PLAINTIFF'S
EXHIBIT
USX-109

IN THE COURT OF COMMON PLEAS OF WASHINGTON COUNTY, PENNSYLVANIA

CIVIL DIVISION - ASBESTOS

JOHN PATTERSON, Executor of The Estate of Vonida J. Patterson, and JOHN PATTERSON, Individually, Plaintiffs,	)	
vs.	)	No.: 95 - 359
USX CORPORATION, et al., Defendants,	)	
vs.	)	
A. P. GREEN REFRACTORIES CO., et al., Additional Defendants.	)	

DOCUMENTS PRODUCED BY USX CORPORATION MADE EXHIBITS TO DEPOSITIONS GIVEN BY USX CORPORATION (ALSO SOME DOCUMENTS IDENTIFIED AT USX DEPOSITIONS NOT PRODUCED BY USX CORPORATION*)

SUBMITTED IN RESPONSE TO USX CORPORATION'S MOTION FOR SUMMARY JUDGMENT

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May 15, 1997

INDEX TO EXHIBITS

*Asterisk indicates that the document had not been produced by USX Corporation but was identified at a deposition given by USX Corporation.

USX Exhibit No.	Description Of Exhibit	USX Bates No.
No. 15	Interorganization Correspondence from J. B. Masaitis to Safety and Environmental Health Representatives, et al., dated 10/17/80, regarding procedures for removing insulation materials containing asbestos with attached Procedures For Removing Insulation Materials Containing Asbestos	0000353
17	Stipulation As To Medical Records of John Patterson	None
18	Guidelines for Medical Surveillance, Asbestos Exposure, dated 10/15/80	0001012
19	Memorandum from Frederick M. Toca, Ph.D. to Plant General Managers, et al., dated 4/27/84, regarding revised corporation asbestos guidelines and radiation guidelines, with attached Appendix 1, Guidelines For Medical Surveillance Asbestos Exposure	0000946
20	Letter from William C. Marshall, M.D., to P. X. Masciantonio, dated 7/18/84, with attached Guidelines For Medical Surveillance, Asbestos Exposure, dated 6/26/84	0000930
21	Interorganization Correspondence from William C. Marshall, M.D. to All Holders of USS Physician's Guide, dated 7/23/84, regarding guidelines for medical surveillance asbestos exposure with attached revised guidelines dated 6/26/84 and USS Physician's Guide dated 7/23/84	0000935
22	Document titled, "Air Sample Studies for Asbestos Performed at Homestead Workers" with cover titled "Representation By USX" - 12/6/95	None
23	Memorandum from K. M. Morse to F. R. Smith, Jr., dated 7/18/73, regarding asbestos dusty survey open hearth, with attached asbestos dust survey dated 6/25/73	0000180
24	Memorandum from R. H. Deibert to Kenneth M. Morse, dated 10/22/73, regarding Asbestos survey, Carrie Furnaces, with attached Table No. 1 dated 9/5, 10/3 and 10/4/73	0000773

USX Exhibit No.	Description Of Exhibit	USX Bates No.
No. 25	Memorandum from W. C. Janes to F. R. Smith, Jr., dated 2/1/74, regarding asbestos dust survey with attached Table 1 dated 10/24/73	0000185
27A	Memorandum from J. F. Quealy to W. C. Janes, dated 2/5/76, regarding OSHA inspection - Homestead Works, with attached "Samples For Analysis" dated 1/7/76	0000173
29	Memorandum from W. C. Janes to Mr. Dean Wilson, dated 4/13/76, regarding asbestos survey - Forbes Shop, with attached Table 1, Asbestos Clothing Survey, Homestead Works, 3/29/76	0002266
31	Memorandum from W. C. Janes to Mr. Dean Wilson, dated 6/8/76, regarding asbestos survey open hearth division, with attached Asbestos Exposures, No. 73 Furnace Reline, Open Hearth #5, Homestead Works, May 11, 1976	0000199
32	Memorandum from T. M. Civic to Mr. Dean Wilson, dated 7/2/76, regarding asbestos survey, 160", 100", 48" and 45" Mills and Wheel and Axle Plant, with attached Table 1 dated 6/8/76	0000204
45	Memorandum from J. B. Masaitis to K. M. Morse, dated 5/21/73,1 regarding asbestos open hearth Homestead Works	0000183
46	Memorandum from J. F. Quealy to Mr. Frank S. Pokrywka, dated 11/5/81, regarding analysis of insulation material	0000769
49	Memorandum from Kenneth M. Morse to General Superintendents, et al., dated 7/3/72, regarding Proposed Permanent Asbestos Standard	0000849
50	Memorandum from Kenneth M. Morse to General Superintendents, et al., dated 6/26/72, regarding proposed Permanent Asbestos Standard	0000339
51	Interorganization Correspondence dated 12/10/71 from Kenneth M. Morse to General Superintendents, et al., dated 12/10/71, regarding Threshold Limit Value For Asbestos Dust Exposure, Federal Occupational Safety and Health Act (OSHA)	0000845

USX Exhibit No.	Description Of Exhibit	USX Bates No.
No. 55*	Treatise: "Asbestos-Related Disease In Employees Of A Steel Mill And A Glass Bottle-Manufacturing Plant", Richard S. Kronenberg, et al., Annals of the N.Y. Academy of Sciences, Vol. 643, p. 398, 1991	None
56	Interorganization Correspondence from Kenneth M. Morse to D. W. Brown, dated 5/17/71, regarding asbestos protective apparel	0000865
57*	Treatise: "Letters to the Editor - Asbestos Hazard from Protective Clothing", H.A. Bamber and R. Butterworth, Ann. Occup. Hyg., Vol. 13, pp.77-80, 1970	None
58	Interorganization Correspondence from E. M. Gorden to Plant Managers, et al., dated 8/24/83, regarding Mon Valley Works Guidelines for the Removal and Disposal of Asbestos Containing Materials with attached guidelines	None
59	Interorganization Correspondence from S. A. Bennett, Jr. to Plant Managers, et al., dated 4/9/84, regarding revised Mon Valley Works Guidelines For The Handling and Removal of Asbestos Bearing Materials, with attached guidelines	None
60	Memorandum to File - Analysis of Insulation Material - Main Steam Line for Homestead 48" Mill Engine - 2/84	None
61	Interorganization Correspondence from Walter D. Holloway to Holders of USS Health Services Protective Apparel And Equipment Manual, dated 6/16/83	0000571
68	Interorganization Correspondence from A.S. Patterson to All Division And Staff Heads dated 12/28/79 regarding Guidelines For Removal and Disposal of Asbestos Materials	00002862

USX Exhibit No.	Description Of Exhibit	USX Bates No.
No. 69	Interorganization Correspondence from T.R. McCune to Division Superintendents and Staff Heads, dated 5/8/81, regarding Corporation Asbestos Guidelines and attached Guidelines dated 10/15/80	00002868
73	Interorganization Correspondence frmo William D. Miller to Safety and Environmental Health Representatives dated 11/21/83 regarding Asbestos - Emergency Temporary Standard and attached Standards	0002893

United States Steel Corporation

PLAINTIFF'S EXHIBIT

Interorganization Correspondence

Date: February 14, 1972

To: All Administrative Physicians
Plants, Mines, and General Offices
United States Steel Corporation

From: Merle Bundy, M.D.
Director-Industrial Medicine

Subject: Threshold Limit Value For Asbestos Dust Exposure
Federal Occupational Safety And Health Act (OSHA)

Attached is a memorandum from Mr. Kenneth M. Morse, Director-Environmental Health, concerning the revision downward of this standard under the OSHA-70.

It is recommended that chest x-rays of employees exposed to asbestos dust be done at the time of pre-employment examination and yearly thereafter. If exposure continues beyond one year, even though at or below the standard, x-rays should be continued on a yearly basis so long as the employee remains with U. S. Steel.

Because there is some early evidence that "smokers" in an asbestos exposure, admittedly considerably above the present standard, have shown a much, much greater risk (90-1) for the development of lung cancer than non-smokers, every effort should be made to encourage the smokers in any asbestos exposure to "kick the habit." The relationship of smoking in the development of asbestosis is not yet understood. A recent article from the Harvard School of Public Health and an Editorial in the December 2, 1971 issue of "The New England Journal of Medicine" are enclosed for additional information.

Merle Bundy MD

MB/rp

Attachments

USX0000808 #1

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Ex. II (n)

The New England Journal of Medicine

ACTION ON ASBESTOS

Asbestos workers are unintentional victims of industrial progress. They are at risk of pulmonary fibrosis, pleural calcification, mesotheliomas and lung cancer. Asbestos exposure is now widespread, involving not only air but also drinking water, wine and beer.[1] Fibers have been found in the lungs of people without industrial asbestos exposure. Whatever the exact nature of asbestos or ferruginous bodies may be, there is no doubt that electron microscopy of the lungs of urban dwellers has shown the presence of chrysotile asbestos.[2] Although there is no evidence of asbestos-linked disease in the general population at this time, the presence of asbestos in their lungs is disturbing. Asbestos is relatively resistant to destruction by most chemical and physical means and can float freely in the atmosphere for prolonged periods. Asbestos diseases have a long latent period, 20 years or more. We therefore believe that more sweeping decisions on the control of asbestos must be made now, on the basis of "reasonable probability" rather than after a delay for a precise definition of dose-response relations.

These thoughts are reinforced by the work of Murphy and associates in this issue of the *Journal* (p 1271). Their studies of pipe coverers involved in new ship construction include better than usual exposure data and indicate a high incidence of asbestosis (38 per cent after 20 years) at what have been previously regarded as "safe" dust concentrations. A second study of Murphy et al[3] reports two cases of pleural disease (one mesothelioma) in workers who sanded asbestos floor tiles. Since the degree of asbestos exposure was unknown, the authors simulated the working conditions and found concentrations of 1.3 fibers per milliliter of room air. This concentration is less than 1/5 of currently used threshold limit values. A fiber per milliliter of room air means that a worker breathing 15 liters per minute for eight hours inhales some 10^7 fibers every work day. Although only a fraction of the inhaled fibers remains in the lung, these figures suggest that an alarming number will still accumulate over a 10-year period.

A recent Committee report prepared by a National Academy of Sciences panel[4] has called for control of asbestos emissions at the source and for protection of those who are exposed in their occupations. The report also calls for further research on the biologic effects and the physical characteristics of asbestos fibers; such data are urgently needed "if a range of safe exposure is to be established with confidence." Although we endorse these recommendations, we want to underline the urgent need for technical controls based on existing knowledge. Epidemiologic monitoring, physical studies of asbestos and other fibers and analysis of their effects on cells and tissues are important and must be continued. But there is now a clear need for more decisive action on control measures and the Occupational Safety and Health Act of 1970 sets the stage for such action.

Application of the technics of industrial hygiene must be accelerated. The present threshold limit value for asbestos should be lowered far below some recent proposals. National administrative mechanisms to initiate and implement action are available — the recently established National Institute for Occupational Safety and Health and the National Advisory Committee on Occupational Safety and Health foremost among them. The Secretary of Labor, under the aforementioned Act, is charged with the setting of standards and has the right of entry into and inspection of places of employment. Thus, enforcement and regulatory mechanisms as well as advisory bodies have been established by law. Among the many problems that they face, asbestos should have high priority. Technologic developments are needed in many areas: sophisticated dust control; better and harmless asbestos substitutes; and improved monitoring of both the workers and their environment. Adequately devised tax policies could provide incentives for industry to clean the air and protect the workers. Such policies, by generating action in each plant where a risk exists, can rapidly and considerably amplify efforts on the national scale.

Bernard Gee, M.D.
Arend Bouhuys, M.D., Ph.D.

References

1. Cunningham HM, Pontefract R: Asbestos fibres in beverages and drinking water. Nature (Lond) 232:332-333, 1971
2. Langer AM, Selikoff IJ, Sastre A: Chrysotile asbestos in the lungs of persons in New York City. Arch Environ Health 22:348-361, 1971
3. Murphy RL, Levine BW, Al Bazzaz FJ, et al: Floor tile installation as a source of asbestos exposure. Am Rev Resp Dis 104:576-580, 1971
4. Asbestos: The need for and feasibility of air pollution controls. Panel on Asbestos, Committee on Biologic Effects of Atmospheric Pollutants. Washington DC, Division of Medical Sciences, National Research Council, 1971

FOR YOUR INFORMATION

D. W. BROWN
DIRECTOR OF SAFETY
UNITED STATES STEEL CORPORATION

Title 29—Labor

CHAPTER XVII—OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION, DEPARTMENT OF LABOR

PART 1910—OCCUPATIONAL SAFETY AND HEALTH STANDARDS

Standard for Exposure to Asbestos

Pursuant to sections 6(b) and 8(c) of the Occupational Safety and Health Act of 1970 (84 Stat. 1593, 1599; 29 U.S.C. 655, 657), Secretary of Labor's Order No. 12-71 (36 FR 8754), and 29 CFR Part 1911, § 1910.1001(i)(1) of Part 1910 of Title 29, Code of Federal Regulations, is hereby amended in the manner set forth below, in order to extend the retention period for asbestos exposure monitoring records from three years to twenty years.

On December 7, 1971 (36 FR 23207), OSHA issued an emergency temporary standard on asbestos in response to a petition by the Industrial Union Department of the AFL-CIO, pursuant to section 6(c) of the Act (84 Stat. 1596, 29 U.S.C. 655). This emergency temporary standard was designed primarily to immediately reduce and control occupational exposure to asbestos dust concentrations, and did not contain recordkeeping procedures. However, on January 12, 1972 (37 FR 466), OSHA published a proposed comprehensive standard for asbestos exposure which did include recordkeeping provisions. Paragraph (h)(1) of the proposal (37 FR 468) provided that exposure monitoring records, and records of medical examinations, be maintained for a period of twenty years. After public hearings the Secretary promulgated a new, permanent OSHA standard for asbestos on June 7, 1972 (37 FR 11318), in accordance with section 6(b) of the Act (84 Stat. 1593, 29 U.S.C. 655). This new regulation, which appeared as 29 CFR 1910.93a prior to recodification, contained a three-year requirement for retaining exposure monitoring records, 20

USX0000810

CFR 1910.93a(l)(1) (now 29 CFR 1910.1001(l)(1)).

On July 27, 1972, pursuant to section 6(f) of the Act, (84 Stat. 1597, 29 U.S.C. 655), a petition for judicial review of the asbestos standard was filed with the United States Court of Appeals for the District of Columbia. The principal petitioners, the Industrial Union Department, AFL–CIO, objected to several substantive portions of the standard, including those dealing with recordkeeping. The Court affirmed the Secretary's judgments and the standard's validity except for two provisions, one of which was the retention period for exposure monitoring records. "Industrial Union Department, AFL–CIO v. Hodgson," 499 F. 2d 467 (C.A.D.C. 1974). The Court directed the Secretary to re-examine the standard with respect to the three-year recordkeeping provision and to reconsider whether such time period adequately assured employee protection from asbestos-related diseases.

In discussing this issue, the Court noted that many of the problems facing the Secretary in developing an asbestos standard were directly attributable to the lack of information concerning asbestos-related diseases, and particularly to the lack of reliable data on past exposure levels. Noting the close functional relationship between medical records and exposure records, and the fact that the standard required that medical records be maintained for at least 20 years, the Court expressed surprise at the short three-year retention period for monitoring records. After reviewing the Secretary's obligation under the Act to require retention of records necessary for the development of information concerning the causes of disease and the importance of exposure data in establishing this causal relationship, the Court remanded the recordkeeping requirements to the Secretary "for such modification or clarification as may be necessary to ensure that the statutory objectives will be fulfilled" 499 F. 2d at 488.

Pursuant to the Court's direction, OSHA has completed its review, and has concluded that the opinion expressed by the Court is an accurate reflection of the record, and that the agency's initial judgment warrants correction.

OSHA believes that extension of the recordkeeping requirement for exposure monitoring from three years to twenty years as originally proposed would be in harmony with the twenty-year retention period now required for employee medical records, 29 CFR 1910.1001(j)(6)(ii). As the court noted (499 F. 2d at 488), the two sets of records when read together would provide a more complete record of an employee's history of exposure, a factor vitally important with respect to asbestos-related diseases. The extended period for retention, with resultant data accumulation, will be critical to medical and scientific investigations studying such questions as dose-response relationships in diseases caused by occupational exposure to asbestos. This decision would also be responsive to the agency's declared concern that the past inadequacy of health and monitoring records have hindered research into the consequences of asbestos exposure at the workplace. 37 FR 11318, June 7, 1972.

The long latency periods associated with asbestos-related diseases, and the consequent need for a standard to take such latency periods into account, were recognized by both the OSHA Advisory Committee on Asbestos Dust (proceedings at pp. 103–106, February 17, 1972) and the NIOSH Criteria Document for a Recommended Standard on Asbestos (generally chapters I and II). In addition, testimony by two witnesses at the OSHA hearings also supported longer retention periods for exposure monitoring records (Tr. at 527, 538, March 17, 1972). A consensus of the evidence in the record indicates that exposure monitoring records should be held for at least 20 years in order to make such a requirement meaningful in view of what is generally recognized as the minimum latency period for many asbestos-related diseases. OSHA is of the view that the interests of worker health would be best served by requiring the retention of exposure monitoring records for a period which reflects an appreciation of this recognized latency factor.

Accordingly, pursuant to the Court's remand for further consideration of the retention period for monitoring records, we have concluded, based on the existing record and for the reasons stated above, that a 20-year retention period is supported by the evidence and necessary for the protection of employees. It is noted that in a new proposal on exposure to asbestos (40 FR 47652, October 9, 1975), which reflects the most recent scientific and medical developments in the field, a 40-year retention period (or the duration of employment plus twenty years) for both exposure measurement and medical records has been proposed.

For the reasons stated above, the exposure records provision of the asbestos standard will be corrected to require retention of exposure monitoring records for at least 20 years, effective March 19, 1976. OSHA believes that a delay in the effective date of this requirement is not warranted since this rule only requires that affected employers retain records which they have already compiled and therefore does not impose a new burden of action, and since the initial three-year retention period for such records has now lapsed and these records might be destroyed. Loss of such records would be irreparable. Continued access to such records by all concerned is essential in the public interest, and is an appropriate means of effectuating the goals of improved worker safety and health under the Act. Good cause is found, therefore, pursuant to section 4(d)(3) of the Administrative Procedure Act (5 U.S.C. 553(d)(3)), for making this rule effective.

Accordingly, pursuant to the direction of the United States Court of Appeals ("Industrial Union Department, AFL–CIO v. Hodgson, supra"), and the above referenced authority, paragraph (l)(1) of 29 CFR 1910.1001 is hereby amended to read as follows:

§ 1910.1001 Asbestos.

*   *   *   *   *

(l) *Recordkeeping*—(1) *Exposure records.* Every employer shall maintain records of any personal or environmental monitoring required by this section. Records shall be maintained for a period of at least 20 years and shall be made available upon request to the Assistant Secretary of Labor for Occupational Safety and Health, the Director of the National Institute for Occupational Safety and Health, and to authorized representatives of either.

*   *   *   *   *

(Secs. 6, 8, Pub. L. 91–596, 84 Stat. 1593, 1599 (29 U.S.C. 655, 657); Secretary of Labor's Order No. 12–71 (36 FR 8754); 29 CFR Part 1911).

Signed at Washington, D.C. this 12th day of March 1976.

MORTON CORN,
Assistant Secretary of Labor.

[FR Doc.76–7791 Filed 3-18-76;8:45 am]

Institute for Occupational Safety and Health, and to authorized representatives of either.

(2) *Employee access.* Every employee and former employee shall have reasonable access to any record required to be maintained by subparagraph (1) of this paragraph, which indicates the employee's own exposure to asbestos fibers.

(3) *Employee notification.* Any employee found to have been exposed at any time to airborne concentrations of asbestos fibers in excess of the limits prescribed in paragraph (b) of this section shall be notified in writing of the exposure as soon as practicable but not later than 5 days of the finding. The employee shall also be timely notified of the corrective action being taken.

(j) *Medical examinations*—(1) *General.* The employer shall provide or make available at his cost, medical examinations relative to exposure to asbestos required by this paragraph.

(2) *Preplacement.* The employer shall provide or make available to each of his employees, within 30 calendar days following his first employment in an occupation exposed to airborne concentrations of asbestos fibers, a comprehensive medical examination, which shall 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 1 second ($FEV_{1.0}$).

(3) *Annual examinations.* On or before January 31, 1973, and at least annually thereafter, every employer shall provide, or make available, comprehensive medical examinations to each of his employees engaged in occupations exposed to airborne concentrations of asbestos fibers. Such annual examination shall 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 1 second ($FEV_{1.0}$).

(4) *Termination of employment.* The employer shall provide, or make available, within 30 calendar days before or after the termination of employment of any employee engaged in an occupation exposed to airborne concentrations of asbestos fibers, a comprehensive medical examination which shall 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 1 second ($FEV_{1.0}$).

(5) *Recent examinations.* No medical examination is required of any employee, if adequate records show that the employee has been examined in accordance with this paragraph within the past 1-year period.

(6) *Medical records*—(i) *Maintenance.* Employers of employees examined pursuant to this paragraph shall cause to be maintained complete and accurate records of all such medical examinations. Records shall be retained by employers for at least 20 years.

(ii) *Access.* The contents of the records of the medical examinations required by this paragraph shall be made available, for inspection and copying, to the Assistant Secretary of Labor for Occupational Safety and Health, the Director of NIOSH, to authorized physicians and medical consultants of either of them, and, upon the request of an employee or former employee, to his physician. Any physician who conducts a medical examination required by this paragraph shall furnish to the employer of the examined employee all the information specifically required by this paragraph, and any other medical information related to occupational exposure to asbestos fibers.

3. A new § 1910.19 is added to Subpart B of Part 1910, reading as follows:

§ 1910.19 Asbestos dust.

Section 1910.93a shall apply to the exposure of every employee to asbestos dust in every employment and place of employment covered by § 1910.12, § 1910.13, § 1910.14, § 1910.15, or § 1910.16, in lieu of any different standard on exposure to asbestos dust which would otherwise be applicable by virtue of any of those sections.

Effective date. Paragraph (b)(2) of § 1910.93a shall become effective July 1, 1976. All other provisions of §§ 1910.93a, 1910.93, and 1910.19 shall become effective July 7, 1972. The current emergency temporary standard remains in effect until July 7, 1972.

(Secs. 6, 8, 84 Stat. 1593, 1600; 29 U.S.C. 655, 657; 29 CFR 1910.4; Secretary of Labor's Order No. 12-71, 36 F.R. 8754)

Signed at Washington, D.C., this 2d day of June 1972.

G. C. GUENTHER,
Assistant Secretary of Labor.

[FR Doc.72-8674 Filed 6-6-72;8:48 am]

USX0000812

General Superintendents
Plant Managers

United States Steel Corporation

Interorganization Correspondence

Date: April 6, 1981

From: J. B. Masaitis
Assistant Manager
Environmental Health

Subject: Corporation Asbestos Guidelines

Attached for your information and use is a copy of Corporation guidelines recently developed by Headquarters Environmental Health for the protection of our employees against the hazards associated with exposure to asbestos.

As indicated in these guidelines, primary efforts should be directed towards the substitution of non-asbestos materials for those applications which previously used only asbestos products. In addition to eliminating the hazard, this step will preclude the necessity of complying with the costly provisions of the OSHA asbestos standard, such as monitoring, medical surveillance, record-keeping, etc. In this regard, we have also enclosed, for your consideration, information gathered by the AISI Committee on Manufacturing on asbestos substitution activities within other companies. This data includes the results of field trials conducted on specific alternative materials.

J B Masaitis

JBM/js
attachments

USX0000357

GUIDELINES FOR THE PROTECTION OF EMPLOYEES AGAINST THE HAZARDS OF ASBESTOS DUST EXPOSURE

UNITED STATES STEEL CORPORATION

USX0000358

TABLE OF CONTENTS

I. Introduction

Asbestos is a generic term used to describe a variety of naturally-occurring, fibrous, hydrated mineral silicates. There are two main types: serpentine and amphibole. The serpentine variety is called chrysotile and accounts for more than 90% of the asbestos used in the United States. Amphibole asbestos includes the fibrous forms of the minerals amosite, crocidolite, tremolite, actinolite and anthophyllite. Asbestos fibers are generally characterized by high tensile strength, flexibility, heat and chemical resistance, and favorable frictional properties. Certain grades can be carded, spun and woven, while others can be laid and pressed to form sheets or used for structural reinforcement of materials such as cement, plastic and asphalt.

There are over 3,000 known asbestos products used in industry, commerce and the home. Examples of these include building and pipe insulation materials; products such as millboard, roofing felt and beverage filters; rope and braid; asbestos-cement pipe and sheets; vinyl-asbestos floor tiles; automotive brake linings and clutch plates; paints, coatings and sealants; gaskets and packings; and reinforced plastics. For all practical purposes, asbestos is a ubiquitous substance, i.e., almost everyone is exposed to it in some form and to some degree, everyday.

II. The Health Hazard Asbestos

Knowledge of diseases associated with the use of asbestos apparently dates back 2,000 years. However, the association of asbestos with chronic respiratory disease had to be rediscovered in the modern era. In very recent times, asbestos exposure has been shown to have a causal relationship with a variety of disease entities and pulmonary abnormalities including:

A. Pleural Effusion, Pleural Thickening, Calcification & Plaques -

Asbestos exposure should be considered whenever there is benign effusion in the pleural cavity. The effusion may be accompanied by pleural thickening. Pleural thickening, usually bilateral in distribution, may occur, however, without previous evidence of effusion. A pleural plaque is a localized fibrous thickening of a parietal pleural surface. Microscopically, plaques consist primarily of connective tissue, often containing deposits of calcium. They do not interfere with pulmonary function to any significant extent, nor do they necessarily indicate the presence of pulmonary fibrosis. An association between pleural abnormalities and exposure to asbestos has been clearly demonstrated in several studies. Although pleural plaques do not, themselves, appear to be precursors of malignant disease, a recent study showed that bronchial carcinoma was 2-1/2 times more frequent in men with pleural plaques.

