppression		
Cutter Operator	9-10:00	0.76
Cutter Operator	9-10:00	0.60
Assistant	9-10:00	0.76
Assistant	9-10:00	0.43
Area 1	9-10:15	0.17
Area 2	9-10:15	0.59
Area 3	9-10:15	0.60
Area 4	9-10:15	0.21

EVALUATION CRITERIA	NIOSH	OSHA
	0.1	2.0 10.0 (C)

LABORATORY LIMIT OF DETECTION = 0.03 Fibers per filter (1500 fibers/filter).

Note: No analysis performed, filters overloaded.

(C) = Refers to a ceiling level which should never be exceeded.

Table 2

Personal Noise Dosimeter Levels

Denver Water Department
Denver, Colorado

November 1985

Job/Task Description	Sampling Time (minutes)	Noise Exposure Level
Cutter Operator	60	109
Cutter Operator	60	108
Assistant	60	95
Assistant	60	96
Area 1	*	85-90
Area 2	*	85-90
Area 3	*	85-90
Area 4	*	85-90

EVALUATION CRITERIA	Exposure Time	NIOSH	OSHA*
	1/8 hour	115 dBA	----
	1/4 hour	110 dBA	115 dBA
	1/2 hour	105 dBA	110 dBA
	1 hour	100 dBA	105 dBA

* OSHA Revised Hearing Conservation Regulation requires employers to institute a hearing protection program if TWA noise levels exceed 85 dBA.

DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
CENTERS FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
ROBERT A. TAFT LABORATORIES
4676 COLUMBIA PARKWAY, CINCINNATI, OHIO 45226

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE. $300

Third Class Mail

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF HHS
HHS 396