B. Asbestosis - a diffuse, interstitial, non-malignant scarring of the lung. This is the most common disease produced by exposure to asbestos. It is a sometimes fatal condition that results from significant, but not necessarily heavy exposure. Lung infections, such as pneumonia or bronchitis, are extremely threatening to people with asbestosis.

C. Bronchogenic Carcinoma - a malignancy of the interior of the lung. A high proportion of asbestos patients may develop lung cancer. The cancer risk is much higher for cigarette smokers suggesting some synergistic relationship between asbestos fibers and tobacco smoke. It has been estimated that asbestos workers who smoke have almost 90 times greater risk of lung cancer than the non-smoking general public.

D. Mesothelioma - a diffuse malignancy of the lining of the chest cavity or of the lining of the abdomen. This condition is extremely rare in the general public; however, the incidence of these cancers has been increasing and their peculiar relationship to asbestos fibers has received considerable attention. Mesotheliomas can occur even after a limited exposure to asbestos dust and may affect people who were not directly involved in handling the material, such as relatives of asbestos workers who may be exposed to dust carried home on work clothing.

E. Cancer of the Digestive System - asbestos may also produce disease when it is ingested. A number of studies now indicate that the increase in incidence of cancer of the stomach and colon among asbestos workers is two or three times the number of expected tumors.

III. An Integrated Control Program to Protect Employees Against the Hazardous Effects of Asbestos Exposure

Four key elements are necessary to insure the success of a program designed to control the adverse health effects of asbestos fibers in man's environment. These basic components include:

---Air monitoring and analysis to determine the level of exposure to asbestos fibers.

---Medical surveillance to assure that no physiological changes are occurring as a result of the asbestos exposures.

---Physical control of human exposure to asbestos fibers, i.e., to reduce the contact between the worker and the fibers.

---An educational program to inform employees of the potential hazards of asbestos and to train them in the proper implementation of procedures designed to minimize exposures.

A. Environmental Monitoring

The first determination that must be made is whether or not there is an actual exposure to asbestos. It is meaningless and often costly to arrive at a solution where no problem exists. There are numerous fibrous insulation materials used throughout the Corporation which may or may not contain asbestos. Where there is uncertainty, a bulk sample of the material is sent to Headquarters Environmental Health to ascertain the possible presence of asbestos. Fiber morphology is examined under phase contrast microscopy and the crystal properties of the fibers are studied under the polarizing light microscope. A wet chemical screening test, specific for magnesium and iron complexes, may also be conducted. In most cases, these tests will confirm the presence of asbestos or eliminate the possibility of it being a component of the bulk material. If there is any doubt, the sample is forwarded to USS Research for positive identification of the fiber using electron microscope techniques.

When employees work with materials known to contain asbestos, their exposures are evaluated with personal monitoring equipment which can detect and measure the concentrations of asbestos fibers which may be released into the worker's breathing zone. With such equipment, the exposures can be monitored over short, peak periods or averaged over the entire workshift.

The OSHA asbestos standard requires that periodic monitoring be conducted, at intervals no greater than six months, on those employees whose asbestos exposures may reasonably be foreseen to exceed permissible exposure limits. However, any initial determination of such elevated exposures would be an immediate cause for concern, and corrective action would be promptly taken by U. S. Steel management to implement control measures to reduce asbestos exposures to the lowest possible levels.

B. Medical Surveillance

The OSHA standard further dictates that all employees exposed to airborne asbestos fibers, regardless of concentration, must be given annual medical examinations, including chest X-rays and pulmonary function tests. However, as pointed out earlier, asbestos is such a widespread substance that virtually everyone has some measurable exposure. OSHA has apparently come to understand this premise and under Program Directive 300-16 (October, 1978) has defined, for medical purposes, exposure to airborne asbestos fibers as a minimum of 0.1 asbestos fibers, longer than 5 micrometers, per cubic centimeter of air (i.e., 1 fiber per 10 cc). At U. S. Steel, we use this 0.1 fiber/cc exposure level to identify those employees to be included in the medical surveillance program. Separate guidelines detailing the medical surveillance procedures were previously sent to plant physicians by the Director of Industrial Medicine. A copy of these guidelines is attached.

C. Controlling Employee Exposures to Asbestos Fibers

1) Substitution of Alternative Materials

Using "non-asbestos" materials on applications which previously used asbestos products is the first choice of controlling exposures since it eliminates the source of the hazard. Some of the alternative materials that have found common usage as substitutes for asbestos include fiberglass, kaolin wool, ceramics, mineral wool and various plastic fibers. In certain individual applications, each of these has exhibited adequate tensile strength, heat resistance, flexibility and durability to satisfactorily perform functions previously served only by asbestos products. Some examples of "asbestos-free" materials being used at operations at U. S. Steel facilities include:

--the widespread use of ceramic fiber and kaolin wool as pipe insulation materials.

--non-asbestos mortar compounds for heat resistant cement applications.

--fiberglas and aramid fiber textile products such as welding curtains and heat resistant clothing.

--various hot-top products at ingot teeming operations.

Although the use of asbestos is well entrenched in many important applications, it is likely that substitution will play an increasingly significant future role in reducing health hazards from asbestos.

2) Encapsulation

The mere presence of asbestos insulation materials does not constitute a health hazard. In this regard it is not U. S. Steel's philosophy or intention that all asbestos insulation materials be torn out and replaced with alternative materials. However, once it is determined that such insulation has deteriorated to the point that fibers may be emitted into occupied areas, steps should be taken to control the hazard.

A feasible alternative to complete removal of asbestos insulation is encapsulation, i.e., treating the material with an acrylic or elastomeric polymer protective coating to seal the fibers in place and prevent further deterioration. Although each case must be considered on an individual basis, encapsulation can often be a preferable solution because it generally costs much less, does not cause long-term disruption of operations, and does not require the intensive decontamination efforts necessitated by complete removal. Examples of these asbestos containment treatments are Hydro-ban by KRC Corporation and Asbestos Guard Fiber Fix (719) by U. S. Coatings Collaborative, Inc.

Raybestos Manhattan has developed a product called Novatex which is an asbestos textile encapsulated with an acrylic resin. A neoprene coating may give additional protection. Novatex cloth can be used for welding curtains, insulation applications, and for aluminized and non-aluminized protective bodywear.

3) Exhaust Ventilation

Any operation which may conceivably generate airborne asbestos dust concentrations in excess of permissible exposure limits should be provided with local exhaust ventilation. Where such ventilation is used the exhaust hood should be located as close as possible to the point of dust generation to achieve maximum capture of the released fibers. Examples of operations where local ventilation may be employed include the mixing of asbestos mortar compounds and the use of saws, drills and grinders on asbestos materials.

4) Isolation

Operations which have the potential to generate high concentrations of airborne fibers should be isolated to the extent feasible to minimize human exposure to the fibers. The removal or teardown of asbestos pipe insulation is an example of this type of operation. U. S. Steel guidelines outlining procedures to be followed during this task stipulate that the vicinity of the operation be designated a restricted area, thus denying access to employees whose presence is not required.

5) Work Practices

Changes in work practices may often be the most cost-effective way of reducing occupational exposure to asbestos. When conducting an operation which involves the handling of asbestos materials, consideration should be given to performing the task in such a manner that the emission of asbestos fibers into the air will be minimized. Some of the ways in which work practices may be modified include:

--the use of a slow band saw or hand saw in lieu of a high-speed circular table saw to cut Transite asbestos board.

--thoroughly wetting asbestos materials prior to use - such as immersing a coil of asbestos rope in water prior to applying it as a sealant around furnace or oven doors.

--the purchase of pre-cut and pre-drilled materials such as brake shoe lining containing asbestos.

--using a vacuum cleaner instead of a compressed air hose to remove dust residue from mobile equipment brakes during inspection and repair operations.

--removing asbestos insulation in as large of sections as possible to minimize the amount of fracturing.

--using hand tools such as chisels or knives, rather than power tools or saws, to cut and remove asbestos insulation.

6) Housekeeping

Good housekeeping practices are essential to maintain low levels of airborne asbestos fibers. Dust on floors, ledges, equipment and workbenches may become airborne when disturbed by work activity, air movement, or vehicular traffic. Dry sweeping should be prohibited in areas where asbestos is used because it merely redisperses the fine fibers into the workroom air. Instead, vacuum cleaning is the preferred method of removing dust accumulations.

Waste materials such as rejects, scrap, shavings or other debris should be collected and placed in plastic bags or some other impermeable container. The containers should be sealed shut, labeled as to the contents and hazard, and disposed of in accordance with applicable Federal and State regulations.

7) Personal Protection

The control measures previously discussed under this section should always be the primary means of minimizing employee exposure to asbestos fibers. If, however, these measures are not sufficient, or if some specific operations are not amenable to such control, the use of personal protective equipment will be necessary. While respirators and protective clothing should always be available, it must be understood they serve only as a complement to, not as a replacement for, engineering and work practice control measures.

a. Respirators

Respirators may be necessary to control asbestos exposures in some instances, such as the removal of thermal pipe insulation. Since these devices place a burden on the respiration of the worker, it must first be determined whether the wearer can use the equipment and still perform the assigned task. In such a determination, consideration should be given to: the physical condition of the worker, such as possible pulmonary or cardiovascular impairment; the physiological demands of the task, such as required oxygen uptake; and the presence of facial hair which may negate an effective respirator seal.

The type of respirator needed will be dictated by the preceding factors as well as the concentration of airborne asbestos fibers. With fiber concentrations less than 10 times the permissible exposure levels a properly fitted air purifying dust respirator will provide sufficient protection. The type of respirator selected should be specifically approved by NIOSH for protection against dusts containing asbestos. It should be noted, however, that single use,-disposable respirators are not permitted within U. S. Steel for protection against asbestos.

When the fiber contamination level is between 10 and 100 times the permissible exposure level, powered air-purifying respirators should be worn. If exposures exceed 100 times the acceptable limits, a type "C" supplied air respirator or pressure-demand self-contained breathing unit should be worn.

Respirator wearers should be instructed to wash the masks, and change filters, where applicable, daily. Proper fitting instructions should also be given. When respirators are issued, it is important to comply with the appropriate regulations governing the use of respiratory protection. For those facilities under OSHA jurisdiction, these regulations are stated in 29 CFR 1910.134. MSHA requires a respirator program consistent with the provisions of ANSI Z88.2-1980.

b. Protective Clothing

In regard to asbestos, it is important to consider protective clothing in two ways. First, it may be necessary to provide special clothing to employees who are required to handle asbestos to prevent work clothing from becoming contaminated with the fibers. In this instance protective clothing is a control measure to protect not only the worker but also family members who may be exposed to dust carried home on his work clothing. Second, some protective clothing articles, intended to provide thermal protection for those in close proximity to high radiant heat sources, are made from asbestos materials. Reports in the literature indicate that this type of clothing, through gradual deterioration with use, is actually a source of asbestos exposure to workers. We will consider each type of protective clothing separately.

i) Protective Clothing as a Control Measure

When employee asbestos exposures exceed a "ceiling limit" of 10 fibers/cc the OSHA asbestos standard requires employers to provide "special clothing" (coveralls, head coverings, gloves and foot coverings), change rooms with two lockers (one for the employee's street clothes and one for his contaminated work clothes), transportation of contaminated clothing in sealed impermeable bags or containers, and laundering facilities. The necessity of complying with some of these provisions can be eliminated by issuing employees disposable protective garments. Disposables may include hard hat liners, coveralls and shoe liners. The coverall garment should be without pockets or cuffs. A good example is DuPont's Tyvek protective garments. Tyvek is a durable spunbonded olefin with high tensile/tear strength, chemically resistant and due to a relatively slick surface, it does not tend to entrap particles. A vacuum cleaner should be used to remove loose fibers adhering to contaminated work clothing. Employees should not attempt to dislodge these fibers by brushing them off nor by using compressed air. In addition respirators should continue to be worn until contaminated work clothing is removed.

ii) Protective Clothing Made of Asbestos Material

Occasionally, employees working in areas of high radiant heat, those who are exposed to molten metal or weld spatter or those who have to handle hot objects or tools are required to wear heat-resistant asbestos clothing. Eventually there may be sufficient wear and movement of the fabric to cause the release of appreciable airborne fibers into the employee's breathing zone. As previously discussed, the primary method of controlling asbestos exposures is to substitute a non-asbestos material. In this regard, there have been several recent advances by protective garment manufacturers in developing incombustible, thermal resistant fabrics. Some examples of these are aramid fibers (a high temperature nylon) such as DuPont's Nomex and Southern Textile's Goldengard; polyacrylonitrile fabrics like Gentex's Preox, which also comes with an aluminized facing where heat reflectivity is crucial, as in teeming operations; and glass fiber products, including Zetek by Newtex Industries and Pyroglas by Raybestos Industrial Products.

8) Removal of Insulation Materials

At U. S. Steel, the greatest potential for high exposures to asbestos is the removal of deteriorating insulation materials such as pipe coverings. Specific guidelines to protect the employees during this operation were developed by Headquarters Environmental Health and distributed to all Corporate facilities. These procedures included provisions on work practices to minimize dust generation, personal protective equipment, exposure monitoring, personal hygiene, housekeeping, restriction of area, employee training and waste disposal.

D. Education

Employees will be more apt to cooperate with management's attempts to control their exposures to toxic substances if they are made aware of the nature of the hazard and its consequences. It is mutually beneficial to the workers and the Corporation to develop and implement an education and training policy regarding exposure to asbestos. The goals of the program should be to increase the employees' knowledge of:

--the nature of the asbestos hazard

--work processes involving asbestos and the potential for fiber emissions

--diseases that may result from exposure to asbestos fibers and how these diseases are manifested

--the concept of "risk"

--environmental monitoring procedures and objectives

--the purpose and nature of engineering and work practice controls

--the purpose, proper use, and limitations of respiratory protection equipment

--the application of decontamination and waste disposal practices

--the elements of the medical surveillance program and the reasons for it

--the role of related factors in disease production. such as smoking

It is strongly recommended that supervisory personnel be included in any education program. A well-informed supervisor may personify management's concern and insistence that operations involving the use and handling of asbestos products be conducted in a safe and healthful manner.

Industrial Hygiene Services

Environmental Health .... Recognition, Evaluation, Control

IHS GUIDELINE 12

GUIDELINES FOR THE PROTECTION OF EMPLOYEES AGAINST THE HAZARDS OF ASBESTOS DUST EXPOSURE

INDUSTRIAL HYGIENE SERVICES
UNITED STATES STEEL CORPORATION

Revised: April, 1984

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I. Introduction

Asbestos is a generic term used to describe a variety of naturally occurring, fibrous, hydrated mineral silicates. There are two main types: serpentine and amphibole. The serpentine variety is called chrysotile and accounts for more than 90% of the asbestos used in the United States. Amphibole asbestos includes the fibrous forms of the minerals amosite, crocidolite, tremolite, actinolite and anthophyllite. Asbestos fibers are generally characterized by high tensile strength, flexibility, heat and chemical resistance, and favorable frictional properties. Certain grades can be carded, spun and woven, while others can be laid and pressed to form sheets or used for structural reinforcement of materials, such as cement, plastic and asphalt.

There are over 3,000 known asbestos products used in industry, commerce and the home. Examples of these include building and pipe insulation materials; products such as millboard, roofing felt and beverage filters; rope and braid; asbestos-cement pipe and sheets; vinyl-asbestos floor tiles; automotive brake linings and clutch plates; paints, coatings and sealants; gaskets and packings; and reinforced plastics. For all practical purposes, asbestos is a ubiquitous substance; i.e., almost everyone is exposed to it in some form and to some degree, everyday.

II. The Health Hazard of Asbestos

Knowledge of diseases associated with the use of asbestos apparently dates back 2,000 years. However, the association of asbestos with chronic respiratory disease had to be rediscovered in the modern era. In very recent times, asbestos exposure has been shown to have a causal relationship with a variety of disease entities and pulmonary abnormalities including:

A. Pleural Effusion, Pleural Thickening, Calcification & Plaques

Asbestos exposure should be considered whenever there is benign effusion in the pleural cavity. The effusion may be accompanied by pleural thickening. Pleural thickening, usually bilateral in distribution, may occur, however, without previous evidence of effusion. A pleural plaque is a localized fibrous thickening of a parietal pleural surface. Microscopically, plaques consist primarily of connective tissue, often containing deposits of calcium. They do not interfere with pulmonary function to any significant extent, nor do they necessarily indicate the presence of pulmonary fibrosis. An association between pleural abnormalities and exposure to asbestos has been demonstrated in several studies. However, pleural plaques are not diagnostic of asbestos disease. Although pleural plaques do not, themselves, appear to be precursors of malignant disease, a recent study showed that bronchial carcinoma was 2-1/2 times more frequent in men with pleural plaques.

B. Asbestosis

A diffuse, interstitial, non-malignant scarring of the lung. This is the most common disease produced by exposure to asbestos. It is a sometimes fatal condition that results from significant, but not necessarily heavy exposure. Lung infections, such as pneumonia or bronchitis, are extremely threatening to people with asbestosis.

C. Bronchogenic Carcinoma (Asbestos and Smoking)

A malignancy of the interior of the lung. A high proportion of asbestos patients may develop lung cancer. The cancer risk is much higher for cigarette smokers suggesting some synergistic relationship between asbestos fibers and tobacco smoke. It has been estimated that asbestos workers who smoke have almost 90 times greater risk of lung cancer than the non-smoking general public.

D. Mesothelioma

A diffuse malignancy of the lining of the chest cavity or of the lining of the abdomen. This condition is extremely rare in the general public; however, the incidence of these cancers has been increasing and their peculiar relationship to asbestos fibers has received considerable attention. Mesotheliomas can occur even after a limited exposure to asbestos dust and may affect people who were not directly involved in handling the material, such as relatives of asbestos workers who may be exposed to dust carried home on work clothing.

E. Cancer of the Digestive System

Asbestos may also produce disease when it is ingested. A number of studies now indicate that the increase in incidence of cancer of the stomach and colon among asbestos workers is two or three times the number of expected tumors.

III. An Integrated Control Program to Protect Employees Against the Hazardous Effects of Asbestos Exposure

Four key elements are necessary to insure the success of a program designed to control the adverse health effects of asbestos fibers in man's environment. These basic components include:

- air monitoring and analysis to determine the level of exposure to asbestos fibers;
- medical surveillance to assure that no physiological changes are occurring as a result of the asbestos exposures;
- physical control of human exposure to asbestos fibers; i.e., to reduce the contact between the worker and the fibers;
- an educational program to inform employees of the potential hazards of asbestos and to train them in the proper implementation of procedures designed to minimize exposures; posting of warning signs in locations where airborne concentrations of asbestos fibers are anticipated to exceed the reduced exposure limit of 0.5 fibers/cc.

A. Industrial Hygiene Monitoring

The first determination that must be made is whether or not there is an actual exposure to asbestos. It is meaningless and often costly to arrive at a solution where no problem exists. There are numerous fibrous insulation materials used throughout the Corporation which may or may not contain asbestos. Where there is uncertainty, a bulk sample of the material is sent to the Environmental Health Laboratory at the USS Technical Center to ascertain the possible presence of asbestos. Fiber morphology is examined under phase contrast microscopy, and the crystal properties of the fibers are studied under the polarizing light microscope. A wet chemical screening test, specific for magnesium and iron complexes, may also be conducted. In most cases, these tests will confirm the presence of asbestos or eliminate the possibility of it being a component of the bulk material. If there is any doubt, the sample will be analyzed by electron microscope techniques to make a positive identification.

When employees work with materials known to contain asbestos, their exposures are evaluated with personal monitoring equipment which can detect and measure the concentrations of asbestos fibers which may be released into the worker's breathing zone. With such equipment, the exposures can be monitored over short, peak periods or averaged over the entire workshift.

The OSHA Asbestos Standard requires that periodic monitoring be conducted, at intervals no greater than six months, on those employees whose asbestos exposures may reasonably be foreseen to exceed permissible exposure limits. However, any initial determination of such elevated exposures would be an immediate cause for concern, and corrective action should be promptly taken by U. S. Steel Management to implement control measures to reduce asbestos exposures to the lowest possible levels. It is recommended that monitoring of exposure levels be conducted with sufficient frequency so that accurate exposure evaluation information is available for each operation where asbestos is encountered.

Asbestos Monitoring Procedures

OSHA Permissible Exposure Limit:

	*fibers/cc
8-hr. time-weighted average:	2
ceiling:	10
**emergency temporary standard 8-hr. time-weighed average:	0.5

*Fibers greater than 5 micrometers long with a 3:1 aspect ratio

Sampling Equipment: (mixed cellulose ester filter method)
A calibrated personal sampling pump plus 0.8 micrometer pore size mixed cellulose ester filter with a cellulose back-up pad mounted in an open 3-piece filter cassette (refer to Chapter VIII-Sampling for Particulates-Environmental Health Monitoring Manual).

The sampling tube is connected to the pump by means of flexible tubing with a stainless steel luer.

Sample Size:***

Sample Volume: 25.5 liters

Sample Rate: 1.7 liters per minute

Sample Time: 15 minutes

** The Emergency Standard was struck down by the courts; however, OSHA has proceeded with its development of a permanent Standard which we believe will be set at 0.5 fibers/cc or lower.

*** See Comments.

Interferences:
The presence of other fibrous material which "will be counted" as asbestos.

Sampling Procedure:

1. Assemble the filter, support pad, and cassette and close firmly to insure a good seal between the cassette edge and filter. Seal the cassette with a tape or shrinkable band.
2. Remove the cassette outlet plug, and attach to the pump with a stainless steel luer.
3. For personnel monitoring, clip the pump to the worker's belt and the cassette to the worker's lapel and remove the cassette top (creating an open-face cassette).
4. Set the pump flow rate at the calibrated rate by positioning the middle of the rotameter ball to the calibration mark. The pump flow rate should be checked and readjusted as needed.
5. Record the sampling time.
6. After sampling, replace the cassette top and insert the plug into the cassette outlet.
7. An appropriate number of blanks, properly labeled, should be sent with each batch of filters.

Shipping Instructions: The cassettes in which the samples are collected should be shipped to the Environmental Health Laboratory in a suitable container, such as a wooden box or plastic container, designed to prevent the cassettes from opening in transit.

Analytical Method:
Fiber count by phase contrast microscopy using 400 magnification following the clearing of the filter on a microscope slide.

Comments:

Since there is a ceiling level for asbestos exposure of 10 fibers (greater than 5 micrometers long with a 3:1 aspect ratio) per cubic centimeter, then 15-minute samples should be collected to determine if the ceiling level is exceeded.

Professional judgement should be used to determine the optimum sample size when monitoring for an 8-hour time-weighted average exposure to asbestos. Filter loading must be considered since asbestos counting depends on the ability to differentiate between dust particles and asbestos fibers. Air monitoring in relatively clean environments, such as offices and storerooms, can usually be conducted for 2-hour sampling periods without overloading the filter with dust. However, in dusty plant environments, filters may be overloaded by 1/2-hour sampling periods. Thus, the sampling time will vary depending on the background dust levels at the sampling location.

Care must be taken to assure that the filter is not contaminated during cassette assembly. Cassettes should only be assembled a clean environment. Industrial Hygiene Services recommends that all filter cassettes that are to be used for asbestos sampling be assembled by the Environmental Health Laboratory to avoid potential contamination. Therefore, clean cassettes must be submitted to the Environmental Health Laboratory with supports and numbered labels.

A properly completed request for analysis form should be sent with the asbestos samples giving both the sampling rate and time.

Note: Prior to air sampling, a bulk sample of the suspect material must be submitted to the Environmental Health Laboratory for bulk asbestos determination. Care should be taken to assure that the container for the bulk sample is properly sealed.

B. Medical Surveillance

The OSHA Standard further dictates that all employees exposed to airborne asbestos fibers, regardless of concentration, must be given annual medical examinations, including chest x-rays and pulmonary function tests. However, as pointed out earlier, asbestos is such a widespread substance that virtually everyone has some measureable exposure. OSHA has apparently come to understand this premise and under Program Directive 300-16 (October, 1978) has defined, for medical purposes, exposure to airborne asbestos fibers as a minimum of 0.1 asbestos fibers, longer than 5 micrometers, per cubic centimeter of air (i.e., 1 fiber per 10 cc). At U. S. Steel, we use this 0.1 fiber/cc exposure level to identify those employees to be included in the medical surveillance program. Separate guidelines detailing the medical surveillance procedures were previously sent to plant physicians by the Director of Industrial Medicine. A copy of these guidelines is also included in Appendix 1.

C. Controlling Employee Exposures to Asbestos Fibers

1) Substitution of Alternative Materials

Using "non-asbestos" materials on applications which previously used asbestos products is the first choice of controlling exposures since it eliminates the source of the hazard.

Some of the alternative materials that have found common usage as substitutes for asbestos include fiberglass, kaolin wool, ceramics, mineral wool and various plastic fibers. In certain individual applications, each of these has exhibited adequate tensile strength, heat resistance, flexibility and durability to satisfactorily perform functions previously served only by asbestos products. Some examples of "asbestos-free" materials being used at operations at U. S. Steel facilities include:

- the widespread use of ceramic fiber and kaolin wool as pipe insulation materials;

- non-asbestos mortar compounds for heat resistant cement applications;

- fiberglass and aramid fiber textile products, such as welding curtains and heat resistant clothing;

- various hot-top products at ingot teeming operations.

Although the use of asbestos is well entrenched in many important applications, it is likely that substitution will play an increasingly significant future role in reducing health hazards from asbestos.

2) Encapsulation

The mere presence of asbestos insulation materials does not constitute a health hazard. In this regard, it is not U. S. Steel's philosophy or intention that all asbestos insulation materials be torn out and replaced with alternative materials. However, once it is determined that such insulation has deteriorated to the point that fibers may be emitted into occupied areas, steps should be taken to control the hazard.

A feasible alternative to complete removal of asbestos insulation is encapsulation; i.e., treating the material with an acrylic or elastomeric polymer protective coating to seal the

AISI MEMBERS
ASBESTOS SUBSTITUTION EXPERIENCE

Application	Replacement Products	Comments
5. Entry-Exit Rolls Annealing Furnace (Contd.)	D. Water Cooled Steel Marinite (Johns-Manville)	Large cost savings. No labor problems due to asbestos handling and machining.
6. Tape Covering for Electrical Connectors and Rubber Hoses	A. Siltemp Wt. 36-10	
	.060" x 1.5" x 100' .060" x 2" x 100'	Satisfactory performance. Costs twice that of asbestos.
	B. Kaowool (2 in.)	Satisfactory performance.
	C. Refrasil	
	.015" x 1" x 280' 0.15" x 1.5" x 280'	Satisfactory performance.
	D. Southern Textile 300	
	1/32" x 1.5" x 100' 1/32" x 2" x 100' 1/16" x 1" x 100' 1/16" x 1.5" x 100' 1/16" x 2" x 100'	Satisfactory performance.
	E. Ceramic Cloth 60" x 1/2" (Allied Industries)	Performance and quality good. Life 85% that of asbestos. Fair performance in high heat zone.
	F. Glass Insulation Tape 1-1/2" wide 1" wide	Motor insulation. Thinner than asbestos tape; better quality and longer life expectancy.

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ASBESTOS SUBSTITUTION EXPERIENCE

Application	Replacement Products	Comments
4. Gasket Material (Contd.)	B. Garlock Blue-Gard	
	1/32 x 60 x 120 in. 1/16 x 60 x 120 in. 1/8 x 60 x 120 in.	Satisfactory performance.
	C. Armstrong Thermo-Tork	
	1/32 x 36 in. 1/16 x 36 in.	Satisfactory performance.
	D. Zentex 1200	
	E. Refrasil Blanket	
	F. Plibrico Blanket	
	G. Fiberfrax	
5. Entry-Exit Rolls Annealing Furnace	A. Kover-Kwick KKAF-29	Satisfactory performance. Costs twice that of asbestos.
	B. Stainless Steel Rolls	Satisfactory for non-finish application.
	C. American Metalizing - Stainless Steel Body Plasma Sprayed with magnesium-zironate	Experimental.

USX0000403

AISI MEMBERS
ASBESTOS SUBSTITUTION EXPERIENCE

Application	Replacement Products	Comments
3. Blankets and Curtains (Contd.)	3) Refrasil Cloth (HITCO)	Low abrasion resistance.
	G. "C-Lite" Welding Shield	Not as durable as asbestos.
	H. Promelt Reyfoil Welding Curtains	Not as durable as asbestos.
	I. White Pyrotex Safety Blanket 1-1/2", 2400°	For extreme heat.
	J. Nomex Cloth	Gets holes in it when used as an arc and heat shield.
	K. Zentex	
	L. Fiberfrax Paper	
	M. Calcium-Silicate Paper	
	N. Clear Plastic	
	O. Thermoglass	Satisfactory.
4. Gasket Material	A. Garlock 900	
	1/32 x 40 in. 1/16 x 40 in. 1/8 x 40 in.	Satisfactory performance for steam line flange gaskets.

AISI A. BERS
ASBESTOS SUBSTITUTION EXPERIENCE

Application	Replacement Products	Comments
2. Rope (Contd.)	G. Kaowool Rope 1/4" 3/8" 1/2"	Excellent performance as seal between top half (cope) and bottom half (drag) on foundry sand molds. (Always one-time use). Life expectancy same as asbestos. Coke oven door packing - performance varies. Life slightly longer than asbestos in some cases.
3. Blankets and Curtains	A. Siltemp 884 CH 36" x 50 yd.	Satisfactory performance. High heat resistance. Low abrasion resistance.
	B. Weldgard 200 40" x 50 yd.	Satisfactory performance. High abrasion resistance. Low heat resistance.
	C. Clean Gard #8940 40" x 50 yd.	Satisfactory.
	D. Fibreglass	Greater life expectancy than asbestos.
	E. Fiberfrax 1000 FW 35 (Carborundum)	
	F. Refrasil	
	1) UC 100-96 50 yds./roll 36" wide (HITCO)	Lasts longer than asbestos when used as flame curtains on bright anneal furnace. Fuzz separates from Refrasil and is deposited periodically on stainless pipe and tube with undesirable results.
	2) Irish Cloth 32" roll (HITCO)	Performs well, but lacks abrasion resistance.

AISI MEMBERS
ASBESTOS SUBSTITUTION EXPERIENCE

Application	Replacement Products	Comments
1. Protective Clothing (Contd.)	J. Leather/Wool Foundry Glove (Boss-Mfg.)	Good performance. Life expectancy similar to asbestos.
	K. Nomex Aluminized Mittens	
	L. KP105 Safeco Scarfers Mitts	
	M. Wool and Glass Leggings (Aluminized)	
	N. Kn634 Aluminized Hand Pads 8" x 12"	Hand protection.
	O. Nomex Duck Coat (Aluminized)	Melting operations.
2. Rope	A. Fiberfrax	Breaks up when heated.
	B. Thermo-Ceram	Adequate for caster bloom dummy heads.
	C. Paper Rope	
	D. Fibreglas	
	E. Dry Oakum	Works as well as asbestos rope for caster dummy bar head.
	F. Asbestos Free Custom Sealant	

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ASBESTOS SUBSTITUTION EXPERIENCE

Application	Replacement Products	Comments
1. Protective Clothing i.e. coats hoods aprons gloves	A. Kevlar	Usual life at least twice that of asbestos: 1) scarfing - gloves and aprons. 2) blast furnace cast house - coats. 3) welding - gloves. 4) sundry hot work - gloves and mitts.
	B. Thermobest (Kevlar-Arimid Fiber)	Same as Kevlar.
	C. Fiberglass Insulating Material	Satisfactory.
	D. Aluminized Fiberglass Coat	Satisfactory for light use.
	E. AB-L Gloves	Not for extreme heat.
	F. Aluminized Pre-Ox Coat	Unsatisfactory for clothing which must be flexible; i.e. coats, gloves. Satisfactory for aprons or blankets.
	G. Aluminized Rayon Gloves	
	H. Wool Coats	More durable than asbestos in some applications.
	I. Canvas Aprons	

AISI MEMBERS

ASBESTOS SUBSTITUTION EXPERIENCE

The attached table summarizes field trial experience for several AISI members. The listed information was exchanged by the AISI Manufacturing Committee participants.

Performance information is available as provided by participants.

It is hopeful that this information exchange will assist Operating Industrial Hygiene, Health and Safety personnel in finding suitable substitutes for specific asbestos applications.

APPENDIX 2

ASBESTOS SUBSTITUTE MATERIALS (AISI)

asbestos, should be removed from further exposure either through engineering means, or personal protective equipment (respirators, air masks, disposable clothing, etc.), or by removal from work in the exposure area.

7. Environmental monitoring - will be carried out by Industrial Hygiene Services (Corporate Headquarters or plants) according to requirements of the OSHA Asbestos Standard.

this response is due probably to exposures of many years past. Depending upon the pulmonary function finding, the risk of continued decrement is probably directly correlated to continued smoking especially if any continued exposure is properly handled by respiratory protection and is of very minimal, if any, monitored value. The Corporate Headquarters Environmental Health unit shall prescribe the approved manner of handling any continuing exposure. To be followed every year unless pulmonary function is decreased, then at shorter intervals if clinically indicated. Every effort should be made to get the individual to STOP SMOKING if he/she is a smoker. The risk of lung cancer in those with parenchymal infiltrate is up to sixteen (16) times the risk of a non-smoker with the same exposure and ninety (90) times that of a worker who is a non-smoker and not exposed to asbestos.

(c) Bilateral or unilateral pleural thickening or plaques due to asbestos exposure (with or without calcification). Should be advised that this response is the result of many years of low level of exposure. This also should not progress if the exposure has been eliminated or properly controlled by proper handling of asbestos and by respiratory protection if exposure continues. Depending upon the pulmonary function findings, the risk of continued decrement is directly correlated with continued smoking especially if any continued exposure is properly handled by respiratory protection and is of very minimal, if any, monitored value. The Corporate Headquarters Environmental Health unit shall prescribe the approved manner of handling any continuing exposure. To be followed yearly unless there is a decrement in pulmonary function, then at shorter intervals if clinically indicated. Every effort should be made to get the individual to STOP SMOKING if he/she is a smoker. The risk of lung cancer in those with bilateral pleural thickening or plaques is two and one half (2-1/2) times those without pleural reaction.

(d) Unilateral pleural thickening or plaques (with or without calcification) not the result of exposure to asbestos. Continue to follow on a yearly basis.

(e) Emphysema - if believed due to occupational exposure - follow yearly unless otherwise indicated or requested by employee. If believed to be nonoccupational, then referral to private physician, if appropriate - follow yearly.

(f) Normal - yearly follow-up.

(g) Those persons who have demonstrated radiologic changes in chest film, and who have been exposed to employee. Record on OSHA-200 Log as "Pleural thickening with asbestos exposure". This diagnosis is one of elimination from 5.(d). The language for OSHA-200 Log recording for (b) and (c) has been agreed upon in a meeting held October 1, 1980 of Personnel, Medical, Labor Relations, Safety & Environmental Health, Law, and Workers' Compensation & Casualty representatives.

(d) Unilateral pleural thickening or plaques with or without adequate history of asbestos exposure (with or without calcification) and with or without pulmonary decrements. The most likely explanation for the pleural thickening in this (a) group is one of the following: infection (pleural effusion) or hemorrhage, callous from rib fracture, radiation fibrosis, scleroderma, chronic mineral oil aspiration, metastatic disease, lymphoma, myeloma or a combination of these. DO NOT RECORD ON OSHA-200 LOG. Normal anatomical shadows - pectoral shadow area, extra pleural fat deposits, serratus and external oblique muscle shadows can usually be ruled out by the above mentioned (1.(b)) techniques.

(e) Pulmonary Function Decrement only - Emphysema. It is important to establish whether this is result of occupational exposure or is due to non-occupational origin. Differentiation between obstructive and restrictive disease must be made. Do not record on OSHA-200 Log unless occupationally related. Define cause if so recorded.

(f) Normal Chest - further follow-up testing failed to substantiate suspicions in original chest x-ray or pulmonary function tests. The role of smoking in any pulmonary function decrement must be carefully evaluated. Diffusing capacity determinations may be helpful in ruling out pulmonary fibrosis and probably should be done. In coke plants, the possibility of coalworkers pneumoconiosis with or without focal emphysema must always be ruled out.

6. Recommendations to the physician in discussing findings with the affected employees:

(a) All employees must be told of any positive findings found during his/her examination and the United States Steel physician evaluation (also consultant if used) of these findings. Recorded exposure levels should also be given to the employee. Because of proper handling of asbestos today, these environmental levels should ordinarily be helpful in allaying any fears of continued exposure to hazardous levels.

(b) Pulmonary infiltrate due to asbestos exposure with or without pleural reaction. Shall be advised that asbestos fibers home on their clothing; living (home) location (geographic) for proximity to asbestos mining or manufacturing plant; and play areas in relation to discarded wastes from asbestos factories. The Environmental Health unit (Corporate Headquarters or plants) will be helpful in evaluating the extent of work exposures.

3. The chest x-ray should be read by at least two United States Steel physicians or physicians selected by the plant physicians. Any positive chest x-ray shall be read by a "B" reader for confirmation of the findings. It is permissible to contract with a "B" reader to read all x-rays in this program. (A "B" reader is certified following successful completion of qualifying examination of 125 chest x-rays by NIOSH and the American College of Radiology.)

4. A clinical evaluation leading to a diagnosis and recommendations will be made.

   (a) Correlate all medical findings - history, physical findings, chest x-ray interpretation, pulmonary function results, and any other medical information - with the environmental exposure data.

   (b) Referral to a pulmonary specialist to assist in this evaluation may be done at the option of the plant medical director or other examining physician.

   (c) Referral of the chest x-ray to another "B" reader may occasionally be necessary for the proper interpretation of the x-ray.

5. The clinical evaluation will usually result in a diagnosis of one of the following, in descending order of importance:

   (a) Asbestosis - pulmonary infiltrate classified by I.L.O. System and documentation of exposure with or without pulmonary function decrements, and with or without pleural thickening or plaques (with or without calcification). Record on OSHA-200 Log as "Asbestosis".

   (b) Pleural thickening with a history of asbestos exposure - bilateral pleural thickening or plaques (with or without calcification) and with or without pulmonary function decrements. Without pulmonary function decrements, no need to refer unless requested by employee. Record on OSHA-200 Log as "Pleural thickening with asbestos exposure".

   (c) Pleural thickening with a history of asbestos exposure - unilateral pleural thickening or plaques (with or without calcification) and with or without pulmonary function decrements. Without pulmonary function decrement, no need to refer unless requested by

Appendix 1

GUIDELINES FOR MEDICAL SURVEILLANCE

ASBESTOS EXPOSURE

The following guidelines for medical surveillance shall be followed in all United States Steel Corporation operations whenever exposure to asbestos occurs.

1. All employees exposed to asbestos shall be provided (or made available) a comprehensive medical examination prior to first employment in an occupation exposed to airborne concentration of asbestos fibers. These medical examinations will be required for any 7-to-8-hour time-weighted average concentration of 0.1 fibers/cc, or for a greater concentration. (The OSHA Asbestos Standard permits this examination to occur within 30 calendar days of the first exposure.)

   Annually thereafter and within 30 calendar days before or after termination of employment in an occupation exposed to airborne concentration of asbestos fibers requiring a medical examination as designated above, a physical examination shall be provided or made available to these employees.

   Whenever pleural thickening is found on any routine chest x-ray on an individual who has had any airborne asbestos exposure, this individual shall be kept under yearly medical surveillance.

   The minimum components of the examination shall be:

   (a) A medical history, including a respiratory questionnaire to elicit symptomatology of respiratory disease.

   (b) A 14" x 17" chest x-ray - posterior - anterior view. Whenever there is evidence of pleural response, right and left oblique views and expiratory posterior - anterior view should be taken to confirm or rule out pleural findings.

   (c) Pulmonary Function testing to include forced vital capacity (FVC) and forced expiratory volume at 1 second (FEV_1).

2. A complete work history shall be taken on initial assignment to an occupation where exposure to airborne concentration of asbestos fibers will occur. This is particularly important if changes in the chest x-ray begin to occur. The work history will include all work experiences in United States Steel and other non-United States Steel work experiences to determine extent of exposure to asbestos. In order to be complete, military exposures; i.e., ship and shipyard exposures; hobbies; exposures of family members (father, brothers, grandfathers, mother, sisters, etc.) who might have brought

APPENDIX 1

GUIDELINES FOR MEDICAL SURVEILLANCE OF ASBESTOS EXPOSURE

- health effects associated with asbestos exposure;
- relationship between asbestos exposure and smoking;
- the nature of operations that could result in exposure;
- the protective steps being taken by the company to minimize exposure;
- the purpose, proper use, fitting instructions and limitations of respirators;
- review of provisions covered in 29 CFR 1910.1001.

It is mututally beneficial to the workers and the Corporation to develop and implement an education and training policy regarding exposure to asbestos. The goals of the program, in addition to the OSHA requirements, should be to increase the employees' knowledge of:

- the nature of the asbestos hazard;
- work processes involving asbestos and the potential for fiber emissions;
- the concept of "risk";
- environmental monitoring procedures and objectives;
- the purpose and nature of engineering and work practice controls;
- the application of decontamination and waste disposal practices;
- the elements of the medical surveillance program and the reasons for it.

It is strongly recommended that all potentially exposed personnel be included in any education program. Well-informed supervisors can personify Management's concern and insistence that operations involving the use and handling of asbestos products be conducted in a safe and healthful manner.

9) Waste Disposal

Asbestos waste such as rejects, scrap, shavings and other debris should be accumulated separately from other refuse. It should be placed in plastic bags or some other impermeable container which should then be sealed shut, labeled as to the contents and hazard, and disposed of in accordance with applicable Federal and state regulations. Local haulers contracted to dispose of this material must be informed that the waste products contain asbestos. Warning labels should state the following:

CAUTION

CONTAINS ASBESTOS FIBERS

AVOID CREATING DUST

BREATHING ASBESTOS DUST MAY CAUSE

SERIOUS BODILY HARM

10) Removal of Insulation Materials

At U. S. Steel, the greatest potential for high exposures to asbestos is the removal of deteriorating insulation materials, such as pipe coverings. It is, therefore, especially important that a hazard control program be implemented to protect employees involved in this operation from the effects of asbestos dust exposure. Particular attention is directed to provisions listed under Part III of this document pertaining to exposure monitoring, medical surveillance, employee training, isolation and restriction of area, work practices to minimize dust generation, housekeeping, personal protective equipment, personal hygiene and waste disposal.

D. Education

Employees will be more apt to cooperate with Management's attempts to control their exposures to toxic substances if they are made aware of the nature of the hazard and its consequences. The OSHA regulation requires that the following be included as a part of the training program:

Tyvek is a durable spunbonded olefin with high tensile/tear strength, chemically resistant, and due to a relatively slick surface, it does not tend to entrap particles. A vacuum cleaner should be used to remove loose fibers adhering to contaminated work clothing. Employees should not attempt to dislodge these fibers by brushing them off nor by using compressed air. In addition, respirators should continue to be worn until contaminated work clothing is removed. Contaminated disposable clothing and respirator filters should be placed in impermeable containers and disposed of in accordance with the provisions of Section III.C.9.

ii) <u>Protective Clothing Made of Asbestos Material</u>

Occasionally, employees working in areas of high radiant heat, those who are exposed to molten metal or weld splatter or those who have to handle hot objects or tools are required to wear heat-resistant clothing. Asbestos-free heat-resistant clothing should be selected from the "approved alternates" that are listed in correspondence from the Manager of Safety to Holders of USS Health Services Approved Protective Apparel and Equipment Manual, June 16, 1983. The subject of this correspondence is "Stop Order on Purchasing Asbestos Protective Garments".

8) <u>Personal Hygiene</u>

Employees should be instructed to wash their hands, face and forearms prior to eating, drinking or smoking. The wearing of contaminated work clothing in employee lunchrooms should be prohibited.

b. Protective Clothing

In regard to asbestos, it is important to consider protective clothing in two ways. First, it may be necessary to provide special clothing to employees who are required to handle asbestos to prevent work clothing from becoming contaminated with the fibers. In this instance, protective clothing is a control measure to protect not only the worker but also family members who may be exposed to dust carried home on his work clothing. Second, some protective clothing articles, intended to provide thermal protection for those in close proximity to high radiant heat sources, were made from asbestos materials. Reports in the literature indicate that this type of clothing, through gradual deterioration with use, is actually a source of asbestos exposure to workers. To eliminate this source of potential exposure, the purchase and usage of garments containing asbestos by USSC employees is prohibited.

1) Protective Clothing as a Control Measure

When employee asbestos exposures exceed a "ceiling limit" of 10 fibers/cc, the OSHA Asbestos Standard requires employers to provide "special clothing" (coveralls, head coverings, gloves and foot coverings), change rooms with two lockers (one for the employee's street clothes and one for his contaminated work clothes), transportation of contaminated clothing in sealed impermeable bags or containers, and laundering facilities. The necessity of complying with some of these provisions can be eliminated by issuing employees disposable protective garments. Disposables may include hard hat liners, coveralls and shoe liners. The coverall garment should be without pockets or cuffs. A good example is DuPont's Tyvek protective garments.

well as the concentration of airborne asbestos fibers. With fiber concentrations less than 10 times the permissible exposure levels, a properly fitted air purifying dust respirator will provide sufficient protection. The type of respirator selected should be specifically approved by NIOSH for protection against dusts containing asbestos. It should be noted, however, that disposable-type respirators are not permitted within U. S. Steel for protection against asbestos.

When the fiber contamination level is between 10 and 100 times the permissible exposure level, powered air purifying respirators should be worn. If exposures exceed 100 times the acceptable limits, a type "C" continuous flow, supplied air respirator or pressure-demand, self-contained breathing unit should be worn.

Respirator wearers should be instructed to wash the masks, and change filters, where applicable, daily. Proper fitting instructions and fit testing must also be given. When respirators are issued, it is important to comply with the appropriate regulations governing the use of respiratory protection. For those facilities under OSHA jurisdiction, these regulations are stated in 29 CFR 1910.134. MSHA requires a respirator program consistent with the provisions of ANSI Z88.2-1980.

Table 1

Respiratory Protection for Airborne Concentrations of Asbestos

Airborne Concentration of Asbestos (TWA)	Required Respirator[1]
Not in excess of 5 f/cc (10 X PEL)	Reusable air purifying respirator
Not in excess of 50 f/cc (100 X PEL)	Full facepiece air purifying respirator, or a powered air purifying respirator
Greater than 50 f/cc	A type "C" continuous flow or pressure demand, supplied air respirator

[1]Respirators specified for high concentrations may be used at lower concentrations of asbestos.

6) Housekeeping

Good housekeeping practices are essential to maintain low levels of airborne asbestos fibers. Dust on floors, ledges, equipment and workbenches may become airborne when disturbed by work activity, air movement, or vehicular traffic. Dry sweeping should be prohibited in areas where asbestos is used because it merely redisperses the fine fibers into the workroom air. The use of compressed air to clean up asbestos debris should be strictly forbidden. Instead, vacuum cleaning is the preferred method of removing dust accumulations.

7) Personal Protection

The control measures previously discussed under this section should always be the primary means of minimizing employee exposure to asbestos fibers. If, however, these measures are not sufficient, or if some specific operations are not amenable to such control, the use of personal protective equipment will be necessary. While respirators and protective clothing should always be available, it must be understood they serve only as a complement to, not as a replacement for, engineering and work practice control measures.

a. Respirators

Respirators may be necessary to control asbestos exposures in some instances, such as the removal of thermal pipe insulation. Since these devices place a burden on the respiration of the worker, it must first be determined whether the wearer can use the equipment and still perform the assigned task. In such a determination, consideration should be given to: the physical condition of the worker, such as possible pulmonary or cardiovascular impairment; the physiological demands of the task, such as required oxygen uptake; and the presence of facial hair which may negate an effective respirator seal.

The type of respirator needed will be dictated by the preceding factors as roped off. Warning signs should be posted to alert employees to the potential hazard. In some applications, the work area may have to be sealed to prevent exposure to nearby employees or contamination of adjacent areas.

5) Work Practices

Changes in work practices may often be the most cost-effective way of reducing occupational exposure to asbestos. When conducting an operation which involves the handling of asbestos materials, consideration should be given to performing the task in such a manner that the emission of asbestos fibers into the air will be minimized. Some of the ways in which work practices may be modified include:

- the use of a slow band saw or hand saw in lieu of a high-speed circular table saw to cut Transite asbestos board;

- thoroughly wetting asbestos materials prior to use - such as immersing a coil of asbestos rope in water prior to applying it as a sealant around furnace or oven doors; asbestos insulation materials should be thoroughly wetted prior to removal whenever conditions permit such application;

- the purchase of pre-cut and pre-drilled materials, such as brake shoe lining containing asbestos;

- using a vacuum cleaner instead of a compressed air hose to remove dust residue from mobile equipment brakes during inspection and repair operations;

- removing asbestos insulation in as large a section as possible to minimize the amount of fracturing;

- using hand tools, such as chisels or knives, rather than power tools or saw, to cut and remove asbestos insulation.

fibers in place and prevent further deterioration. Although each case must be considered on an individual basis, encapsulation can often be a preferable solution because it generally costs much less, does not cause long-term disruption of operations, and does not require the intensive decontamination efforts necessitated by complete removal. Examples of these asbestos containment treatments are Hydro-ban by KRC Corporation and Asbestos Guard Fiber Fix (719) by U. S. Coatings Collaborative, Inc.

Raybestos Manhattan has developed a product called Novatex which is an asbestos textile encapsulated with an acrylic resin. A neoprene coating may give additional protection. Novatex cloth can be used for welding curtains, insulation applications, and for aluminized and non-aluminized protective bodywear.

3) Exhaust Ventilation

Any operation which may conceivably generate airborne asbestos dust concentrations in excess of permissible exposure limits should be provided with local exhaust ventilation. Where such ventilation is used, the exhaust hood should be located as close as possible to the point of dust generation to achieve maximum capture of the released fibers. Examples of operations where local exhaust ventilation may be employed include the mixing of asbestos mortar compounds and the use of saws, drills and grinders on asbestos materials.

4) Isolation and Restriction of Area

Operations which have the potential to generate high concentrations of airborne fibers should be isolated to the extent feasible to minimize human exposure to the fibers. The removal or teardown of asbestos pipe insulation is an example of this type of operation. The vicinity of an asbestos removal operation should be designated as a restricted area, thus denying access to employees whose presence is not required. As a minimum, such areas should be

AISI MBERS
ASBESTOS SUBSTITUTION EXPERIENCE

Application	Replacement Products	Comments
6. Tape Covering for Electrical Connectors and Rubber Hoses (Contd.)	G. Zentex	
	H. Thermo-Sil	
	1-1/2" x 1/8" x 100' (Garlock Inc.)	Good substitute.
	I. #3158 Gilt Edge Fiberglass Tape (MG-453-6	Replaces asbestos woven tape for insulating D.C. motor armatures.
7. Bright Anneal Furnace		
A. Entry Seal	A. Pre-Ox	Experimental, twice the cost of asbestos.
B. Exit Seal	B. Pyrotex Fiberglass V3A	Experimental.
8. Hot Pipe Covering	A. Fiberglass Forms	Satisfactory performance.
	B. Owens-Corning Fiberglass	Satisfactory performance.
	C. Microlock 650 (Johns-Manville)	
	1/2" diameter 2" diameter 4" diameter 8" diameter	Excellent material.
	D. Thermo 12 (Johns-Manville)	Satisfactory performance.
9. Brake Shoes	A. Glass (F. B. Wright)	Experimental.

USX0000405

AISI MEMBERS
ASBESTOS SUBSTITUTION EXPERIENCE

Application	Replacement Products	Comments
9. Brake Shoes (Contd.)	B. Woven Brake Fiber	Experimental.
	C. Scan-Pak Milwaukee, IL	Satisfactory performance.
10. Braided Tubing	A. Fiberfrax Tubing (1 HP 126) (Carborundum Corp.)	Used for daming flux during submerged arc welding operations. 75% of the life of asbestos. Performance and quality good.
11. Protection of Launder Scope During Tapping of Furnace	Rsowool Sleeve 6" diameter	Performance satisfactory. Life 1/2 that of asbestos.
12. Protection of Stopper Rod and Gooseneck Threads on Ladels During Pouring	Cerablanket (6PCF) 1/4" thick (Johns-Manville)	Performance satisfactory, life 1/10 that of asbestos.
13. Tundish Liner and Caster Mold Cover	Ceraform (Johns-Manville)	Experimental
4. Protection of Machined Holes During Heat Treat Operations	Fiberfrax LDS Moldable (Carborundum Corp.) 24-11 oz, Tubes	Applied with caulking gun. One time use only.

USX0000406

AISI   4BERS
ASBESTOS SUBSTITUTION EXPERIENCE

Application	Replacement Products	Comments
5. Filter Pads for Manganese (Bismuthate Method) and Mixed with Motar for use as a Refractory Insulation for Electric Lab Furnaces (High Temp.)	Glass Fiber Paper	
6. Insulation	A. Kaowool (Babcock & Wilcox)	Covering for slab transfer railroad cars. Easier to work with than asbestos.
	1" x 24" x 300	
	B. Superrex Block Insulation	Various applications.
	C. #210 Block Insulation	Various applications.
	D. Staz-on Insulation	Various applications.
	E. Mineral Fiber Coating	Various applications.
	F. Fireated Tiles?	Ceiling tiles.
	2' x 4'	
	G. Plibrico Bulk Fiber	Furnace Insulation.
7. Glue	Plibrico Drum Fiber Stick	

USX0000407

AISI MEMBERS
ASBESTOS SUBSTITUTION EXPERIENCE

Application	Replacement Products	Comments
18. Wipes	Kevlar	Wipes for sheet galvanizing unit.
19. Babbitt Mud	A. Babbitt Rite	Ready made.
	B. Pyromite	Ready made.

APPENDIX 3

Part A

ASBESTOS SUBSTITUTES - (USS)

LITERATURE SEARCH

Literature 'earch 3-A

ASBESTOS SUBSTITUTES

Application	Replacement Products	Replacement Product Cost	Comments
Protective Clothing, i.e., coats hoods aprons gloves	A. Kevlar	$3.04/sq. ft. before manufacturing	Usual life at least twice that of asbestos in all applications including: 1.) Scarfing - gloves and aprons 2.) Blast Furnace Cast House - coats 3.) Welding - gloves 4.) Sundry Hot Work - gloves and mitts
	B. Thermobest (Kevlar - Arimid Fiber)	$18.87/yd. before manufacturing	
Rope	A. Fiberfrax (Carborundum)		Breaks up when heated.
	B. Kaowool		Coke oven door packing - life slightly longer than asbestos in some cases.
	C. Thermo-Ceram		Adequate for caster bloom heads.
Blankets and Curtains	A. Siltemp # 84 ch 36 in. x 50 yd.	$10.80/yd.	Satisfactory performance. High heat resistance. Low abrasion resistance.
	B. Weldgard 200 40 in. x 50 yd.	$10.46/yd.	Satisfactory performance. High abrasion resistance. Low abrasion resistance.
	C. Clean Gard #8940 40 in. x 50 yd.	$ 2.50/ft.	Satisfactory.
Gasket Material	A. Garlock 900 1/32 x 40 in.	$ 1.18/lb.	Satisfactory performance for steam line flange gaskets.
	1/16 x 40 in.	$ 1.13/lb.	
	1/8 x 40 in.	$ 1.75/lb.	

ASBESTOS SUBSTITUTES

Application	Replacement Products	Replacement Product Cost	Comments
4. Gasket Material (Cont'd.)	B. Garlock Blue-Gard 1/32 x 60 x 120 in.	$ 53.90/roll	Satisfactory performance.
	1/16 x 60 x 120 in.	$ 89.84/roll	
	1/8 x 60 x 120 in.	$179.70/roll	
	C. Armstrong Thermo-Tork 1/32 x 36 in.	$ 4.80/lb.	Satisfactory performance.
	1/16 x 36 in.	$ 8.76/lb.	
5. Entry-Exit Rolls Annealing Furnace	A. Kover-Kwick KKAF-29		Satisfactory performance. Costs twice that of asbestos.
	B. Stainless Steel Rolls		Satisfactory for non-finish application.
	C. American Metalizing Stainless Steel Body Plasma sprayed with magnesium-zirconate		Experimental.
6. Tape Covering for Electrical Connectors and Rubber Hoses	A. Siltemp Wt. 36-10 .060" x 1.5" x 100' .060" x 2" x 100'	$ 1.15/ft. $ 1.20/ft.	Satisfactory performance. Costs twice that of asbestos.

ASBESTOS SUBSTITUTES

Application	Replacement Products	Replacement Product Cost	Comments
	B. Kaowool (2 in.)		Satisfactory performance.
	C. Refrasil .019" x 1" x 200' 0.15" x 1.5" x 200'	 $ .35/ft $ .36/ft	Satisfactory performance.
	D. Southern Textile 300		
	1/32" x 1.5" x 100'	$ 10.54/roll	Satisfactory performance.
	1/32" x 2" x 100'	$ 12.40/roll	
	1/16" x 1" x 100'	$ 9.78/roll	
	1/16" x 1.5" x 100'	$ 13.64/roll	
	1/16" x 2" x 100'	$ 16.43/roll	
7. Bright Anneal Furnace A. Entry Seal	A. Pre-Ox (aluminum backed)		Experimental. Twice the cost of asbestos.
B. Exit Seal	B. Pyrotex Fiberglass V 3A		Experimental.
8. Hot Pipe Covering	A. Fiberglass Forms		Satisfactory performance.
9. Brake Shoes	A. Glass F.B. Wright		Experimental.
	B. Woven Brake Fiber		Experimental.

USX0000412

APPENDIX 3

Part B

ASBESTOS SUBSTITUTES

USS PLANT SURVEY (1972)

Appendix 3-B

ELIMINATION OF USE OF ASBESTOS - USS

In 1972, the Federal Government published a proposed standard for employee exposure to asbestos dust. At that time, we made a survey of the products in our plants which contained asbestos.

From that survey, a program was begun to consider replacing asbestos-containing items with alternative products. The following is a listing of the replacement products we are now using:

Asbestos Product	Cost	Replacement Product	Cost	Comments
Asbestos Gloves	$8.44 pr.	Aluminized gloves Nor-fab 400 -22 oz. Nor-fab 900 -24 oz.	-	Corporation approved
		Alum/leather Alum/PFR rayon	-	" "
Asbestos Gloves	-	AB-L gloves, aluminized back	$14.18 pr.	Not for extreme heat
Asbestos Gloves	-	AB gloves, aluminized back, heat resistant leather palms	$10.70 pr.	Not for extreme heat
Asbestos Cloth Welding Shield	$47.00	"C-Lite" welding shield	$46.80 ea.	Not as durable as asbestos curtain
		Fromelt Rey-foil welding curtains	$33.00 ea.	" "

Asbestos Product	Cost	Replacement Product	Cost	Comments
Asbestos Welding Blankets	$37.00	White Pyrotex safety blanket 1-1/2", 2400^{O}	$320.00 ea.	For extreme heat
Asbestos Cloth Heat Shield	$6.70 sq.yd.	Sil-Temp	$16.00 sq.yd.	Good protection from heat, low strength
Asbestos Cloth to Wrap Hoses on Electric Furnaces	$6.70 sq.yd.	Sil-Temp	$16.00 sq.yd.	Not fully satisfactory
Aluminized Asbestos Coats	$140.00 ea.	Aluminized Pre-Ox Coat Nor-fab 400 -19 oz. Nor-fab 900 -16 oz.	-	Approved for Corporation use for molten metal exposure
		Alum/PFR Rayon -19 oz. Alum/Core Spun	-	" "
Asbestos Steam Line Insulation	N/A	Fiberglass steam line insulation	$2.63 per 3' length for 3/4" pipe	Satisfactory
Transite Board	-	-	-	No suitable replacement
Asbestos Brake Lining	-	-	-	No suitable replacement

USX0000415

MATERIAL	PRODUCT (MANUFACTURER)	COMMENTS
I. Thermal Insulation		
Blankets/Curtains	Fabrasil (Hitco)	Best tried to date, in respect to price and durability. Fibres do not block so we get good user acceptance. Resists heat to 1000° F. Costs $13.25/sq. yd. (50-yd. roll).
	Refrasil (Hitco)	Expensive but a good material. Resists heat to 3100° F. Costs $46.00/sq. yd.
	Pyrotex Zetex (Hitco) Raytex	Will not withstand abrasive wear or rough handling. Fibres block when handled causing skin irritation. Poor user acceptance. Resists heat to 1100° F. Costs $30.00/sq. yd.
	Kaowool (Babcock & Wilcox)	Good for wrapping pipes. Cheap. $1.35/sq. yd. Comes in large rolls found in Boiler Shop.
	Fiberfrax (Carborundum)	Used in different departments. Has very good strength and can withstand temperatures to 1427° C. (2600° F.).
Gloves/Mitts	Kevlar (DuPont)	Comfortable, good heat resistance to about 600° F. Superior resistance to curling. Found to be bulky. Not very good beyond 500° F. Some complaint about breakdown of "glass" fibres? Not suitable for molten metal exposures.

MATERIAL	PRODUCT (MANUFACTURER)	COMMENTS
Gloves/Mitts (Contd.)	Zetex (Newtex)	Testurized silica. Mitt is still on trial in various departments. Complaint--being glass based, it is extremely itchy. Complaint--fumes arising from gloves when applied to hot material.
		"Boiler Shop appears to like this mitten." Costs $17.00.
	Nor-fab 400 Nor-fab 900	Soft, not itchy to the hand, has excellent abrasion resistance. Does not "fracture" when bent. Comment has been made that it stands up well to heat.
	Leather	Used for welding glove. Good up to about 800° F., then dries out and quickly hardens. Still looking for suitable substitute.
	Pyrotex (Kulka-Hamilton)	Hot metal handling mitt. Proved to be a satisfactory substitute for asbestos mitts. Withstands heat to 1100° F. and costs about $31.00 (pr.). Presently being used in the Boiler Shop and may be expanded to other departments for tests.
		Aluminized asbestos--thin therocell lining backed with double-tanned chrome leather. This has been found very satisfactory and outlasts present gloves used in steelmaking. Costs $23.00.

USX0000417

MATERIAL	PRODUCT (MANUFACTURER)	COMMENTS
<u>Coats</u>	Pre-Ox (Gentex)	Polyacrylonitrile fibre stabilized with Neoprene offers superior splash resistance. Coat is not durable at cost of \$210.00. Life is 4-6 weeks. Also found aluminum cracking and fabric shedding.
	Aluminized PFR Rayon Nor-fab 400-19 oz. Nor-fab 900-16 oz.	Approved for Corporation use.
	Kevlar (DuPont)	Suitable up to temperatures around 600° F. Very expensive--\$300.00.
<u>Spats(Leggings)</u>	<u>Spats</u>: Chrome Leather; Wool with Leather Flare; PFR Canvas Duck <u>Leggings</u>: Chrome Leather; Alum/PFR Rayon; Alum/Nor-fab 400; Alum/Nor-fab 900	Corporation approved.
<u>Pipe Lagging</u>	Thermo "12" (Johns-Manville)	Calcium silicate material. Presently it is replacing all asbestos at this time. Problem area--"loose glass fibres". A new product known as "K-Carb" from England is being investigated as a possible replacement for "Thermo 12". Very little is known other than the product is carbon based and can withstand temperatures to 2000° C.
<u>Tubes and Sleeves</u>	Fabrasil (Hitco) Refrasil (Hitco)	These materials, which were mentioned earlier as replacements for asbestos blankets, also look promising as replacements for tubes and sleeves. As far as we can determine, this material is still being investigated.

MATERIAL	PRODUCT (MANUFACTURER)	COMMENTS
Furnaces	Fiberfrax (Carborundum)	Appears to be a very popular replacement for asbestos. Being used around the furnace doors. Comments from the mills indicate that this material is ideal.
Millboard	Fiberfrax (Carborundum)	Product seems to do the job. Waiting for further results.
Hot Top	No suitable substitutes at this time.	
II. Gaskets-Spacer-Packing		
Gaskets	At present, no suitable gasket substitute has been found. Problem area!	Possible substitutes: 1) S.I.R. Gasket (Chemplast, Inc.) This material is a stainless insert reinforced gasket of Teflon. Appears to work good against corrosion. More information is needed. 2) Garlock Blue-Gard. (Cold Industries) Waiting for information.
Braided Packing	Braided Kevlar #5200 (Garlock)	This is a new material being tested at the Boiler Shop. Presently being evaluated for medium heat applications. Up to 500° C. Costs $31.05. From indications so far, they are happy with this material.
Steampacking	No substitutes yet.	They have tried Teflon base packing but does not meet our temperature demands.

MATERIAL	PRODUCT (MANUFACTURER)	COMMENTS
Rope Packing	Kaowool (Babcock & Wilcox)	Used extensively by utilities due to the cost of this material, which is approximately $1.35. This material is economical and appears to be doing a good job in this area. Complaint--some departments find this material as being an irritant.
	Thermo-Ceram (Garlock)	This is a new material which has been used for several months as gland packing on the oxygen inlet on fce. lances (oxy. roof lance). This application has proved satisfactory. The material resists heat to 2300° F., and the cost is $33.25/lb. Cost per lance--$5.75 (asbestos rope--$3.25).
Paper	Refrasil (Hitco)	Not strong enough for certain applications.
	Cerafelt	This material was found to be an irritant.
	Fiberfrax 440 (Carborundum)	This material is being tested at the Boiler Shop. No comment at this time.
III. Friction Products		
Brake Shoes Cranes/Hoists/Derricks Clutch Facings	To date no suitable substitutes have been found.	
Coating Wipes	Kevlar (DuPont)	We have successfully replaced the use of asbestos wipes on our galvanized units. It is an extremely strong fibre, expensive, but the life is excellent.

USX0000420

MATERIAL	PRODUCT (MANUFACTURER)	COMMENTS
IV. Pollution Control		
Baghouse Filters	Alpha Floc	This is a cellulose fibre with a life span of two years. The material cracks easily. Not regarded as a replacement.
V. Electrical Products		
Wire Control Boards	To date all electrical insulation is being replaced with a high-temperature plastic or Teflon material. This material makes a satisfactory replacement.	
Tape	Refrasil (Hitco)	The tape has the strength properties required and appears to be quite successful. Most of the tape in our departments have been switched to this material. Costs $2.00/ft. Can be obtained in many sizes.
VI. Welding Electrodes	?Switched from asbestos to wood fibres?	
VII. Chemically Resistant Materials		
Cement Asbestos Plastic Asbestos	Teflon	Very little information at this time.

USX0000421

Appendix J-B
Asbestos Substitutes - USS

Asbestos Products	Cost of Asbestos	Substitute Material Manufacturer or Supplier	Cost of Substitute Material	Comments on Performance, Quality, Life Expectancy, Etc. of Substitute Material
Asbestos Rope	Cost Not Obtained	Fiberfrax rope, paper rope	Cost Not Obtained	Blast furnaces, coke oven door, pit recuperator, concast - dummy bar heads
Asbestos Tape	•	Zetex tape Refrasil tape Fiberglass tape	•	Concast - dummy bar rails Ironmaking - mudgun cables and motor connections
Asbestos Gasket Material & Rollboard	•	Sub Zetex 1200 fire blankets Refrasil blanket Plibrico blanket Fiberfrax	•	Burning, welding protection, furnaces, foundry, skirtblocks, 44" pits, false doors, recuperator plates, door frames, coke ovens, plant security
Flintguard H100-40	•	Suitable substitute not yet found	•	Insulating valves and pumps
Asbestos Paper and Cloth	•	Zetex blanket material Fiberfrax paper	•	Welds, asbestos sleeves, slab caster, skirtblocks, coke oven doors
Brake Shoes	•	Suitable substitute not yet found	•	Cranes, hoists, mobile equipment, clutches
Glue containing asbestos	•	Plibrico drum fiber stick	•	Fiber glueing

USX0000422

Appendix J-B
Asbestos Substitutes - USS

Asbestos Products	Cost of Asbestos	Substitute Material Manufacturer or Supplier	Cost of Substitute Material	Comments on Performance, Quality, Life Expectancy, Etc. of Substitute Material
Nickelclad Ni ~~Temp-~~ stranded wire	*	Suitable substitute not yet found	*	Electrical uses
Aluminized Asbestos Coats	*	Aluminized wool and aluminized rayon coats	*	Hot metal splash protection
Ceiling Tiles	*	2' x 4' fireated tiles	*	Ceilings
Curtains	*	Clear plastic curtains for sound	*	Heat and sound barriers
Personal Prot. Equipment Aluminized splash coat - used to protect pouring crews and strand cast workers.	$123.00	Aluminized rayon coat Delaware Valley Safeguards Leiss Road, off Rt. 183, R.D. #1 Leesport, Pa. 19533	$115.79	This garment replaced asbestos because of weight, durability, and quality, life expectancy about equal.
Aluminized Hood	$ 44.00	Aluminized Rayon Hood Delaware Valley Safeguards	$ 31.79	Same Comment as splash coat.
Aluminized Sleeves	$ 16.00	Cape Jackets Delaware Valley Safeguards	Went to Cape Jackets $ 67.38	Did away with sleeves - due to minimal use.
Aluminized Gloves	$ 24.00	NorFab Gloves Delaware Valley Safeguards	$ 23.90	Gloves, mittens, cape jackets, and aprons all perform similar to the asbestos products.

USX0000423

Appendix J-B
Asbestos Substitutes - USS

Asbestos Products	Cost of Asbestos	Substitute Material Manufacturer or Supplier	Cost of Substitute Material	Comments on Performance, Quality, Life Expectancy, Etc. of Substitute Material
Insulation	*	8210 block insulation Mineral fiber coating. Stas-on insulation Superex block insulation	*	Pit floors, fill for reheat furnace uprights, engine exhaust, crane cabs, pits, coke oven doors, bulkheads; blast furnace stoves, soaking pit walls, reheat furnace
Asbestos Fiber	*	Fiberfrax bulk fiber	*	Furnace insulation
8" x 12" A632 DEI	*	8" x 12" Rn634 aluminized hand pads	*	Hand protection at bar shears
Expansion ring on stopper	*	Phased out by sliding gates	*	01 B.O.S.P. ladles
Asbestos Mitts	*	Sub Kevlar gloves	*	Hand protection
Asbestos Gloves	*	Aluminized rayon gloves	*	Hand protection
TD2680 Safeco Asbestos Backed Mitts	*	RP105 Safeco scarfer's mitts	*	Hand protection, scarfing
Safteo/Ferrox Non Skid Coating	*	Suitable substitute not yet found	*	Floor covering
Asbestos Sheets - Compressed Styles 900, 7735, 7021, Transite	*	Suitable substitute not yet found	*	Electrical uses
TD191 863012 Asbestos Spat	*	Aluminized wool spats	*	Ankle protection

USX0000424

Appendix J-B
Asbestos Substitutes - USS

Asbestos Products	Cost of Asbestos	Substitute Material Manufacturer or Supplier	Cost of Substitute Material	Comments on Performance, Quality, Life Expectancy, Etc. of Substitute Material
Nickelclad Al Temp-stranded Wire	*	Suitable substitute not yet found	*	Electrical uses
Aluminized Asbestos Coats	*	Aluminized wool and aluminized rayon coats	*	Hot metal splash protection
Ceiling Tiles	*	2' x 4' fibrated tiles	*	Ceilings
Curtains	*	Clear plastic curtains for sound	*	Heat and sound barriers
Personal Prot. Equipment Aluminized splash coat - used to protect pouring crews and strand cast workers.	$123.00	Aluminized rayon coat Delaware Valley Safeguards Leiss Road, off Rt. 183, R.D. #1 Leesport, Pa. 19533	$115.79	This garment replaced asbestos because of weight, durability, and quality, life expectancy about equal.
Aluminized Hood	$ 44.00	Aluminized Rayon Hood Delaware Valley Safeguards	$ 51.79	Same Comment as splash coat.
Aluminized Sleeves	$ 16.00	Cape Jackets Delaware Valley Safeguards	Went to Cape Jackets $ 67.38	Did away with sleeves - due to minimal use.
Aluminized Gloves	$ 24.00	NorFab Gloves Delaware Valley Safeguards	$ 23.90	Gloves, mittens, cape jackets, and aprons all perform similar to the asbestos products.

Appendix 3-B
Asbestos Substitutes - USS

Asbestos Products	Cost of Asbestos	Substitute Material Manufacturer or Supplier	Cost of Substitute Material	Comments on Performance, Quality, Life Expectancy, Etc. of Substitute Material
Asbestos Blow-cool Blankets Used for clad packs	Not available N/A at time of survey.	Fiberglass Lagging Fabric Pecor-1900 N. 6th Street Philadelphia, Pa.	N/A	Fiberglass blankets do not hold the heat as well as asbestos.
Pipe Insulation	N/A	Fiberglass Insulation Certainteed Corp. Valley Forge, Pa.	Varies according to diameter, examples 1/2" 504 ft. Cost $667.00 3/4" 504 ft. Cost $470.00 3" 1000 ft. Cost $1600.00	Fiberglass, although purchase price is higher than asbestos overall cost, is lower because it is less time and labor consuming.
Asbestos to patch furnaces and pits Trialed on Stick-Tite asbestos.	N/A	Rae-Wool Babcox and Wilcox 150 Strafford Ave. Wayne, Pa. 19087	Varies according to density. 4" density 1.02 sq. ft. 6" density .72 sq. ft.	Easier to work with. Much easier to apply, can be cut to exact size.
		Cerwool C-E Refractories Valley Forge, Pa.	.89 square ft.	Similar to Rae-wool, comes in wider sizes than Rae-wool.
		Monoblock-Block Insulation Michael Creed, Inc. Medford, New Jersey	.81 a board ft.	
Asbestos-used to wrap cylinders, plungers, etc. before welding, to protect against weld splatter.	N/A	Siltemp Protective Material E. R. Joseph Norristown, Pa.	$ 14.90 a yard	Much easier to drape over materials.
Asbestos - used for verto-matic welder, L.W. #1.	N/A	Sticktite Refractory Material-C.E. Refractories Valley Forge, Pa.	N/A	Substitute product performs as well, if not better, than asbestos.

Appendix 3-B
Asbestos Substitutes - USS

Asbestos Products	Cost of Asbestos	Substitute Material Manufacturer or Supplier	Cost of Substitute Material	Comments on Performance, Quality, Life Expectancy, Etc. of Substitute Material
Garlock Packing #234	6.30/lb.	Garlock SynthePak (non-asbestos) #8909	6.00/lb.	Plant general
Garlock Packing #711	4.75/lb.			Plant general
Garlock Packing #730	6.00/lb.	#8913	7.00/lb.	Plant general
John Crane #818 Garlock 10495	6.50/lb.			Satisfactory
Garlock #150	7.45/lb.	#150TG	9.00/lb.	Satisfactory
Sheet Packing #900	1.79/lb.	Bluegard + 20%		Plant general - limited experience.
Sheet Packing #7021	1.79/lb.	Bluegard + 20%		Plant general - limited experience.
Pouring Coats Aluminized Asbestos 343LWM-AAP, Type 75	92.50/coat	Alm. Pre Ox.	124.10/coat	Alm-Pre. Ox - without any success-fabric shedding and cracking plus cost variable.
		Aluminized Rayon 317 #1017 19 oz. (Both Alm. Pre Ox & Aluminized Rayon used in Blast Fur. TOC, Elec. Fur., Con Cast Burn & Weld)	85.53/coat	Alm-Rayon - limited experience but appears to be very satisfactory.

Appendix J-B
Asbestos Substitutes - USS

Asbestos Products	Cost of Asbestos	Substitute Material Manufacturer or Supplier	Cost of Substitute Material	Comments on Performance, Quality, Life Expectancy, Etc. of Substitute Material
Asbestos Gloves Silverbestos 5114-AI-AB-B	11.01/pr.	Aluminized Rayon back Kevlar/Zetex palm. Used Blast Fur. Elec. Fur., Con Cast, TOC, Burn & Weld	30.50/pr.	Alm. Silverbestos not the best glove, will not take the abrasive use from the department indicated. Alm-Kevlar/Zetex will take the abrasive use by cost doubles comparable for protection.
Asbestos Mittens B-M-11-L	8.70/pr.	No Substitutes - Tried Kevlar possibility. Used in all of the above depts. plus Finish, Mill Mat Beds, Foundry, Shops, Plant General		Kevlar mitten could be very costly, approximate cost - $25.00/pr.
Asbestos Cloth	6.70/sq. yd.	Garlock #1200 THERMO SIL CLASS Fibre Cloth P199-B170	7.02/sq. yd.	Suitable for less severe heat applications. Good mechanical strength.
Asbestos Blanket		Carborundum Dura Felt Blanket P199-8179	.7225/sq. yd.	Suitable for higher heat application. Poor mechanical strength.
Asbestos Rope		Garlock Thermo-Ceram Rope P199-8154	9.51/lb.	Poor substitute. Especially poor mechanical strength.
Asbestos Paper		-		No suitable substitute. We have discontinued its use, however.

USX000042

Appendix J-B
Asbestos Substitutes - USS

Asbestos Products	Cost of Asbestos	Substitute Material Manufacturer or Supplier	Cost of Substitute Material	Comments on Performance, Quality, Life Expectancy, Etc. of Substitute Material
Transite Board A970				No suitable substitute. We have discontinued buying it, but there are still some scraps in the plant.
Asbestos Brake Lining A902-E912-X107 - A912				No suitable replacement. Plant general use. Crane, etc.
Asbestos Pipe Insulation	No longer available	J.M. Fiberglas pipe insulation 1" pipe size	1.65/lin. ft.	
Asbestos Pipe Insulation	size	J.M. Fiberglas pipe insulation 1-1/2" pipe	2.96/lin. ft.	
Asbestos Insulated Wire	Numerous sizes & conductors			Engineering and Electric Construction have not approved silicone rubber insulation because of lower temperature rating.
Asbestos Roll Grade "C"	1,284.00	8RX29(Cold Strip Area) 8RX800C(Experimental Stage)	1,309 1,335	All our asbestos furnace rolls are sent to an outside source to be rebuilt and returned. We are in the process of testing non-asbestos rolls.

Appendix 3-B
Asbestos Substitutes - USS

Asbestos Products	Cost of Asbestos	Substitute Material Manufacturer or Supplier	Cost of Substitute Material	Comments on Performance, Quality, Life Expectancy, Etc. of Substitute Material
Asbestos Mitten w/o leather 8-M-11-B	9.96/pr.	No substitutes tried - Kevlar possibility		Kevlar mitten could be very costly-approximate cost $25/pr.
Aluminized Asbestos back/leather palm 5L116-AB	11.90/pr.	Aluminized Rayon/back leather palm.	10.95/pr.	Aluminized Rayon back - very satisfactory replacement.
Rope 3/8 X172-3421		Thermoceron	12.80/lb.	This product very satisfactory for furnace use.

USX0000430

Electrical Construction

Blankets - Fiberglass base thermobarrier fabric has a thickness 1/3 that of asbestos. Costs $70.00/yd. Dilwol-distributor.

Insulated Wire - TEW (with nylon jacket). This insulated wire can withstand temperatures up to 105° C. Produced by Canada Wire.

Tapes - Fiberglass/silica tapes - little information on this material. Performs well. Do not know the manufacturer.

AISI MEMBERS
ASBESTOS SUBSTITUTION EXPERIENCE

The attached table summarizes field trial experiences for several AISI members. The listed information was exchanged by the AISI Manufacturing Committee participants.

Performance information is available as provided by participants.

It is hopeful that this information exchange will assist Operating, Safety and Health personnel in finding suitable substitutes for specific asbestos applications.

APPENDIX 2

ASBESTOS SUBSTITUTE MATERIALS (AISI)

7. Environmental monitoring - will be carried out by the Environmental Health unit (Corporate Headquarters or plants) according to requirements of the OSHA Asbestos Standard.

(b) Pleural thickening with history of asbestos exposure - bilateral pleural thickening or plaques (with or without calcification) and with or without pulmonary function decrements. Without pulmonary function decrements, there is no need to refer unless requested by employee. Record on OSHA-200 Log as "Pleural thickening with history of asbestos exposure".

(c) Unilateral pleural thickening or plaques with or without adequate history of asbestos exposure (with or without calcification) and with or without pulmonary decrements - the most likely explanation for the pleural thickening in this group is one of the following: infection (pleural effusion) or hemorrhage, callous from rib fracture, radiation fibrosis, scleroderma, chronic mineral oil aspiration, metastatic disease, lymphoma, myeloma, or a combination of these. DO NOT RECORD ON OSHA-200 LOG. Normal anatomical shadows (pectoral shadow area, extra pleural fat deposits, serratus and external oblique muscle shadows) can usually be ruled out by the above mentioned (1.(b)) techniques.

(d) Normal Chest - further follow-up testing failed to substantiate suspicions in original chest x-ray or pulmonary function tests. The role of smoking in any pulmonary function decrement must be carefully evaluated. Diffusing capacity determinations may be helpful in ruling out pulmonary fibrosis and probably should be done. In coke plants, the possibility of coal workers' pneumoconiosis (with or without focal emphysema) must always be ruled out.

6. Recommendations to the physician in discussing findings with the affected employees:

(a) Each employee must be told of any positive findings discovered as a result of his/her examination by the United States Steel physician and/or consultant, and an evaluation of these findings will be discussed with the employee. Recorded exposure levels should also be given to the employee. Because of proper handling of asbestos today, these environmental levels will likely be low enough to allay any fears of continued exposure to hazardous levels.

(b) If the employee has a pulmonary infiltrate due to asbestos exposure, with or without pleural reaction, he/she shall be advised that this response is due probably to exposures of passed

Appendix 1

GUIDELINES FOR MEDICAL SURVEILLANCE ASBESTOS EXPOSURE

The following guidelines for medical surveillance shall be followed in all United States Steel Corporation operations whenever exposure to asbestos occurs.

1. A comprehensive medical examination shall be provided (or made available) to all employees prior to initial employment in an occupation with exposure to airborne concentrations of asbestos fibers. These medical examinations will be required for any 7 to 8 hour time-weighted average concentration of 0.1 fibers/cc, or for a greater concentration. (The OSHA Asbestos Standard permits this examination to occur within 30 calendar days of the first exposure.)

   Annually thereafter and within 30 calendar days before or after termination of employment involving exposure to airborne concentration of asbestos fibers, a physical examination, as designated above, shall be provided (or made available) to these employees.

   Whenever pleural thickening is found on any routine chest x-ray on an individual who has had any airborne asbestos exposure, this individual shall be kept under yearly medical surveillance.

   The minimum components of the examination shall be:

   (a) A medical history, including a respiratory questionnaire to elicit symptomatology of respiratory disease.

   (b) A 14" x 17" chest x-ray - posterior - anterior view. Whenever there is evidence of pleural response, right and left oblique views and expiratory posterior - anterior view should be taken to confirm or rule out pleural findings.

   (c) Pulmonary Function testing to include forced vital capacity (FVC) and forced expiratory volume at 1 second (FEV_1).

2. Upon initial assignment to an occupation where exposure to airborne concentrations of asbestos fibers may exist, a complete work history shall be taken. This is particularly important if changes in the chest x-ray begin to appear. The work history shall

APPENDIX 1

GUIDELINES FOR MEDICAL SURVEILLANCE
OF ASBESTOS EXPOSURE

Revised: June, 1984

It is strongly recommended that all potentially exposed personnel be included in any education program. Well-informed supervisors can personify Management's concern and insistence that operations involving the use and handling of asbestos products be conducted in a safe and healthful manner.

monitoring, medical surveillance, employee training, isolation and restriction of area, work practices to minimize dust generation, housekeeping, personal protective equipment, personal hygiene and waste disposal.

D. Education

Employees will be more apt to cooperate with Management's attempts to control their exposures to toxic substances if they are made aware of the nature of the hazard and its consequences. The OSHA regulation requires that the following be included as a part of the training program:

- health effects associated with asbestos exposure;
- relationship between asbestos exposure and smoking;
- the nature of operations that could result in exposure;
- the protective steps being taken by the company to minimize exposure;
- the purpose, proper use, fitting instructions and limitations of respirators;
- review of provisions covered in 29 CFR 1910.1001.

It is mutually beneficial to the workers and the Corporation to develop and implement an education and training policy regarding exposure to asbestos. The goals of the program, in addition to the OSHA requirements, should be to increase the employees' knowledge of:

- the nature of the asbestos hazard;
- work processes involving asbestos and the potential for fiber emissions;
- the concept of "risk";
- environmental monitoring procedures and objectives;
- the purpose and nature of engineering and work practice controls;
- the application of decontamination and waste disposal practices;
- the elements of the medical surveillance program and the reasons for it.

should be selected from the "approved alternates" that are listed in correspondence from the Manager of Safety to Holders of USS Health Services Approved Protective Apparel and Equipment Manual, June 16, 1983. The subject of this correspondence is "Stop Order on Purchasing Asbestos Protective Garments".

8. Personal Hygiene

Employees should be instructed to wash their hands, face and forearms prior to eating, drinking or smoking. The wearing of contaminated work clothing in employee lunchrooms should be prohibited.

9. Waste Disposal

Asbestos waste such as rejects, scrap, shavings and other debris should be accumulated separately from other refuse. It should be placed in plastic bags or some other impermeable container which should then be sealed shut, labeled as to the contents and hazard, and disposed of in accordance with applicable Federal and state regulations. Local haulers contracted to dispose of this material must be informed that the waste products contain asbestos. Warning labels should state the following:

CAUTION
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
BREATHING ASBESTOS DUST MAY CAUSE
SERIOUS BODILY HARM

10. Removal of Insulation Materials

At U. S. Steel, the greatest potential for high exposures to asbestos is the removal of deteriorating insulation materials, such as pipe coverings. It is, therefore, especially important that a hazard control program be implemented to protect employees invoved in this operation from the effects of asbestos dust exposure. Particular attention is directed to provisions listed Under Part III of this document pertaining to exposure

i) Protective Clothing as a Control Measure

When employee asbestos exposures exceed a "ceiling limit" of 10 fibers/cc, the OSHA Asbestos Standard requires employers to provide "special clothing" (coveralls, head coverings, gloves and foot coverings), change rooms with two lockers (one for the employee's street clothes and one for his contaminated work clothes), transportation of contaminated clothing in sealed impermeable bags or containers, and laundering facilities. The necessity of complying with some of these provisions can be eliminated by issuing employees disposable protective garments. Disposables may include hard hat liners, coveralls and shoe liners. The coverall garment should be without pockets or cuffs. A good example is DuPont's Tyvek protective garments. Tyvek is a durable spunbonded olefin with high tensile/tear strength, chemically resistant, and due to a relatively slick surface, it does not tend to entrap particles.

A vacuum cleaner should be used to remove loose fibers adhering to contaminated work clothing. Employees should not attempt to dislodge these fibers by brushing them off nor by using compressed air to blow particles off. In addition, respirators should continue to be worn until contaminated work clothing is removed. Contaminated disposable clothing and respiator filters should be placed in impermeable containers and disposed of in accordance with the provisions of Section III.C.9.

ii) Protective Clothing Made of Asbestos Material

Occasionally, employees working in areas of high radiant heat, those who are exposed to molten metal or weld splatter or those who have to handle hot objects or tools are required to wear heat-resistant clothing. Asbestos-free heat-resistant clothing jurisdiction, these regulations are stated in 29 CFR 1910.134. MSHA requires a respirator program consistent with the provisions of ANSI Z88.2-1980.

Table 1
Respiratory Protection
for Airborne Concentrations of Asbestos

Airborne Concentration of Asbestos (TWA)	Required Respirator[1]
Not in excess of 5 f/cc (10 X PEL)	Reusable air purifying respirator
Not in excess of 50 f/cc (100 X PEL)	Full facepiece air purifying respirator, or a powered air purifying respirator
Greater than 50 f/cc	A type "C" continuous flow or pressure demand, supplied air respirator

[1]Respirators specified for high concentrations may be used at lower concentrations of asbestos.

b. Protective Clothing

In regard to asbestos, it is important to consider protective clothing in two ways. First, it may be necessary to provide special clothing to employees who are required to handle asbestos to prevent work clothing from becoming contaminated with the fibers. In this instance, protective clothing is a control measure to protect not only the worker but also family members who may be exposed to dust carried home on his work clothing. Second, some protective clothing articles, intended to provide thermal protection for those in close proximity to high radiant heat sources, were made from asbestos materials. Reports in the literature indicate that this type of clothing, through gradual deterioration with use, is actually a source of asbestos exposure to workers. To eliminate this source of potential exposure, the purchase and usage of garments containing asbestos by USSC employees is prohibited.

will be necessary. While respirators and protective clothing should always be available, it must be understood they serve only as a complement to, not as a replacement for, engineering and work practice control measures.

a. Respirators

Respirators may be necessary to control asbestos exposures in some instances, such as the removal of thermal pipe insulation. Since these devices place a burden on the respiration of the worker, it must first be determined whether the wearer can use the equipment and still perform the assigned task. In such a determination, consideration should be given to: the physical condition of the worker, such as possible pulmonary or cardiovascular impairment; the physiological demands of the task, such as required oxygen uptake; and the presence of facial hair which may negate an effective respirator seal.

The type of respirator needed will be dictated by the preceding factors as well as the concentration of airborne asbestos fibers. With fiber concentrations less than 10 times the permissible exposure levels, a properly fitted air purifying dust respirator will provide sufficient protection. The type of respirator selected should be specifically approved by NIOSH for protection against dusts containing asbestos. It should be noted, however, that disposable-type respirators are not permitted within U. S. Steel for protection against asbestos.

When the fiber contamination level is between 10 and 100 times the permissible exposure level, powered air purifying respirators should be worn. If exposures exceed 100 times the acceptable limits, a type "C" continuous flow, supplied air respirator or pressure-demand, self-contained breathing unit should be worn.

Respirator wearers should be instructed to wash the masks, and change filters, where applicable, daily. Proper fitting instructions and fit testing must also be given. When respirators are issued, it is important to comply with the appropriate regulations governing the use of respiratory protection. For those facilities under OSHA into the air will be minimized. Some of the ways in which work practices may be modified include:

- the use of a slow band saw or hand saw in lieu of a high-speed circular table saw to cut Transite asbestos board;
- thoroughly wetting asbestos materials prior to use - such as immersing a coil of asbestos rope in water prior to applying it as a sealant around furnace or oven doors; asbestos insulation materials should be thoroughly wetted prior to removal whenever conditions permit such application;
- the purchase of pre-cut and pre-drilled materials, such as brake shoe lining containing asbestos;
- using a vacuum cleaner instead of a compressed air hose to remove dust residue from mobile equipment brakes during inspection and repair operations;
- removing asbestos insulation in as large a section as possible to minimize the amount of fracturing;
- using hand tools, such as chisels or knives, rather than power tools or saw, to cut and remove asbestos insulation.

6. Housekeeping

Good housekeeping practices are essential to maintain low levels of airborne asbestos fibers. Dust on floors, ledges, equipment and workbenches may become airborne when disturbed by work activity, air movement, or vehicular traffic. Dry sweeping should be prohibited in areas where asbestos is used because it merely redisperses the fine fibers into the workroom air. The use of compressed air to clean up asbestos debris should be strictly forbidden. Instead, vacuum cleaning is the preferred method of removing dust accumulations.

7. Personal Protection

The control measures previously discussed under this section should always be the primary means of minimizing employee exposure to asbestos fibers. If, however, these measures are not sufficient, or if some specific operations are not amenable to such control, the use of personal protective equipment encapsulation can often be a preferable solution because it generally costs much less, does not cause long-term disruption of operations, and does not require the intensive decontamination efforts necessitated by complete removal. Examples of these asbestos containment treatments are Hydro-ban by KRC Corporation and Asbestos Guard Fiber Fix (719) by U. S. Coatings Collaborative, Inc.

Raybestos Manhattan has developed a product called Novatex which is an asbestos textile encapsulated with an acrylic resin. A neoprene coating may give additional protection. Novatex cloth can be used for welding curtains, insulation applications, and for aluminized and non-aluminized protective bodywear.

3. Exhaust Ventilation

Any operation which may conceivably generate airborne asbestos dust concentrations in excess of permissible exposure limits should be provided with local exhaust ventilation. Where such ventilation is used, the exhaust hood should be located as close as possible to the point of dust generation to achieve maximum capture of the released fibers. Examples of operations where local exhaust ventilation may be employed include the mixing of asbestos mortar compounds and the use of saws, drills and grinders on asbestos materials.

4. Isolation and Restriction of Area

Operations which have the potential to generate high concentrations of airborne fibers should be isolated to the extent feasible to minimize human exposure to the fibers. The removal or teardown of asbestos pipe insulation is an example of this type of operation. The vicinity of an asbestos removal operation should be designated as a restricted area, thus denying access to employees whose presence is not required. As a minimum, such areas should be roped off. Warning signs should be posted to alert employees to the potential hazard. In some applications, the work area may have to be sealed to prevent exposure to nearby employees or contamination of adjacent areas.

5. Work Practices

Changes in work practices may often be the most cost-effective way of reducing occuptional exposure to asbestos. When conducting an operation which involves the handling ot asbestos materials, consideration should be given to performing the task in such a manner that the emission of asbestos fibers

USX0000442

C. Controlling Employee Exposures to Asbestos Fibers

1. Substitution of Alternative Materials

Using "non-asbestos" materials on applications which previously used asbestos products is the first choice of controlling exposures since it eliminates the source of the hazard. Some of the alternative materials that have found common usage as substitutes for asbestos include fiberglass, kaolin wool, ceramics, mineral wool and various plastic fibers. In certain individual applications, each of these has exhibited adequate tensile strength, heat resistance, flexibility and durability to satisfactorily perform functions previously served only by asbestos products. Some examples of "asbestos-free" materials being used at operations at U. S. Steel facilities include:

- and kaolin wool as pipe insulation materials;
- non-asbestos mortar compounds for heat resistant cement applications;
- fiberglass and aramid fiber textile products, such as welding curtains and heat resistant clothing;
- various hot-top products at ingot teeming operations.

Although the use of asbestos is well entrenched in many important applications, it is likely that substitution will play an increasingly significant future role in reducing health hazards from asbestos.

2. Encapsulation

The mere presence of asbestos insulation materials does not constitute a health hazard. In this regard, it is not U. S. Steel's philosophy or intention that all asbestos insulation materials be torn out and replaced with alternative materials. However, once it is determined that such insulation has deteriorated to the point that fibers may be emitted into occupied areas, steps should be taken to control the hazard.

A feasible alternative to complete removal of asbestos insulation is encapsulation; i.e., treating the material with an acrylic or elastomeric polymer protective coating to seal the fibers in place and prevent further deterioration. Although each case must be considered on an individual basis, Professional judgement should be used to determine the optimum sample size when monitoring for an 8-hour time-weighted average exposure to asbestos. Filter loading must be considered since asbestos counting depends on the ability to identify fibers with a relatively unobstructed view of the background.

Air monitoring in relatively clean environments, such as offices and storerooms, can usually be conducted for 2-hour sampling periods without overloading the filter with dust. However, in dusty plant environments, filters may be overloaded by 1/2-hour sampling periods. Thus, the sampling time will vary depending on the background dust levels at the sampling location.

Care must be taken to assure that the filter is not contaminated during cassette assembly. Cassettes should be assembled in a clean environment and all facilities will continued to do this function. Blanks submitted with samples will be monitored for contamination from improper assembly.

A properly completed request for analysis form should be sent with the asbestos samples giving both the sampling rate and time.

Note: If possible, prior to air sampling, a bulk sample of the suspect material should be submitted to the Environmental Health Laboratory for bulk asbestos determination. Care should be taken to assure that the container for the bulk sample is properly sealed, and unless paper envelopes and cartons are sealed in plastic bags, they should not be used. The Environmental Health Laboratory is currently evaluating plastic urine specimen containers for shipping bulk asbestos samples. They have proven very satisfactory in durability and ease of sample removal.

B. Medical Surveillance

The OSHA Standard further dictates that all employees exposed to airborne asbestos fibers, regardless of concentration, must be given annual medical examinations, including chest x-rays and pulmonary function tests. However, as pointed out earlier, asbestos is such a widespread substance that virtually everyone has some measureable exposure. OSHA has apparently come to understand this premise and under Program Directive 300-16 (October, 1978) has defined, for medical purposes, exposure to airborne asbestos fibers as a minimum of 0.1 asbestos fibers, longer than 5 micrometers, per cubic centimeter of air (i.e., 1 fiber per 10 cc). At U. S. Steel, we use this 0.1 fibers/cc exposure level to identify those employees to be included in the medical surveillance program. Separate guidelines detailing the medical surveillance procedures were previously sent to plant physicians by the Director of Industrial Medicine. A copy of these guidelines is also included in Appendix 1.

21 Corr

United States Steel Corporation

PLAINTIFF'S EXHIBIT

Interorganization Correspondence

To: Plant General Managers, General Superintendents, Plant Managers, Administrative Physicians, Industrial Hygiene and Safety Representatives

Date: April 27, 1984

From: Frederick M. Toca, Ph.D.
Manager-Industrial Hygiene

Subject: Revised Corporation Asbestos Guidelines and Radiation Guidelines

Revised copies of the Corporation guidelines for assisting in the protecting of our employees from the hazards associated with asbestos and ionizing radiation exposures are attached. The asbestos guidelines were revised by Health Services Personnel and include the criteria of the recent OSHA Emergency Temporary Standard (ETS) for Asbestos. The criteria of the ETS is included, although a Federal appeals court struck down this Standard, because we believe that a permanent Standard proposing the same criteria will be promulgated shortly.

The ionizing radiation guidelines were revised by the Corporation Radiation Committee and Industrial Hygiene Services. Included with this guideline are selected portions of the NRC regulations concerning Specific and General License requirements. These excerpts are included to provide information regarding the difference between the two types of licenses and an overview of the requirements of each type.

Holders of the Industrial Hygiene Policy and Guidelines Manual should insert the revised copy of the asbestos guidelines into Section I, I.H.-12 of this Manual and the revised copy of the radiation guidelines into Section I, I.H.-3 of the Manual. Please discard the original guidelines.

Fred.

JBM/mdd
Attachments

cc: Holders of Industrial Hygiene Policy and Guidelines Manuals

USX0000946

Appendix 1

GUIDELINES FOR MEDICAL SURVEILLANCE

ASBESTOS EXPOSURE

file

The following guidelines for medical surveillance shall be followed in all United States Steel Corporation operations whenever exposure to asbestos occurs.

1. All employees exposed to asbestos shall be provided (or made available) a comprehensive medical examination prior to first employment in an occupation exposed to airborne concentration of asbestos fibers. These medical examinations will be required for any 7- to 8-hour time-weighted average concentration of 0.1 fibers/cc, or for a greater concentration. (The OSHA Asbestos Standard permits this examination to occur within 30 calendar days of the first exposure.)

   Annually thereafter and within 30 calendar days before or after termination of employment in an occupation exposed to airborne concentration of asbestos fibers requiring a medical examination as designated above, a physical examination shall be provided or made available to these employees.

   Whenever pleural thickening is found on any routine chest x-ray on an individual who has had any airborne asbestos exposure, this individual shall be kept under yearly medical surveillance.

   The minimum components of the examination shall be:

   (a). A medical history, including a respiratory questionnaire to elicit symptomatology of respiratory disease.

   (b). A 14" x 17" chest x-ray - posterior-anterior view. Whenever there is evidence of pleural response, right and left oblique views and expiratory posterior-anterior view should be taken to confirm or rule out pleural findings.

   (c). Pulmonary Function testing to include forced vital capacity (FVC) and forced expiratory volume at 1 second (FEV_1).

2. A complete work history shall be taken on initial assignment to an occupation where exposure to airborne concentration of asbestos fibers will occur. This is particularly important if changes in the chest x-ray begin to occur. The work history will include all work experiences in United States Steel and other non-United States Steel work experiences to determine extent of exposure to asbestos. In order to be complete, military exposures, i.e. ship and shipyard exposures; hobbies; exposures of family members (father, brothers, grandfathers, mother, sisters, etc.) who might have brought asbestos fibers home on their clothing; living (home) location (geographic) for proximity to asbestos mining or manufacturing plant; and play areas

in relation to discarded wastes from asbestos factories. The Environmental Health unit (corporate headquarters or plants) will be helpful in evaluating the extent of work exposures.

3. The chest x-ray should be read by at least two United States Steel physicians or physicians selected by the plant physicians. Any positive chest x-ray shall be read by a "B" reader for confirmation of the findings. It is permissible to contract with a "B" reader to read all x-rays in this program. (A "B" reader is certified following successful completion of qualifying examination of 125 chest x-rays by NIOSH and the American College of Radiology.)

4. A clinical evaluation leading to a diagnosis and recommendations will be made.

   (a). Correlate all medical findings - history, physical findings, chest x-ray interpretation, pulmonary function results, and any other medical information -- with the environmental exposure data.

   (b). Referral to a pulmonary specialist to assist in this evaluation may be done at the option of the plant medical director or other examining physician.

   (c). Referral of the chest x-ray to another "B" reader may occasionally be necessary for the proper interpretation of the x-ray.

5. The clinical evaluation will usually result in a diagnosis of one of the following, in descending order of importance:

   (a). Asbestosis - pulmonary infiltrate classified by I.L.O. System and documentation of exposure with or without pulmonary function decrements, and with or without pleural thickening or plaques (with or without calcification). Record on OSHA-200 Log as "Asbestosis".

   (b). Pleural thickening with a history of asbestos exposure - bilateral pleural thickening or plaques (with or without calcification) and with or without pulmonary function decrements. Without pulmonary function decrements, no need to refer unless requested by employee. Record on OSHA-200 Log as "Pleural thickening with asbestos exposure".

   (c). Pleural thickening with a history of asbestos exposure - unilateral pleural thickening or plaques (with or without calcification) and with or without pulmonary function decrements. Without pulmonary function decrement, no need to refer unless requested by employee. Record on OSHA-200 Log as "Pleural thickening with asbestos exposure". This diagnosis is one of elimination from 5.(d).

The language for OSHA-200 Log recording for (b) and (c) has been agreed upon in a meeting held October 1, 1980 of Personnel, Medical, Labor Relations, Safety & Environmental Health, Law, and Workers' Compensation & Casualty representatives.

(d). Unilateral pleural thickening or plaques with or without adequate history of asbestos exposure (with or without calcification) and with or without pulmonary decrements. The most likely explanation for the pleural thickening in this (d) group is one of the following: infection (pleural effusion) or hemorrhage, callous from rib fracture, radiation fibrosis, scleroderma, chronic mineral oil aspiration, metastatic disease, lymphoma, myeloma or a combination of these. DO NOT RECORD ON OSHA-200 LOG. Normal anatomical shadows -- pectoral shadow area, extra pleural fat deposits, serratus and external oblique muscle shadows can usually be ruled out by the above mentioned (1.(b)) techniques.

(e). Pulmonary Function Decrement only - Emphysema. It is important to establish whether this is result of occupational exposure or is due to non-occupational origin. Differentiation between obstructive and restrictive disease must be made. Do not record on OSHA-200 Log unless occupationally related. Define cause if so recorded.

(f). Normal Chest - further follow-up testing failed to substantiate suspicions in original chest x-ray or pulmonary function tests. The role of smoking in any pulmonary function decrement must be carefully evaluated. Diffusing capacity determinations may be helpful in ruling out pulmonary fibrosis and probably should be done. In coke plants, the possibility of coalworkers pneumoconiosis with or without focal emphysema must always be ruled out.

6. Recommendations to the physician in discussing findings with the affected employees:

(a). All employees must be told of any positive findings found during his/her examination and the United States Steel physician evaluation (also consultant if used) of these findings. Recorded exposure levels should also be given to the employee. Because of proper handling of asbestos today, these environmental levels should ordinarily be helpful in allaying any fears of continued exposure to hazardous levels.

(b). Pulmonary infiltrate due to asbestos exposure with or without pleural reaction. Shall be advised that this response is due probably to exposures of many years past. Depending upon the pulmonary function finding, the risk of continued decrement is probably directly correlated to continued smoking especially if any continued exposure is properly handled by respiratory protection and is of very minimal, if any, monitored value. The corporate headquarters Environmental Health unit shall prescribe the approved manner of handling any continuing exposure. To be followed every year unless pulmonary function is decreased, then at shorter intervals if clinically indicated. Every effort should be made to get the individual to STOP SMOKING if he/she is a smoker. The risk of lung cancer in those with parenchymal infiltrate is up to sixteen (16) times the risk of a non-smoker with the same exposure and ninety (90) times that of a worker who is a non-smoker and not exposed to asbestos.

(c). Bilateral or unilateral pleural thickening or plaques due to asbestos exposure (with or without calcification). Should be advised that this response is the result of many years of low level of exposure. This also should not progress if the exposure has been eliminated or properly controlled by proper handling of asbestos and by respiratory protection if exposure continues. Depending upon the pulmonary function findings, the risk of continued decrement is directly correlated with continued smoking especially if any continued exposure is properly handled by respiratory protection and is of very minimal, if any, monitored value. The corporate headquarters Environmental Health unit shall prescribe the approved manner of handling any continuing exposure. To be followed yearly unless there is a decrement in pulmonary function then at shorter intervals if clinically indicated. Every effort should be made to get the individual to STOP SMOKING if he/she is a smoker. The risk of lung cancer in those with bilateral pleural thickening or plaques is two and one-half (2-1/2) times those without pleural reaction.

(d). Unilateral pleural thickening or plaques (with or without calcification) not the result of exposure to asbestos. Continue to follow on a yearly basis.

(e). Emphysema - if believed due to occupational exposure - follow yearly unless otherwise indicated or requested by employee.

If believed to be nonoccupational, then referral to private physician, if appropriate - follow yearly.

(f). Normal - yearly follow-up.

(g). Those persons who have demonstrated radiologic changes in chest film, and who have been exposed to asbestos, should be removed from further exposure either through engineering means, or personal protective equipment (respirators, air masks, disposable clothing, etc.), or by removal from work in the exposure area.

7. Environmental monitoring - will be carried out by the Environmental Health unit (corporate headquarters or plants) according to requirements of the OSHA Asbestos Standard.

PLAINTIFF'S EXHIBIT

United States Steel Corporation

July 18, 1984

Mr. P. X. Masciantonio
Vice President
Environmental Affairs

Subject: Revised Guidelines For Medical Surveillance
Asbestos Exposure

For your information, a copy of the recently revised "Guidelines For Medical Surveillance, Asbestos Exposure", is attached.

W. C. Marshall, M.D.
William C. Marshall, M.D.
Assistant Medical Director

WCM:rp

Attachment

cc: Messrs. W. B. Buhrmann
C. W. Connor, III
N. N. Diehl
C. S. Day
D. H. Hoffman
A. P. Myer
T. Forrest Fisher, M.D.

USX0000930

GUIDELINES FOR MEDICAL SURVEILLANCE
ASBESTOS EXPOSURE

The following guidelines for medical surveillance shall be followed in all United States Steel Corporation operations whenever exposure to asbestos occurs.

1. A comprehensive medical examination shall be provided (or made available) to all employees prior to initial employment in an occupation with exposure to airborne concentrations of asbestos fibers. These medical examinations will be required for any 7 to 8 hour time weighted average concentration of 0.1 fibers/cc, or for a greater concentration. (The OSHA Asbestos Standard permits this examination to occur within 30 calendar days of the first exposure.)

   Annually thereafter, and within 30 calendar days before or after termination of employment involving exposure to airborne concentration of asbestos fibers, a physical examination, as designated above, shall be provided (or made available) to these employees.

   Whenever pleural thickening is found on any routine chest x-ray of an individual who has had any airborne asbestos exposure, this individual shall be kept under yearly medical surveillance.

   The minimum components of the examination shall be:

   (a) A medical history, including a respiratory questionnaire to elicit symptomatology of respiratory disease.

   (b) A 14" x 17" chest x-ray, posterior-anterior view. Whenever there is evidence of pleural response, right and left oblique views and an expiratory posterior-anterior view should be taken to confirm or rule out pleural findings.

   (c) Pulmonary function testing to include forced vital capacity (FVC) and forced expiratory volume at one second (FEV_1).

2. Upon initial assignment to an occupation where exposure to airborne concentrations of asbestos fibers may exist, a complete work history shall be taken. This is particularly important if changes in the chest x-ray begin to appear. The work history shall include all work experiences in United States Steel, as well as non-United States Steel work experiences, to determine the effect of exposure to asbestos. This history should include military exposures, ship and shipyard duties, hobbies, exposures from family members (father, brothers, grand-

fathers, mother, sisters, etc.) who may have worked and brought asbestos fibers home on their clothing, residential locations for proximity to asbestos mining or manufacturing plants, and even recreational areas in relation to discarded wastes from asbestos factories.

3. All chest x-rays should be read by a certified radiologist who is also a "B" reader. It is permitted to contract with such a radiologist to read all x-rays taken at the work location. Where the x-rays are not taken in-plant, arrangements should be made to have the films read by a certified radiologist who is a "B" reader. (A "B" reader is certified following successful completion of qualifying examination of 125 chest x-rays by NIOSH and the American College of Radiology.)

4. A clinical evaluation leading to a diagnosis and recommendations will be made.

   (a) Correlate all medical findings (history, physical findings, chest x-ray interpretation, pulmonary function results, and any other medical information) with the environmental exposure data.

   (b) Referral to a pulmonary specialist to assist in this evaluation may be done at the option of the plant medical director or other examining physician.

   (c) Referral of the chest x-ray to another "B" reader may occasionally be necessary for the proper interpretation of the x-ray.

5. The clinical evaluation will usually result in a diagnosis of one of the following in decreasing order of importance:

   (a) Asbestosis - typically pulmonary infiltrate of s, t, u type, with or without pulmonary function decrements, and with or without pleural thickening or plaques (with or without calcification) - record on OSHA-200 Log as "Asbestosis".

   (b) Pleural thickening with history of asbestos exposure - bilateral pleural thickening or plaques (with or without calcification) and with or without pulmonary function decrements. Without pulmonary function decrements, there is no need to refer unless requested by the employee. Record on OSHA-200 Log as "Pleural thickening with history of asbestos exposure".

(c) Unilateral pleural thickening or plaques with or without adequate history of asbestos exposure (with or without calcification) and with or without pulmonary decrements - the most likely explanation for the pleural thickening in this group is one of the following: infection (pleural effusion) or hemorrhage, callous from rib fracture, radiation fibrosis, scleroderma, chronic mineral oil aspiration, metastatic disease, lymphoma, myeloma, or a combination of these. DO NOT RECORD ON OSHA-200 LOG. Normal anatomical shadows (pectoral shadow area, extra pleural fat deposits, serratus and external oblique muscle shadows) can usually be ruled out by the above mentioned (1.(b)) techniques.

(d) Normal chest - further follow-up testing fails to substantiate suspicions in original chest x-ray or pulmonary function tests. The role of smoking in any pulmonary function decrement must be carefully evaluated. Diffusing capacity determinations may be helpful in ruling out pulmonary fibrosis and probably should be done. In coke plants, the possibility of coal workers' pneumoconiosis (with or without focal emphysema) must always be ruled out.

6. Recommendations to the physician in discussing findings with the affected employees:

(a) Each employee must be informed of any positive findings discovered as a result of his/her examination by the United States Steel physician and/or consultant, and an evaluation of these findings will be discusssed with the employee. Recorded exposure levels should also be given to the employee. Because of proper handling of asbestos today, these environmental levels will likely be low enough to allay any fears of continued exposure to hazardous levels.

(b) If the employee has a pulmonary infiltrate due to asbestos exposure, with or without pleural reaction, he/she shall be advised that this response is due probably to exposures of passed years. Depending upon the pulmonary function finding, the risk of continued decrement is probably directly correlated to continued smoking. This is especially true if any continued exposure is properly handled by respiratory protection and is of minimal monitored value. The corporate headquarters' Environmental Health unit shall prescribe the approved manner of handling any continuing exposure. Medical surveillance should be continued every year and, if pulmonary function levels decrease, then at shorter intervals if clinically indicated. Every effort should be made to get the individual to STOP SMOKING if he/she is a smoker. By some estimates, the risk of lung cancer in those with parenchymal infiltrate is up to sixteen (16) times the risk of a non-smoker with the same exposure and ninety (90) times that of a worker who is a non-smoker and not exposed to asbestos.

(c) An employee with bilateral pleural thickening or plaques due to asbestos exposure (with or without calcification) - should be advised that this response is the result of many years of low level exposure. These changes should not progress if the exposure has been eliminated or properly controlled by proper handling of asbestos or by respiratory protection if exposure continues. Depending upon the pulmonary function findings, the risk of continued decrement is directly correlated with continued smoking. This is especially true if continued exposure is properly handled by respiratory protection and is of minimal monitored value. The corporate headquarters' Environmental Health unit shall prescribe the approved manner of handling any continuing exposure. Medical surveillance should be continued yearly unless there is a decrement in pulmonary function, then at shorter intervals if clinically indicated. If this occurs, more frequent surveys may be clinically indicated. Every effort should be made to get the individual to STOP SMOKING if he/she is a smoker.

(d) Unilateral pleural thickening or plaques (with or without calcification) - continue to follow on a yearly basis.

(e) Normal - yearly follow-up.

7. Environmental monitoring - will be carried out by the Environmental Health unit (corporate headquarters or plants) according to requirements of the OSHA Asbestos Standard.

PLAINTIFF'S EXHIBIT #21

United States Steel Corporation

Interorganization Correspondence

To: All Holders of USS PHYSICIAN'S GUIDE

Date: July 23, 1984

From: William C. Marshall, M.D.
Assistant Medical Director

Subject: Guidelines for Medical Surveillance Asbestos Exposure

The attached revised "Guidelines for Medical Surveillance - Asbestos Exposure" should be filed in Volume I of the Physician's Guide under "Asbestos".

The previously issued guidelines should be destroyed.

W. C. Marshall, M.D.

WCM:noc

Enclosure

USX0000935

GUIDELINES FOR MEDICAL SURVEILLANCE
ASBESTOS EXPOSURE

The following guidelines for medical surveillance shall be followed in all United States Steel Corporation operations whenever exposure to asbestos occurs.

1. A comprehensive medical examination shall be provided (or made available) to all employees prior to initial employment in an occupation with exposure to airborne concentrations of asbestos fibers. These medical examinations will be required for any 7 to 8 hour time weighted average concentration of 0.1 fibers/cc, or for a greater concentration. (The OSHA Asbestos Standard permits this examination to occur within 30 calendar days of the first exposure.)

   Annually thereafter, and within 30 calendar days before or after termination of employment involving exposure to airborne concentration of asbestos fibers, a physical examination, as designated above, shall be provided (or made available) to these employees.

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   The minimum components of the examination shall be:

   (a) A medical history, including a respiratory questionnaire to elicit symptomatology of respiratory disease.

   (b) A 14" x 17" chest x-ray, posterior-anterior view. Whenever there is evidence of pleural response, right and left oblique views and an expiratory posterior-anterior view should be taken to confirm or rule out pleural findings.

   (c) Pulmonary function testing to include forced vital capacity (FVC) and forced expiratory volume at one second (FEV_1).

2. Upon initial assignment to an occupation where exposure to airborne concentrations of asbestos fibers may exist, a complete work history shall be taken. This is particularly important if changes in the chest x-ray begin to appear. The work history shall include all work experiences in United States Steel, as well as non-United States Steel work experiences, to determine the effect of exposure to asbestos. This history should include military exposures, ship and shipyard duties, hobbies, exposures from family members (father, brothers, grand-

fathers, mother, sisters, etc.) who may have worked and brought asbestos fibers home on their clothing, residential locations for proximity to asbestos mining or manufacturing plants, and even recreational areas in relation to discarded wastes from asbestos factories.

3. All chest x-rays should be read by a certified radiologist who is also a "B" reader. It is permitted to contract with such a radiologist to read all x-rays taken at the work location. Where the x-rays are not taken in-plant, arrangements should be made to have the films read by a certified radiologist who is a "B" reader. (A "B" reader is certified following successful completion of qualifying examination of 125 chest x-rays by NIOSH and the American College of Radiology.)

4. A clinical evaluation leading to a diagnosis and recommendations will be made.

   (a) Correlate all medical findings (history, physical findings, chest x-ray interpretation, pulmonary function results, and any other medical information) with the environmental exposure data.

   (b) Referral to a pulmonary specialist to assist in this evaluation may be done at the option of the plant medical director or other examining physician.

   (c) Referral of the chest x-ray to another "B" reader may occasionally be necessary for the proper interpretation of the x-ray.

5. The clinical evaluation will usually result in a diagnosis of one of the following in decreasing order of importance:

   (a) Asbestosis - typically pulmonary infiltrate of s, t, u type, with or without pulmonary function decrements, and with or without pleural thickening or plaques (with or without calcification) - record on OSHA-200 Log as "Asbestosis".

   (b) Pleural thickening with history of asbestos exposure - bilateral pleural thickening or plaques (with or without calcification) and with or without pulmonary function decrements. Without pulmonary function decrements, there is no need to refer unless requested by the employee. Record on OSHA-200 Log as "Pleural thickening with history of asbestos exposure".

(c) Unilateral pleural thickening or plaques with or without adequate history of asbestos exposure (with or without calcification) and with or without pulmonary decrements - the most likely explanation for the pleural thickening in this group is one of the following: infection (pleural effusion) or hemorrhage, callous from rib fracture, radiation fibrosis, scleroderma, chronic mineral oil aspiration, metastatic disease, lymphoma, myeloma, or a combination of these. DO NOT RECORD ON OSHA-200 LOG. Normal anatomical shadows (pectoral shadow area, extra pleural fat deposits, serratus and external oblique muscle shadows) can usually be ruled out by the above mentioned (1.(b)) techniques.

(d) Normal chest - further follow-up testing fails to substantiate suspicions in original chest x-ray or pulmonary function tests. The role of smoking in any pulmonary function decrement must be carefully evaluated. Diffusing capacity determinations may be helpful in ruling out pulmonary fibrosis and probably should be done. In coke plants, the possibility of coal workers' pneumoconiosis (with or without focal emphysema) must always be ruled out.

6. Recommendations to the physician in discussing findings with the affected employees:

(a) Each employee must be informed of any positive findings discovered as a result of his/her examination by the United States Steel physician and/or consultant, and an evaluation of these findings will be discussed with the employee. Recorded exposure levels should also be given to the employee. Because of proper handling of asbestos today, these environmental levels will likely be low enough to allay any fears of continued exposure to hazardous levels.

(b) If the employee has a pulmonary infiltrate due to asbestos exposure, with or without pleural reaction, he/she shall be advised that this response is due probably to exposures of passed years. Depending upon the pulmonary function finding, the risk of continued decrement is probably directly correlated to continued smoking. This is especially true if any continued exposure is properly handled by respiratory protection and is of minimal monitored value. The corporate headquarters' Environmental Health unit shall prescribe the approved manner of handling any continuing exposure. Medical surveillance should be continued every year and, if pulmonary function levels decrease, then at shorter intervals if clinically indicated. Every effort should be made to get the individual to STOP SMOKING if he/she is a smoker. By some estimates, the risk of lung cancer in those with parenchymal infiltrate is up to sixteen (16) times the risk of a non-smoker with the same exposure and ninety (90) times that of a worker who is a non-smoker and not exposed to asbestos.

(c) An employee with bilateral pleural thickening or plaques due to asbestos exposure (with or without calcification) - should be advised that this response is the result of many years of low level exposure. These changes should not progress if the exposure has been eliminated or properly controlled by proper handling of asbestos or by respiratory protection if exposure continues. Depending upon the pulmonary function findings, the risk of continued decrement is directly correlated with continued smoking. This is especially true if continued exposure is properly handled by respiratory protection and is of minimal monitored value. The corporate headquarters' Environmental Health unit shall prescribe the approved manner of handling any continuing exposure. Medical surveillance should be continued yearly unless there is a decrement in pulmonary function, then at shorter intervals if clinically indicated. If this occurs, more frequent surveys may be clinically indicated. Every effort should be made to get the individual to STOP SMOKING if he/she is a smoker.

(d) Unilateral pleural thickening or plaques (with or without calcification) - continue to follow on a yearly basis.

(e) Normal - yearly follow-up.

7. Environmental monitoring - will be carried out by the Environmental Health unit (corporate headquarters or plants) according to requirements of the OSHA Asbestos Standard.

Exb #22

PLAINTIFF'S EXHIBIT #22

PATTERSON V. USX

REPRESENTATION BY USX

USX Corporation represents to John Patterson and to all other parties that the attached chart (titled Air Sample Studies For Asbestos Performed At Homestead Works) constitutes all reports in the possession of USX or known by USX to exist relating to asbestos air surveys done at the Homestead Works during the period of John Patterson's employment.

USX CORPORATION

12/6/95
Date

By: [signature]
General Attorney
Title

/jd - Pattarsn.USX

Exhibit 18

AIR SAMPLE STUDIES FOR ASBESTOS PERFORMED AT HOMESTEAD WORKS

Date of Study	Date of Report	Location	Person/Area Sampled
6/25/73	7/18/73	Open Hearth	Bricklayer - West Side
"	"	Open Hearth	Bricklayer's Helper - West Side
"	"	Open Hearth	Bricklayer - East Side
"	"	Open Hearth	Bricklayer's Helper - East Side
10/24/73	2/1/74	No. 3 Machine	Conset Tester at Shop Heat Lathe (J. Pifer)
10/31/73	2/1/74	No. 2 Forge - Heat Treating Sealas Furnaces Area	Quencher Helper (E. Turozey)
"	"	No. 2 Forge - Heat Treating Sealas Furnaces Area	Furnace Operator (D. Lloyd)
1/7/76	2/5/76	Harvey Shop	Craneman

Date of Study	Date of Report	Location	Person/Area Sampled
2/4/76	3/18/76 & 3/5/76	Harvey Shop	Craneman (Stutok)
"	"	Harvey Shop	Heater (D. Cunningham)
"	"	Harvey Shop	Expeditor (M. Havilla)
"	"	Harvey Shop	Heater (Armbrust)
"	"	Harvey Shop	Heater (Schwab)
"	"	No. 2 Forge Shop	Quencher (White)
"	"	No. 2 Forge Shop	Quencher Helper (Mitnik)
2/26/76	4/1/76	No. 2 Forge Shop	Quencher (Dobransky)
"	"	No. 2 Forge Shop	Quencher (Geer)
3/29/76	4/13/76	Forge Shop	Scarfers (2)
4/8/76	5/7/76	160" Mill	Roll Hand #1
"	"	160" Mill	Roll Hand #2
"	"	100" Mill	Layerout #1
"	"	100" Mill	Layerout #2

Date of Study	Date of Report	Location	Persons/Area Sampled
4/23/76	5/7/76	Automotive Repair Facility	Mechanic; Scrap Metal Yard Operator; Automotive Repair Facility
5/11/76	6/8/76	Open Hearth #5 No. 73 Furnace Reline	Bricklayer - East End (Kocher)
"	"	Open Hearth #5 No. 73 Furnace Reline	Bricklayer's Helper - East End (Miller)
5/11/76	6/8/76	Open Hearth #5 No. 73 Furnace Reline	Bricklayer - West End (Hromanik)
"	"	Open Hearth #5 No. 73 Furnace Reline	Bricklayer's Helper - West End (Peters)
6/8/76	7/2/76	160" Mill Hot	Shear Stamper
"	"	100" Mill	Cinderman
"	"	45" Mill	Slab Yard Scarfer
"	"	48" Mill	Shipping and Piling Area

Date of Study	Date of Report	Location	Person/Area Sampled
1/23/80	4/3/80	160" Mill Stainless Furnace	West Side - Stainless Furnace
"	"	160" Mill Stainless Furnace	Northeast Corner Stainless Furnace
"	"	160" Mill Stainless Furnace	Roll Storage Area
"	"	160" Mill Stainless Furnace	Blank Fitter
4/16/80	5/2/80	45" Mill Soaking Pits	Bricklayer (Menemmer)
5/1/80	5/19/80	45" Soaking Pits	Bricklayer (Nemmer)
"	"	45" Soaking Pits	Bricklayer (March)
"	"	45" Soaking Pits	Helper (Sloan)
"	"	45" Soaking Pits	Area Monitor near #28 pit while grade-all working on pit bottom
"	"	45" Soaking Pits	Blank

Date of Study	Date of Report	Location	Person/Area Sampled
5/7/80	5/19/80	45" Soaking Pits	Bricklayer (Bauer)
"	"	45" Mill Soaking Pits	Bricklayer (March)
"	"	45" Mill Soaking Pits	Bricklayer (Nemmer)
"	"	45" Mill Soaking Pits	Bricklayer (Stroup)
"	"	45" Mill Soaking Pits	Bricklayer (Steferak)
"	"	45" Mill Soaking Pits	Area Monitor in Pit
"	"	45" Mill Soaking Pits	Helper (Scury)
"	"	45" Mill Soaking Pits	Helper (Armbrust)
8/29/80	11/7/80	No. 5 Open Hearth - Charging Floor	J. Petrisko (1st Helper)
"	"	No. 5 Open Hearth - Charging Floor	W. Coats (1st Helper)
"	"	No. 5 Open Hearth - Charging Floor	M. McKee (Process Observer)
"	"	No. 5 Open Hearth - Charging Floor	M. Escajeda (Process Observer)

Date of Study	Date of Report	Location	Person/Area Sampled
1/9/81	1/26/81 and 3/2/81	Open Hearth #5, Charging Floor, #74 Furnace	Near Door Jams During Furnace Teardowns
"	"	Open Hearth #5, Charging Floor, #74 Furnace	Inside Gradall Cab
"	"	Open Hearth #5, Charging Floor	Painter
"	"	Open Hearth #5, Charging Floor, #74 Furnace	Near Furnace Panel Board
"	"	Open Hearth #5, Charging Floor, #74 Furnace	Near Door Jam During Front Loader Cleanup
6/5/81	6/11/81 and 6/26/81	Metallurgical Lab	Test Preparers (2) Physical Testers (2)
7/18/81	8/5/81	#275 Crane Cab at 100" Mill A-Yard	South Side Crane Cab North Side Crane Cab

/jd - Patterson.Air

United States Steel Corporation

f.L.M.
~~WFS~~ for file

Interorganization Correspondence

Date: July 18, 1973

To: Mr. F. R. Smith, Jr.
General Supt.
Homestead Works

From: K. M. Morse, Director
Environmental Health

Subject: Asbestos Dust Survey
Open Hearth

At the request of William Coates, Ceramics Engineer, an environmental health survey was conducted at Homestead Works on June 25, 1973. The survey was conducted by Mr. J. F. Quealy, Environmental Health Engineer. Its purpose was to determine whether worker exposures to atmospheric concentrations of asbestos dust during the rebuilding of open hearth furnaces exceed the OSHA (Occupational Safety and Health Act of 1970) standards. The bricks used in rebuilding the furnaces are lined with asbestos, which acts as an expansion strip to allow for proper expansion of the bricks when they are heated.

Standard

The present OSHA standard for exposure to asbestos dust is 5.0 fibers, longer than 5 micrometers, per cubic centimeter of air, based on an 8-hour time-weighted average exposure. However, as of July 1, 1976, the limit is reduced to 2.0 fibers per cubic centimeter.

Although the asbestos standard is based on an 8-hour time-weighted average, the dust concentration cannot exceed a ceiling limit of 10 fibers per cubic centimeters for any period of time.

Conclusions

Asbestos dust concentrations for the 4 workers who were sampled during this survey ranged from 0.03 to 0.07 fibers/cc. This is well below the present standard of 5.0 fibers/cc and also well within the permanent standard of 2.0 fibers/cc which goes into effect on July 1, 1976. The asbestos dust concentrations found during this survey do not produce any significant health hazards to workers involved in rebuilding open hearth furnaces.

Recommendations

Since worker exposures to asbestos dust during the rebuilding of open hearth furnaces do not exceed Federal standards, recommendations to control dust exposures are not deemed necessary. However, asbestos dust exposures could be significantly greater during the tearing down of the furnaces. Environmental Health should be contacted when the next furnace is to be torn down so that the asbestos dust situation may be assessed at that time.

Results of the Survey

Thirty short-term (15 to 86 minutes) breathing zone samples were collected during the survey. Samplers were worn by 4 workers (2 bricklayers, 2 helpers), thus giving each worker's integrated exposure for the period of sampling.

A total of 6 samples were collected on the bricklayer lining bricks on the west side of the roof of No. 74 open hearth furnace. Asbestos dust concentrations for these 6 samples ranged from 0.0 to 0.07 fibers/cc with a time-weighted average exposure for the period of sampling of 0.04 fibers/cc. A total of 8 samples were collected on one of the above bricklayer's helpers with asbestos dust concentrations ranging from 0.0 to 0.23 fibers/cc. The time-weighted average exposure for these 8 samples was 0.07 fibers/cc. Eight samples were also collected in the breathing zone of the bricklayer on the east side of No. 74 furnace. Asbestos dust concentrations ranged from 0.0 to 0.05 fibers/cc with a time-weighted average concentration of 0.04 fibers/cc. Eight samples collected on one of the bricklayer's helpers on the east side of the furnace ranged from 0.0 to 0.20 with a time-weighted average concentration of 0.03 fibers/cc.

The results of the survey show that workers are not exposed to asbestos dust concentrations exceeding Federal standards during the rebuilding of open hearth furnaces and, therefore, are not subjected to any significant health hazards resulting from exposure to asbestos dust.

K. M. Morse

JFQ/mdd

Attachment

cc: P. R. Morrow
A. S. Patterson

ASBESTOS DUST SURVEY
OPEN HEARTH DIVISION
Homestead Works
June 25, 1973

Occupation	Number of Samples	Total Time (Minutes)	Time-Weighted Average Conc. (Fibers/cc)
Bricklayer-West Side	6	227	0.04
Bricklayer's Helper - West Side	8	306	0.07
Bricklayer - East Side	8	291	0.04
Bricklayer's Helper - East Side	8	295	0.03

Federal Standard - Asbestos Dust:

As of July 7, 1972: 5.0 fibers/cc

As of July 1, 1976: 2.0 fibers/cc

United States Steel Corporation

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PLAINTIFF'S EXHIBIT #24

Interorganization Correspondence

Date: October 22, 1973

To: Kenneth M. Morse, Director
Environmental Health

From: R. H. Deibert

Subject: Asbestos Survey
Carrie Furnaces

This memo covers an asbestos survey conducted by McGill University personnel at No. 3 and 4 Blast Furnaces on September 4 and 5 and October 3 and 4, 1973. The purpose of this survey was to determine the asbestos exposure of the blast furnace workers while wearing asbestos protective clothing during casting. The McGill University personnel were conducting this survey under contract with Raybestos-Manhattan Corporation and with cooperation from Headquarters Environmental Health and Homestead Works management.

The McGill University personnel sampled using open-face membrane filters and MSA Monitaire pumps at a sampling rate of 2.0 lpm. The samplers were attached to the workers immediately before the cast and removed shortly thereafter. The workers were instructed to keep the filter outside their coat, but under their hood. On the last day, 8 new sets of asbestos clothing, of the same type currently being used, were distributed and the sampling concentrated on the workers wearing this new clothing. During each cast, one worker also wore a USS sampler. Approximately 50 samples were collected by McGill University during the survey, and 9 concurrent samples were collected by USS.

The results of the USS samples are given in detail in Table No. 1 included. Sample results are limited and may not be highly accurate as discussed below. However, they indicate the time-weighted asbestos exposure of the keeper, 1st helper, 2nd helper and 3rd helper to be 0.9, 0.6, 1.5 and 0.2 fibers per cubic centimeter respectively. The concentrations during individual casts ranged from 0.4 fibers per cc at a 3rd helper to 4.0 fibers per cc at a 2nd helper. The writer was told that the results of McGill University's samples on September 5 ranged from 0.8 to 6.0 fibers per cc. Their results from the last two survey days are not yet known.

From the above, it would appear that asbestos exposures due to wearing asbestos protective clothing are within both

USX0000773

18A

the present and coming 1976 standard, on both the time-weighted average and ceiling basis. However, the magnitude of the exposures is such that periodic monitoring may be required under the provisions of the OSHA asbestos standard. Needless to say, such a monitoring program would be large in scope and would involve many areas in our steelmaking operations.

Several problems which affected or could affect the accuracy of the USS (and McGill) sample results should be noted. First of all, 5 out of 9 USS samples showed filter damage in the form of smudges and/or fingerprints on the filter surface. Extraneous dust loadings on the filters were generally heavy, and in 5 of 9 instances, were felt to interfere with the asbestos fiber counting. One sample was so heavily loaded that fiber counting was impossible. Another potential source of error may occur when the worker puts on his asbestos hood. Should the asbestos cloth scrape against the filter holder, a localized "cloud" of asbestos dust could be deposited on the filter and thus lead to high results.

The 8 new suits of asbestos clothing, provided free of charge by Raybestos-Manhattan, were left with the workers who were told to wear them in a normal manner. Dr. Magenhiemer, Raybestos-Manhattan, stated that he would like to resurvey these workers after the suits had been worn for a few months. He also expressed a desire to do another survey using suits made with a different type of asbestos cloth. The McGill University people appeared to be confused over these plans. It can be assumed that we will be contacted if more sampling is desired.

To summarize, the results of limited sampling at workers wearing asbestos protective clothing indicate an asbestos exposure within both the current and 1976 OSHA standard. However, the exposure levels are by no means insignificant and may lead to an extensive periodic monitoring program including all workers wearing such clothing. Several problems were noted which could have effected the accuracy of the above results, either on the high or low side. These results may indicate the need for independent work on our part; however, before deciding on a course of action, the McGill University results should be obtained and evaluated.

R. H. Deibert

R. H. Deibert

RHD/mdd
Attachment

cc: W. C. Janes

TABLE NO. 1

Asbestos Dust Samples

Carrie Furnaces - September 5 and October 3 & 4, 1973

Blast Furnace Occupation	Sample No.	Asbestos Concentration fibers/cc	Sample Duration (Time of Cast) Minutes	Filter Smudged-Fingerprints	Filter Condition Hard to Count Due to Heavy Dust Overlay
Keeper	432	1.3	50	Yes	Yes
	134	2.2	59	No	Yes
1st Helper	121	1.6	38	Yes	No
	479	Could not count	57	Yes	Yes. Impossible to count.
2nd Helper	21	0.5	51	No	Yes
	464	4.0	60	Yes	No
	148	4.0	60	No	Yes
	20	2.8	58	No	No
3rd Helper	107	0.4	65	Yes	No

Notes:

OSHA Standard: 5 fibers per cubic centimeter time-weighted average over 8 hour workday;
10 fibers per cubic centimeter ceiling.

About 3 casts are made per turn.

File

United States Steel Corporation

Interorganization Correspondence

Date April 13, 1976

To Mr. Dean Wilson
General Superintendent
Homestead Works

From W. C. Janes, Manager
Environmental Health

Subject Asbestos Survey
Forge Shop

As requested, an Environmental Health survey was conducted on March 29, 1976 at the Forge Shop of the Homestead Works by T. M. Civic, Environmental Health Engineer. The purpose of the survey was to determine if the aluminized asbestos apparel worn by the scarfers during scarfing operations constituted an asbestos exposure.

The present OSHA standard for exposure to asbestos dust is 5.0 fibers, longer than 5 micrometers, per cubic centimeter of air, based on an 8-hr. time-weighted average exposure. On July 1, 1976, the 8-hr. time-weighted average limit will be reduced to 2.0 fibers/cm^3 of air. OSHA has recently proposed to further reduce the daily 8-hr. average exposure limit to 0.5 fibers/cm^3 of air.

The time-weighted average exposures of the scarfers monitored during scarfing operations were found to be well below the present Federal standards, as well as the proposed OSHA limit of 0.5 fibers/cm^3 of air. Airborne asbestos concentrations ranged from 0.04 fibers/cm^3 of air to 0.19 fibers/cm^3 of air, while time-weighted average exposures of 0.04 fibers/cm^3 of air and 0.06 fibers/cm^3 of air were obtained for the two scarfers monitored.

These test results indicate the aluminized asbestos clothing worn by the scarfers releases asbestos: consequently, the scarfers are exposed to asbestos filters and should be included in the annual medical monitoring program outlined in Federal Register, Vol. 39, No. 125, June 27, 1974, Section 1910.93.

The asbestos fibers probably become airborne when the coat is put on or removed. A sample taken after all operations had ceased indicated there was no exposure to asbestos after operations had ceased and the coat was no longer handled.

W. C. Janes

W. C. Janes

TMC/mdd
Attachment

USX0002266

TABLE 1

Asbestos Clothing Survey

Homestead Works

3-29-76

Occupation	Duration of Test(Min.)	Asbestos Exposure Fiber/cm^3	Remarks
Scarfer #1			
Test #1	27	0.19	Scarfing-wearing aluminized asbestos clothing
Test #2	110	0.15	Scarfing-wearing aluminized asbestos clothing
Test #3	92	0.10	Scarfing-wearing aluminized asbestos clothing
Test #4	158	0.0	No scarfing-not wearing aluminized asbestos clothing
Scarfer #2			
Test #1	52	0.12	Scarfing-wearing aluminized asbestos clothing
Test #2	52	0.12	Scarfing-wearing aluminized asbestos clothing
Test #3	220	0.04	Scarfing-wearing aluminized asbestos clothing

Time-Weighted Average #1 Scarfer - 0.06 fibers/cm^3 of air

Time-Weighted Average #2 Scarfer - 0.04 fibers/cm^3 of air

JFS

BP-WNB - Is there a substitute material?

Use substitute material - WS

United States Steel Corporation

31

U. S. STEEL CORP.
JUN 11 1976
GENERAL SUPERINTENDENT
HOMESTEAD WORKS

Interorganization Correspondence

ASST.	1547
ASST. TO	
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MET.	
ACCTS	
PROD. PLAN.	

To: Mr. Dean Wilson
General Superintendent
Homestead Works

Date: June 8, 1976

From: W. C. Janes, Manager
Environmental Health

Subject: Asbestos Survey
Open Hearth Division

At the request of Al Patterson, Supervisor of Safety, an Environmental Health survey was conducted in the Open Hearth Division on May 11, 1976. The purpose of the survey was to evaluate employee exposures to atmospheric concentrations of asbestos dust during the relining of No. 73 open hearth furnace. The Nucon 60 Refractory Brick (Harbison-Walker Refractories) used to rebuild the furnace roof is lined with an asbestos sheet which acts as an expansion strip.

Criteria

The present OSHA standard for exposure to asbestos dust is 5 fibers, longer than 5 micrometers, per cubic centimeter (cc) of air, based on an 8-hr. time-weighted average (TWA) exposure. The standard also states that employee exposures shall not exceed 10 fibers/cc for any period during the workday. On July 1, 1976, the time-weighted average limit will be reduced to 2 fibers/cc. OSHA has recently proposed to further reduce the 8-hr. average exposure to 0.5 fibers/cc with a ceiling limit of 5 fibers/cc, as determined over any period of up to 15 minutes.

Conclusions

The time-weighted average exposure of each monitored employee was found to be well below the present OSHA standard, as well as the proposed limit of 0.5 fibers/cc. The peak exposures of each employee, measured over periods up to 15 minutes, were also well within the proposed OSHA ceiling limit of 5 fibers/cc.

Recommendations

In compliance with the OSHA Asbestos Standard published in the Federal Register, June 27, 1974, Section 1910.93a(j), page 23545, annual comprehensive medical examinations should be provided to bricklayers and their helpers involved in relining open hearth furnace roofs.

PLAINTIFF'S EXHIBIT #31

USX0000199

Asbestos Exposures
No. 73 Furnace Reline
Open Hearth #5
Homestead Works
May 11, 1976

Occupation	Sample Duration (Minutes)	Exposure (Fibers/cc)	Time-Weighted Average Exposure for Total Sampling Period (Fibers/cc)
Bricklayer-East End (Kocher)	30	0.03	0.07
" " "	43	0.06	
" " "	15	0.17	
" " "	15	0.06	
" " "	30	0.06	
" " "	29	0.09	
" " "	15	0.06	
Bricklayer's Helper-East End (Miller)	30	0.00	0.04
" " " "	30	0.06	
" " " "	15	0.12	
" " " "	15	0.06	
" " " "	30	0.03	
" " " "	37	0.05	
" " " "	15	0.00	
Bricklayer-West End (Hromanik)	30	0.12	0.12
" " "	39	0.07	
" " "	15	0.23	
" " "	30	0.17	
" " "	39	0.07	
" " "	14	0.19	
Bricklayer's Helper-West End (Peters)	30	0.09	0.07
" " " "	30	0.03	
" " " "	15	0.17	
" " " "	15	0.06	
" " " "	30	0.06	
" " " "	38	0.07	
" " " "	15	0.00	

United States Steel Corporation

U. S. STEEL CORP.

Interorganization Correspondence JUL 6 1976

GENERAL SUPERINTENDENT HOMESTEAD WORKS

ASST.	
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PERS. SERV.	
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ACCTS.	
PROD. PLAN.	

To: Mr. Dean Wilson
General Superintendent
Homestead Works

July 2, 1976

From: T. M. Civic

PLAINTIFF'S EXHIBIT

REF BSA

Subject: Asbestos Survey
160", 100", 48" and
45" Mills and Wheel
and Axle Plant

This survey, part of an overall plant survey, reports the results of the asbestos exposure tests conducted by T. M. Civic, Environmental Health Engineer, on June 8 and 9, 1976 at the 160", 100", 48" and 45" Mills of the Homestead Works and the Wheel and Axle Plant. The occupations monitored were selected on the basis of the responses obtained from the various divisions pursuant to your letter of February 13, 1976.

Criteria

OSHA limits an employee exposure to asbestos dust to 5 fibers, longer then 5 micrometers per cubic centimeter of air based on an 8-hr. time-weighted average exposure. On July 1, 1976, the 8-hr. time-weighted average exposure limit will be reduced to 2 fibers/cc of air. OSHA has recently proposed to further reduce the daily 8-hr. exposure limit to 0.5 fibers/cc of air.

Conclusions

Homestead Works

The results of samples, as shown in Table 1, indicate asbestos fibers are released from the asbestos gloves, mittens and clothing worn by the 160" Mill Stamper, 100" Mill Cinderman and 45" Mill Scarfer. Time-weighted average exposures to asbestos fiber were 0.05 fibers/cc, 0.14 fibers/cc and 0.08 fibers/cc for the Stamper, Cinderman and Scarfer, respectively. Air samples collected in the 48" Mill on the employee handling and tearing asbestos sheets during the loading of hot plates into railroad cars indicated a time-weighted average exposure to asbestos fiber of 0.01 fibers/cc.

Wheel & Axle

The results of the samples, as shown in Table 2, indicate the laborer cleaning below an axle heat treat furnace had a time-weighted average exposure to asbestos fiber of 0.36 fibers/cc of air. Air samples collected while a Millwright cut a gasket material containing asbestos indicated the employee was not exposed to airborne asbestos fibers.

Although asbestos exposures of all occupations monitored were well below the permissible limits, all exposed personnel exposed to asbestos fibers should be included in a medical monitoring program, as outlined in the Federal Register, Vol. 39, No. 125, June 27, 1974, Section 1910.93.

Results of the Survey

Homestead

At the 160" Mill, air samples collected on the Hot Shear Stamper, whose only exposure to asbestos was from the wearing of asbestos gloves, indicated a time-weighted average exposure to asbestos of 0.05 fibers/cc. These gloves are similar to those worn by the 100" Mill Markers and Stampers, and the air samples collected on April 8 on these employees indicated similar asbestos exposures.

At the 100" Mill, air samples collected on the Cinderman, one of the furnace personnel who wear asbestos mittens, indicated a time-weighted average exposure of 0.14 fibers/cc of air.

Based on the results of this survey and the results of the previous survey, it is evident the asbestos gloves and mittens worn are responsible for the asbestos exposures observed and efforts should be directed toward replacement with non-asbestos materials. Discussions with operating personnel seem to indicate a brushed leather double insulated glove may be a suitable replacement. Until such times that a substitute glove containing no asbestos is issued, employees should be included in a medical monitoring program.

Similarly, air samples collected on a Scarfer, working in the 45" Mill, whose only exposure to asbestos was from the wearing of asbestos clothes, indicated a time-weighted average asbestos exposure of 0.08 fibers/cc of air. All Scarfers required to wear similar asbestos clothing should be included in a medical monitoring program until a substitute material can be found.

At the 48" Mill, Shipping and Piling Area, samples collected during the handling and tearing of the asbestos sheets during the loading of hot plates into railroad cars indicated the employee involved in the above operation was exposed to airborne asbestos fibers. Although his time-weighted average exposure was 0.01 fibers/cc of air, it is required he be included in a medical monitoring program. It is recommended that Kaowool, an alternate material, be substituted for the asbestos at this operation to eliminate the need for medical monitoring.

This report concludes the exposure evaluations of the employees involved in the different applications of asbestos-containing materials in the 45, 48, 100 and 160" Mill except for the use of asbestos sheets used by the burner to cover hot plates during flame cutting to protect his feet. No air samples were collected because the flame cutting operation is not a routine procedure and was not operating at the time of the survey; however, if no effort is made to find a substitute for the asbestos, arrangements should be made to have air samples collected to evaluate the burner's exposure to asbestos.

Wheel & Axle

At the Wheel & Axle Plant, asbestos usage was limited to asbestos tape and rope, asbestos pipe insulation, asbestos gloves, asbestos curtains on the wheel heat treat furnaces, asbestos gasket materials, and asbestos insulating brick. Efforts are being made to replace (1) asbestos gloves with gloves not containing asbestos; (2) asbestos pipe insulation with fiberglass insulation; (3) asbestos curtains with "Kaowool"; (4) asbestos rope and tape with ceramic fiber or linen with substitutes. If these materials are not replaced with materials that do not contain asbestos, arrangements should be made to evaluate employee asbestos exposures.

Asbestos exposure tests conducted on a Millwright cutting gasket material (Johns-Manville Style 1600 and Garlock HHD) indicated no exposure to asbestos fibers. The gasket materials were completely encapsulated with a plastic-type coating, thus preventing the fibers from becoming airborne.

Air tests conducted on a laborer cleaning out under an axle heat treating furnace indicated an asbestos exposure of 0.36 fibers/cc of air. This exposure to asbestos originates from the asbestos contained in the insulating brick. Most manufacturers of insulating and fire brick have removed the asbestos from their products. We suggest purchasing asbestos-free brick for relining of furnaces. Until the brick can be replaced with brick not containing asbestos, all employees engaged in tear-down operations should be included in a medical monitoring program.

W C Janes

W. C. Janes

TMC/mdd
Attachments

Table 1

Asbestos Survey

Homestead Works

6-8-76

Location	Remarks	Asbestos Exposure Tests Fibers/cc	Time-Weighted Average Exposure Fibers/cc
160" Mill Hot Shear Stamper	Wears asbestos gloves	0.04 0.07	0.05
100" Mill Cinderman	Wears asbestos mittens	0.09 0.24	0.14
45" Mill Slab Yard Scarfer	Wears asbestos coat and pants	0.10 0.04 0.13	0.08
48" Mill Shipping & Piling Area	Breaks asbestos sheets for loading of Hot Plates in RR Cars	0.02	0.01

O Homestead — 1
Dust

United States Steel Corporation

Interorganization Correspondence

PLAINTIFF'S EXHIBIT

Date: May 21, 1973

To: K. M. Morse, Director
Environmental Health

From: J. B. Masaitis

Subject: Asbestos Open Hearth
Homestead Works

On May 21, 1973, I talked with Bill Coates, Ceramic Engineer at Homestead Works, pertaining to the asbestos composition of the spacers, rings, etc. used for hot tops. He advised me that the manufacturers (Ferro, Fesceco, etc.) stated the products contain between 5-10% asbestos. I told Mr. Coates of our previous surveys at similar operations, and found out that they conduct the operation similar to that at Fairless Works; that is vacuuming molds, knocking the material to the tracks and cleaning up, etc. Upon this basis, I told Mr. Coates that the moldmen's exposures would probably be similar to those at Fairless Works, that is excessive, and there probably would be no need to take samples; and they should change to the asbestos-free products now available. He told me of the reluctance of the operating personnel to switch to the asbestos-free products because of the higher costs. I told Mr. Coates of the stringent control measures governing the use of asbestos products, and to have the operating personnel review the control measures as outlined in the Occupational Safety and Health Act.

The other operation that Mr. Coates wanted surveyed was the furnace rebuilds because of the 90-100% asbestos in the spacer boards used in the roof. I told Mr. Coates that we would probably want to collect samples during this operation since, to my knowledge, it has not been evaluated. The next furnace rebuild is scheduled for June 2 and usually takes 2-3 days. Mr. Coates is expecting to hear from us prior to this date.

Jack

J. B. Masaitis

JBM/mdd

Attachment

cc: W. C. Janes

USX0000183

file 2

United States Steel Corporation

PLAINTIFF'S EXHIBIT 2142

Interorganization Correspondence

To: Mr. Frank S. Pokrywka
Environmental Health Engineer
Homestead Works

Date: November 5, 1981

From: J. F. Quealy
Senior Environmental
Health Engineer

Subject: Analysis of Insulation Material

As requested, Environmental Health as analyzed a bulk sample of insulation material, currently in use at Carrie Furnaces, for determination of possible asbestos content. Visual examination of the material showed it to have a soft, white, fluffy appearance with an obvious fibrous component.

Several fibers were removed from the sample and examined under polarized light microscopy at 400 magnification. Numerous fibrous bundles consisting of individual fibrils were clearly observed. In addition, the fibers were determined to be anisotropic, i.e., they exhibited more than one index of refraction when viewed under crossed polars. All forms of asbestos exhibit this birefringent property.

Finally, the sample was analyzed by the dispersion staining technique, in which the fibers are mounted in a liquid of known refractive index and examined under 100 magnification using a specially designed microscope objective. Using this method to positively identify the fibers, the sample was found to contain an extremely high percentage of amosite asbestos and a lesser, but still significant, amount of chrysotile asbestos.

In summary, our tests showed that asbestos is definitely a major component of this insulation material.

James F. Quealy

JFQ/jmr

USX0000769

United States Steel Corporation

Interorganization Correspondence

PLAINTIFF'S EXHIBIT

Ex

Date: July 3, 1972

To: General Superintendents, Plant Managers and Attendees at OSHA Regional Meetings

From: Kenneth M. Morse, Director Environmental Health

Subject: Proposed Permanent Asbestos Standard

OSHA published its permanent (final) Standard for Exposure to Asbestos Dust, in the Federal Register of June 7, 1972. A copy of this standard is enclosed for your information. We suggest your thorough review of this standard due to the highly restrictive requirements that are established. It is further suggested that you inventory your uses of asbestos compounds as to location, jobs and quantity used per month or year in order to establish a priority list of jobs and areas for monitoring.

We are indicating below the pertinent aspects of this standard.

1. Permissible Maximum Dust Exposure

   a. As of July 7, 1972, the 8-hour time-weighted average exposure is limited to 5 fibers per milliliter of air for dust not exceeding 5 micrometers in length. However, as of July 1, 1976, the limit is reduced to 2 fibers per milliliter.

   b. While a time-weighted average is determined over an 8-hour work period, the dust concentration to which a worker is exposed cannot exceed 10 fibers per milliliter for any period of time (ceiling value).

   c. This standard applies to the use of any type of asbestos.

2. Methods of Compliance

   Feasible technological controls and appropriate work practices must be the primary means of controls. Rotation of employees is allowed only in stated exceptional circumstances. The use of respirators and shift rotation of employees will be limited. The methods for controls consist of, but are not limited to, the following:

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(3) In emergencies

(4) Where both respirators and personnel rotation are allowed, the latter shall be preferred.

b. The types of air-purifying respirators allowed are based upon the dust concentration to which an employee is exposed and must be of the types approved by the U. S. Bureau of Mines (USBM)—and the National Institute of Occupational Safety and Health (NIOSH).

(1) When the employee may be expected to receive an exposure no more than 10 times the exposure limits, a reusable or single use air purifying respirator of the non-powered or supplied air type may be used. (This is the commonly used mechanical filter type.)

(2) When the exposure is expected to be between 10 to 100 times the exposure limits, a full face piece, oral-nasal, or continuous flow or pressure-demand types of supplied-air respirators must be used.

(3) When the exposure is expected to be in excess of 100 times the exposure limits, only the supplied-air respirators of the continuous flow or pressure-demand class can be used. These are now classed by USBM and NIOSH as Type "C".

(4) A respirator program must be established by the employer in compliance with the American National Standards Practices For Respiratory Protection (ANSI Z88.2-1969).

If an employee cannot function normally when wearing a respirator, as determined by a physician from the employee's most recent examination, he must be rotated to another job or provided the opportunity for a job transfer. The job to which he

b. Monitoring Requirements

(1) Initial Survey: Within six months a survey must be conducted to determine the exposure of every employee to asbestos dust. If the exposure limits are exceeded, a control program, as herein indicated must be immediately initiated.

(2) Periodic Survey: At least every six months for all employees who may be reasonably expected to have exposures exceeding the exposure limits.

(3) Personal and Area Samples: Both personal and area air samples are required. No significant reason for both appears justified. Exposures of workers are best determined by having workers wear battery-operated sampling devices (personal samplers) which provide a time-weighted concentration to which the wearer is exposed. If this sampling is done, area sampling would be superfluous.

c. Employee Observation of Monitoring

Affected employees, or their representatives, must be given a reasonable opportunity to observe monitoring and shall have access to the records thereof.

5. Caution Signs and Labels

a. Posting of Asbestos Areas

Caution signs of prescribed specifications must be posted at all approaches to areas containing excessive concentrations of dust and at each location where dust may be excessive.

b. Labels

Caution labels are required on all asbestos containing materials or on their containers except when a bonding agent is used to prevent in any foreseeable use, airborne dust in excess of the exposure limits. Specifications for such labels are prescribed.

(2) On or before January 31, 1973, and at least annually thereafter, every exposed employee shall be provided, or have available to him, a comprehensive medical examination.

(3) A comprehensive medical examination shall be provided, or made available to every exposed employee within 30 days before, or after termination of employment.

(4) No medical examination is required if records show such an examination within the past 1-year period.

c. Records

(1) Employers shall maintain complete and accurate medical records for at least 20 years. Such records shall be made available, for inspection, and copying, to OSHA, NIOSH, authorized physicians and medical consultants of OSHA and NOISH, and to the personal physician of employees or former employees if requested by such employees.

(2) The employer shall be furnished all the medical information of the required medical examination by the physician who conducts same.

Kenneth M Ihnacheck

mt

PLAINTIFF'S EXHIBIT #50

Exb #50

United States Steel Corporation

Interorganization Correspondence

Date: June 26, 1972

To: General Superintendents, Plant Managers and Attendees at OSHA Regional Meetings

From: Kenneth M. Morse, Director Environmental Health

Subject: Proposed Permanent Asbestos Standard

OSHA published its permanent (final) Standard for Exposure to Asbestos Dust, in the Federal Register of June 7, 1972. A copy of this standard is enclosed for your information. We suggest your thorough review of this standard due to the highly restrictive requirements that are established. It is further suggested that you inventory your uses of asbestos compounds as to location, jobs and quantity used per month or year in order to establish a priority list of jobs and areas for monitoring.

We are indicating below the pertinent aspects of this standard.

1. Permissible Maximum Dust Exposure

   a. As of July 7, 1972, the 8-hour time-weighted average exposure is limited to 5 fibers per milliliter of air for dust not exceeding 5 micrometers in length. However, as of July 1, 1976, the limit is reduced to 2 fibers per milliliter.

   b. While a time-weighted average is determined over an 8-hour work period, the dust concentration to which a worker is exposed cannot exceed 10 fibers per milliliter for any period of time (ceiling value).

   c. This standard applies to the use of any type of asbestos.

2. Methods of Compliance

   Feasible technological controls and appropriate work practices must be the primary means of controls. Rotation of employees is allowed only in stated exceptional circumstances. The use of respirators and shift rotation of employees will be limited. The methods for controls consist of, but are not limited to, the following:

USX0000339

(3) In emergencies

(4) Where both respirators and personnel rotation are allowed, the latter shall be preferred.

b. The types of air-purifying respirators allowed are based upon the dust concentration to which an employee is exposed and must be of the types approved by the U. S. Bureau of Mines (USBM) and the National Institute of Occupational Safety and Health (NIOSH).

(1) When the employee may be expected to receive an exposure no more than 10 times the exposure limits, a reusable or single use air purifying respirator of the non-powered or supplied air type may be used. (This is the commonly used mechanical filter type.)

(2) When the exposure is expected to be between 10 to 100 times the exposure limits, a full face piece, oral-nasal, or continuous flow or pressure-demand types of supplied-air respirators must be used.

(3) When the exposure is expected to be in excess of 100 times the exposure limits, only the supplied-air respirators of the continuous flow or pressure-demand class can be used. These are now classed by USBM and NIOSH as Type "C".

(4) A respirator program must be established by the employer in compliance with the American National Standards Practices For Respiratory Protection (ANSI Z88.2-1969).

If an employee cannot function normally when wearing a respirator, as determined by a physician from the employee's most recent examination, he must be rotated to another job or provided the opportunity for a job transfer. The job to which he

b. Monitoring Requirements

(1) Initial Survey: Within six months a survey must be conducted to determine the exposure of every employee to asbestos dust. If the exposure limits are exceeded, a control program, as herein indicated must be immediately initiated.

(2) Periodic Survey: At least every six months for all employees who may be reasonably expected to have exposures exceeding the exposure limits.

(3) Personal and Area Samples: Both personal and area air samples are required. No significant reason for both appears justified. Exposures of workers are best determined by having workers wear battery-operated sampling devices (personal samplers) which provide a time-weighted concentration to which the wearer is exposed. If this sampling is done, area sampling would be superfluous.

c. Employee Observation of Monitoring

Affected employees, or their representatives, must be given a reasonable opportunity to observe monitoring and shall have access to the records thereof.

5. Caution Signs and Labels

a. Posting of Asbestos Areas

Caution signs of prescribed specifications must be posted at all approaches to areas containing excessive concentrations of dust and at each location where dust may be excessive.

b. Labels

Caution labels are required on all asbestos containing materials or on their containers except when a bonding agent is used to prevent in any foreseeable use, airborne dust in excess of the exposure limits. Specifications for such labels are prescribed.

(2) On or before January 31, 1973, and at least annually thereafter, every exposed employee shall be provided, or have available to him, a comprehensive medical examination.

(3) A comprehensive medical examination shall be provided, or made available to every exposed employee within 30 days before, or after termination of employment.

(4) No medical examination is required if records show such an examination within the past 1-year period.

c. Records

(1) Employers shall maintain complete and accurate medical records for at least 20 years. Such records shall be made available, for inspection, and copying, to OSHA, NIOSH, authorized physicians and medical consultants of OSHA and NOISH, and to the personal physician of employees or former employees if requested by such employees.

(2) The employer shall be furnished all the medical information of the required medical examination by the physician who conducts same.

Kenneth M. Morse/ca

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Interferences:

The presence of other fibrous material which "will be counted" as asbestos.

Sampling Procedure:

1. Assemble the filter, support pad, and cassette and close firmly to insure a good seal between the cassette edge and filter. Seal the cassette with a tape or shrinkable band.

2. Remove the cassette outlet plug, and attach to the pump with a stainless steel luer.

3. For personnel monitoring, clip the pump to the worker's belt and the cassette to the worker's lapel and remove the cassette top (creating an open-face cassette).

4. Set the pump flow rate at the calibrated rate by positioning the middle of the rotameter ball to the calibration mark. The pump flow rate should be checked and readjusted as needed.

5. Record the sampling time.

6. After sampling, replace the cassette top and insert the plug into the cassette outlet.

7. An appropriate number of blanks, properly labeled, should be sent with each batch of filters.

Shipping Instructions:

The cassettes in which the samples are collected should be shipped to the Environmental Health Laboratory in a suitable container, designed to keep the cassettes upright. Many cassettes do not fit together properly, therefore, tape should be wrapped around each cassette, covering both plugs, to keep all sections intact and the plugs in place.

Analytical Method:

Fiber count by phase contrast microscopy using 400 magnification following the clearing of the filter on a microscope slide.

Comments:

Since there is a ceiling level for asbestos exposure of 10 fibers (greater than 5 micrometers long with a 3:1 aspect ratio) per cubic centimeter, then 15-minute samples should be collected to determine if the ceiling level is exceeded.

the exposures can be monitored over short, peak periods or averaged over the entire workshift.

The OSHA Asbestos Standard requires that periodic monitoring be conducted, at intervals no greater than six months, on those employees whose asbestos exposures may reasonably be foreseen to exceed permissible exposure limits. However, any initial determination of such elevated exposures would be an immediate cause for concern, and corrective action should be promptly taken by U. S. Steel Management to implement control measures to reduce asbestos exposures to the lowest possible levels. It is recommended that monitoring of exposure levels be conducted with sufficient frequency so that accurate exposure evaluation information is available for each operation where asbestos is encountered.

Asbestos Monitoring Procedures

OSHA Permissible Exposure Limit:

	*fibers/cc
8-hr. time-weighted average:	2
ceiling:	10
**emergency temporary standard	
8-hr. time-weighted average:	0.5

*Fibers greater than 5 micrometers long with a 3:1 aspect ratio.

Sampling Equipment: (mixed cellulose ester filter method)

A calibrated personal sampling pump plus 0.8 micrometer pore size mixed cellulose ester filter with a cellulose back-up pad mounted in an open 3-piece filter cassette (refer to Chapter VIII-Sampling for Particulates-Environmental Health Monitoring Manual).

The sampling tube is connected to the pump by means of flexible tubing with a stainless steel luer.

Sample Size:***

Sample Volume: 25.5 liters

Sample Rate: 1.7 liters per minute

Sample Time: 15 minutes

**The Emergency Standard was struck down by the courts; however, OSHA has proceeded with its development of a permanent Standard which we believe will be set at 0.5 fibers/cc or lower.

***See Comments.

III. AN INTEGRATED CONTROL PROGRAM TO PROTECT EMPLOYEES AGAINST THE HAZARDOUS EFFECTS OF ASBESTOS EXPOSURE

Four key elements are necessary to insure the success of a program designed to control the adverse health effects of asbestos fibers in man's environment. These basic components include:

- air monitoring and analysis to determine the level of exposure to asbestos fibers;
- medical surveillance to assure that no physiological changes are occurring as a result of the asbestos exposures;
- physical control of human exposure to asbestos fibers; i.e., to reduce the contact between the worker and the fibers;
- an educational program to inform employees of the potential hazards of asbestos and to train them in the proper implementation of procedures designed to minimize exposures; posting of warning signs in locations where airborne concentrations of asbestos fibers are anticipated to exceed the reduced exposure limit of 0.5 fibers/cc.

A. Industrial Hygiene Monitoring

The first determination that must be made is whether or not there is an actual exposure to asbestos. It is meaningless and often costly to arrive at a solution where no problem exists. There are numerous fibrous insulation materials used throughout the Corporation which may or may not contain asbestos. Where there is uncertainty, a bulk sample of the material is sent to the Environmental Health Laboratory at the USS Technical Center to ascertain the possible presence of asbestos. Using polarizing light microscopy, verification is made by categorizing and identifying fibers and particles by their morphology and crystalline properties. In addition, the K" test, a wet chemical screening test specific for magnesium and iron complexes, may also be conducted. In most cases, these tests will confirm the presence of asbestos or eliminate the possibility of it being a component of the bulk material. If there is any doubt, the sample will be analyzed by electron microscope techniques to make a positive identification.

When employees work with materials known to contain asbestos, their exposures are evaluated with personal monitoring equipment which can detect and measure the concentrations of asbestos fibers which may be released into the worker's breathing zone. With such equipment, peculiar relationship to asbestos fibers has received considerable attention. Mesotheliomas can occur even after a limited exposure to asbestos dust and may affect people who were not directly involved in handling the material, such as relatives of asbestos workers who may be exposed to dust carried home on work clothing.

II. THE HEALTH HAZARD OF ASBESTOS

Knowledge of diseases associated with the use of asbestos apparently dates back 2,000 years. However, the association of asbestos with chronic respiratory disease had to be rediscovered in the modern era. In very recent times, asbestos exposure has been shown to have a causal relationship with a variety of disease entities and pulmonary abnormalities including:

A. Pleural Effusion, Pleural Thickening, Calcification & Placques

Asbestos exposure should be considered whenever there is benign effusion in the pleural cavity. The effusion may be accompanied by pleural thickening. Pleural thickening, usually bilateral in distribution, may occur, however, without previous evidence of effusion. A pleural placque is a localized fibrous thickening of a parietal pleural surface. Microscopically, placques consist primarily of connective tissue, often containing deposits of calcium. They do not interfere with pulmonary function to any significant extent, nor do they necessarily indicate the presence of pulmonary fibrosis. An association between pleural abnormalities and exposure to asbestos has been demonstrated in several studies.

B. Asbestosis

A diffuse, interstitial, non-malignant scarring of the lung. This is the most common disease produced by exposure to asbestos. It is a sometimes fatal condition that results from significant, but not necessarily heavy exposure. Lung infections, such as pneumonia or bronchitis, are extremely threatening to people with asbestosis.

C. Bronchogenic Carcinoma (Asbestos and Smoking)

A malignancy of the interior of the lung. A high proportion of asbestos patients may develop lung cancer. The cancer risk is much higher for cigarette smokers suggesting some synergistic relationship between asbestos fibers and tobacco smoke. It has been estimated that asbestos workers who smoke have almost 90 times greater risk of lung cancer than the non-smoking general public.

D. Mesothelioma

A diffuse malignancy of the lining of the chest cavity or of the lining of the abdomen. This condition is extremely rare in the general public; however, the incidence of these cancers has been increasing and their

I. INTRODUCTION

Asbestos is a generic term used to describe a variety of naturally occurring, fibrous, hydrated mineral silicates. There are two main types: serpentine and amphibole. The serpentine variety is called chrysotile and accounts for more than 90% of the asbestos used in the United States. Amphibole asbestos includes the fibrous forms of the minerals amosite, crocidolite, tremolite, actinolite and anthophyllite. Asbestos fibers are generally characterized by high tensile strength, flexibility, heat and chemical resistance, and favorable frictional properties. Certain grades can be carded, spun and woven, while others can be laid and pressed to form sheets or used for structural reinforcement of materials, such as cement, plastic and asphalt.

There are over 3,000 known asbestos products used in industry, commerce and the home. Examples of these include building and pipe insulation materials; products such as millboard, roofing felt and beverage filters; rope and braid; asbestos-cement pipe and sheets; vinyl-asbestos floor tiles; automotive brake linings and clutch plates; paints, coatings and sealants; gaskets and packings; and reinforced plastics. For all practical purposes, asbestos is a ubiquitous substance; i.e., almost everyone is exposed to it in some form and to some degree, everyday.

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I.H.-12

PLAINTIFF'S EXHIBIT

IHS GUIDELINE 12

GUIDELINES FOR THE PROTECTION OF EMPLOYEES AGAINST THE HAZARDS OF ASBESTOS DUST EXPOSURE

INDUSTRIAL HYGIENE SERVICES
UNITED STATES STEEL CORPORATION

Revised: February, 1985

2.2 5.1(E)

AISI MEMBERS
ASBESTOS SUBSTITUTION EXPERIENCE

Application	Replacement Products	Comments
1. Protective Clothing i.e. coats, hoods, aprons, gloves	A. Kevlar	Usual life at least twice that of asbestos: 1) scarfing - gloves and aprons 2) blast furnace cast house - coats 3) welding - gloves 4) sundry hot work - gloves and mitts
	B. Thermobest (Kevlar-Arimid Fiber)	Same as Kevlar.
	C. Fiberglass Insulating Material	Satisfactory.
	D. Aluminized Fiberglass Coat	Satisfactory for light use.
	E. AB-L Gloves	Not for extreme heat.
	F. Aluminized Pre-Ox Coat	Unsatisfactory for clothing which must be flexible; i.e., coats, gloves. Satisfactory for aprons or blankets.
	G. Aluminized Rayon Gloves	
	H. Wool Coats	More durable than asbestos in some applications.
	I. Canvas Aprons	
	J. Leather/Wool Foundry Glove	Good performance. Life expectancy similar to asbestos.

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AISI MEMBERS
ASBESTOS SUBSTITUTION EXPERIENCE

Application		Replacement Products	Comments
Protective Clothing (continued)	K.	Nomex Aluminized Mittens	
	L.	KF105 Safeco Scarfers Mitts	
	M.	Wool and Glass Leggings (Aluminized)	
	N.	Kn634 Aluminized Hand Pads 8" x 12"	Hand protection.
	O.	Nomex Duck Coat (Aluminized)	Melting operations.
2. Rope	A.	Fiberfrax	Breaks up when heated.
	B.	Thermo-Ceram	Adequate for caster bloom dummy heads.
	C.	Paper Rope	
	D.	Fibreglas	
	E.	Dry Oakum	Works as well as asbestos rope for caster dummy bar head.
	F.	Asbestos Free Custom Sealant	
	G.	Kaowool Rope 1/4" 3/8" 1/2"	Excellent performance as seal between top half (cope) and bottom half (drag) on foundry sand molds. (Always one-time use.) Life expectancy same as asbestos.. Coke oven door packing - performance varies. Life slightly longer than asbestos in some cases.

AISI MEMBERS

ASBESTOS SUBSTITUTION EXPERIENCE

Application		Replacement Products	Comments
3. Blankets and Curtains	A.	Siltemp 8R4 CH 36" x 50 yd.	Satisfactory performance. High heat resistance. Low abrasion resistance.
	B.	Weldgard 200 40" x 50 yd.	Satisfactory performance. High abrasion resistance. Low heat resistance.
	C.	Clean Gard #8940 40" x 50 yd.	Satisfactory.
	D.	Fibreglass	Greater life expectancy than asbestos.
	E.	Fiberfrax 1000 FW 35 (Carborundum)	
	F.	Refrasil	
		1) UC 100-96 50 yds./roll 36" wide (HITCO)	Lasts longer than asbestos when used as flame curtains on bright anneal furnace. Fuzz separates from Refrasil and is deposited periodically on stainless pipe and tube with undesirable results.
		2) Irish Cloth 32" roll (HITCO)	Performs well, but lacks abrasion resistance.
		3) Refrasil Cloth (HITCO)	Low abrasion resistance.
	G.	"C-Lite" Welding Shield	Not as durable as asbestos.
	H.	Fromelt Reyfoil Welding Curtains	Not as durable as asbestos.

AISI MEMBERS
ASBESTOS SUBSTITUTION EXPERIENCE

Application		Replacement Products	Comments
Blankets and Curtains (continued)	I.	White Pyrotex Safety Blanket 1-1/2", 2400°	For extreme heat.
	J.	Nomex Cloth	Gets holes in it when used as an arc and heat shield.
	K.	Zentex	
	L.	Fiberfrax Paper	
	M.	Calcium-Silicate Paper	
	N.	Clear Plastic	
	O.	Thermoglass	Satisfactory.
4. Gasket Material	A.	Garlock 900	
		1/32 x 40 in. 1/16 x 40 in. 1/8 x 40 in.	Satisfactory performance for steam line flange gaskets.
	B.	Garlock Blue-Gard	
		1/32 x 60 x 120 in. 1/16 x 60 x 120 in. 1/8 x 60 x 120 in.	Satisfactory performance.
	C.	Armstrong Thermo-Tork	
		1/32 x 36 in. 1/16 x 36 in.	Satisfactory performance.
	D.	Zentex 1200	
	E.	Refrasil Blanket	

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AIS. MEMBERS
ASBESTOS SUBSTITUTION EXPERIENCE

Application		Replacement Products	Comments
Gasket Material (continued)	F.	Pilbrico Blanket	
	G.	Fiberfrax	
5. Entry-Exit Rolls Annealing Furnace	A.	Kover-Kwick KKAF-29	Satisfactory performance. Costs twice that of asbestos.
	B.	Stainless Steel Rolls	Satisfactory for non-finish application.
	C.	American Metalizing - Stainless Steel Body Plasma Sprayed with magnesium-zironate	Experimental.
	D.	Water Cooled Steel Marinite (Johns-Manville)	Large cost savings. No labor problems due to asbestos handling and machining.
6. Tape Covering for Electrical Connectors and Rubber Hoses	A.	Siltemp Wt. 36-10	
		.060" x 1.5" x 100' .060" x 2" x 100'	Satisfactory performance. Costs twice that of asbestos.
	B.	Kaowool (2 in.)	Satisfactory performance.
	C.	Refrasil	
		.015" x 1" x 280' 0.15" x 1.5" x 280'	Satisfactory peformance.
	D.	Southern Textile 300	
		1/32" x 1.5" x 100' 1/32" x 2" x 100'	Satisfactory performance.

AISI MEMBERS
ASBESTOS SUBSTITUTION EXPERIENCE

Application		Replacement Products	Comments
Tape Covering, etc. (continued)		1/16" x 1" x 100' 1/16" x 1.5" x 100' 1/16" x 2" x 100'	
	E.	Ceramic Cloth 60" x 1/2" (Allied Industries)	Performance and quality good. Life 85% that of asbestos. Fair performance in high heat zone.
	F.	Glass Insulation Tape 1-1/2" wide 1" wide	Motor insulation. Thinner than asbestos tape, better quality and longer life expectancy.
	G.	Zentex	
	H.	Thermo-Sil	
		1-1/2" x 1/8" x 100' (Garlock Inc.)	Good substitute.
	I.	#3158 Gilt Edge Fiberglass Tape #NG-453-6	Replaces asbestos woven tape for insulating D.C. motor armatures.
7. Bright Anneal Furnace			
A. Entry Seal	A.	Pre-Ox	Experimental, twice the cost of asbestos.
B. Exit Seal	B.	Pyrotex Fiberglass VJA	Experimental.
8. Hot Pipe Covering	A.	Fiberglass Forms	Satisfactory performance.
	B.	Owens-Corning Fiberglass	Satisfactory performance.
	C.	Microlock 650 (Johns-Manville)	

AISI MEMBERS
ASBESTOS SUBSTITUTION EXPERIENCE

Application		Replacement Products	Comments
Hot Pipe Covering (continued)		1/2" diameter 2" diameter 4" diameter 8" diameter	Excellent material.
	D.	Thermo 12 (Johns-Manville)	Satisfactory performance.
9. Brake Shoes	A.	Glass (F. B. Wright)	Experimental.
	B.	Woven Brake Fiber	Experimental.
	C.	Scan-Pak Milwaukee, IL	Satisfactory performance.
10. Braided Tubing	A.	Fiberfrax Tubing (1 MP 126) (Carborundum Corp.)	Used for daming flux during submerged arc welding operations. 75% of the life of asbestos. Performance and quality good.
11. Protection of Launder Scope During Tapping of Furnace		Kaowool Sleeve 6" diameter	Performance satisfactory. Life 1/2 that of asbestos.
12. Protection of Stopper Rod and Gooseneck Threads on Ladles During Pouring		Cerablanket (6PCF) 1/4" thick (Johns-Manville)	Performance satisfactory, life 1/10 that of asbestos.
13. Tundish Liner and Caster Mold Cover		Ceraform (Johns-Manville)	Experimental.
14. Protection of Machined Holes During Heat Treat Operations		Fiberfrax LDS Moldable (Carborundum Corp.) 24-11 oz. Tubes	Applied with caulking gun. One-time use only.

ASBESTOS SUBSTITUTION EXPERIENCE

	Application		Replacement Products	Comments
15.	Filter Pads for Manganese (Bismuthate Method) and Mixed with Mortar for use as a Refractory Insulation for Electric Lab Furnaces (High Temp.)		Glass Fiber Paper	
16.	Insulation	A.	Kaowool (Babcock & Wilcox) 1" x 24" x 300	Covering for slab transfer railroad cars. Easier to work with than asbestos.
		B.	Superrex Block Insulation	Various applications.
		C.	#210 Block Insulation	Various applications.
		D.	Staz-on Insulation	Various applications.
		E.	Mineral Fiber Coating	Various applications.
		F.	Fireated Tiles? 2' x 4'	Ceiling tiles.
		G.	Plibrico Bulk Fiber	Furnace insulation.
17.	Glue		Plibrico Drum Fiber Stick	
18.	Wipes		Kevlar	Wipes for sheet galvanizing unit.

AISI MEMBERS
ASBESTOS SUBSTITUTION EXPERIENCE

Application	Replacement Products	Comments
19. Babbitt Mud	A. Babbitt Rite	Ready made.
	B. Pyromite	Ready made.

APPENDIX 3, Part A

ASBESTOS SUBSTITUTES - USS

LITERATURE SEARCH

ASBESTOS SUBSTITUTES
Literature Search

	Application		Replacement Products	Replacement Product Cost (1973)	Comments
1.	Protective Clothing, i.e., coats hoods aprons gloves	A.	Kevlar	$3.04/sq. ft. before manufacturing	Usual life at least twice that of asbestos in all applications including: 1) Scarfing - gloves and aprons 2) Blast Furnace Cast House - coats 3) Welding - gloves 4) Sundry Hot Work - gloves and mitts
		B.	Thermobest (Kevlar - Arimid Fiber)	$18.87/yd. before manufacturing	
2.	Rope	A.	Fiberfrax (Carborundum)		Breaks up when heated.
		B.	Kaowool		Coke oven door packing - life slightly longer than asbestos in some cases.
		C.	Thermo-Ceram		Adequate for caster bloom heads.
3.	Blankets and and Curtains	A.	Siltemp # 84 ch 36 in. x 50 yd.	$10.80/yd.	Satisfactory performance. High heat resistance. Low abrasion resistance.
		B.	Weldgard 200 40 in. x 50 yd.	$10.46/yd.	Satisfactory performance. High abrasion resistance. Low abrasion resistance.
		C.	Clean Gard #8940 40 in. x 50 yd.	$ 2.50/ft.	Satisfactory.

ASBESTOS SUBSTITUTES
Literature Search

Application	Replacement Products	Replacement Product Cost (1973)	Comments
4. Gasket Material	A. Garlock 90 1/32 x 40 in.	$ 1.18/lb.	Satisfactory performance for steam line flange gaskets.
	1/16 x 40 in.	$ 1.13/lb.	
	1/8 x 40 in.	$ 1.75/lb.	
	B. Garlock Blue-Gard		
	1/32x60x120 in.	$53.90/roll	Satisfactory performance.
	1/16x60x120 in.	$89.84/roll	
	1/8x60x120 in.	$179.70/roll	
	C. Armstrong Thermo-Tork 1/32 x 36 in.	$ 4.80/lb.	Satisfactory performance.
	1/16 x 36 in.	$ 8.76/lb.	
5. Entry-Exit Rolls Annealing Furnace	A. Kover-Kwick KKAF-29		Satisfactory performance. Costs twice that of asbestos.
	B. Stainless Steel Rolls		Satisfactory for non-finish application.
	C. American Metalizing		Experimental.
	Stainless Steel Body. Plasma sprayed with magnesium-zirconate		

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ASBESTOS SUBSTITUTES
Literature Search

Application		Replacement Products	Replacement Product Cost (1973)	Comments
6. Tape Covering for Electrical Connectors and Rubber Hoses	A.	Siltemp Wt. 36-10		
		.060"x1.5x100'	$ 1.15/ft.	Satisfactory performance.
		.060"x2"x100'	$ 1.20/ft.	Costs twice that of asbestos.
	B.	Kaowool (2 in.)		Satisfactory performance.
	C.	Refrasil		
		.015"x1"x280'	$ .35/ft.	Satisfactory performance.
		0.15"x1.5"x280'	$ .36/ft.	
	D.	Southern Textile 300		
		1/32"x1.5"x100'	$10.54/roll	Satisfactory performance.
		1/32"x2"x100'	$12.40/roll	
		1/16"x1"x100'	$ 9.78/roll	
		1/16"x1.5"x100'	$13.64/roll	
		1/16"x2"x100'	$16.43/roll	
7. Bright Anneal Furnace				
A. Entry Seal	A.	Pre-Ox (aluminum backed)		Experimental. Twice the cost of asbestos.
B. Exit Seal	B.	Pyrotex Fiberglass V 3A		Experimental.
8. Hot Pipe	A.	Fiberglass Forms		Satisfactory performance.
9. Brake Shoes	A.	Glass F.B. Wright		Experimental.
	B.	Woven Brake Fiber		Experimental.

APPENDIX 3, Part B

ASBESTOS SUBSTITUTES

USS PLANT SURVEY (1972)

APPENDIX 3, Part B
ELIMINATION OF USE OF ASBESTOS - USS

In 1974, the Federal Government published a proposed standard for employee exposure to asbestos dust. At that time, we made a survey of the products in our plants which contained asbestos.

From that survey, a program was begun to consider replacing asbestos-containing items with alternative products. The following is a listing of the replacement products we are now using:

Asbestos Product	Cost	Replacement Product	Cost (1972)	Comments
Asbestos Gloves	$8.44 pr.	Aluminized gloves Nor-fab 400 -22 oz. Nor-fab 900 -24 oz.	-	Corporation approved
		Alum/leather Alum/PFR rayon	-	" "
Asbestos Gloves	-	AD-L gloves, aluminized back	$14.18 pr.	Not for extreme heat
Asbestos Gloves	-	AB gloves, aluminized back, heat resistant leather palms	$10.70 pr.	Not for extreme heat
Asbestos Cloth Welding Shield	$47.00	"C-Lite" welding shield	$46.80 ea.	Not as durable as asbestos curtain
		Fromelt Rey-foil welding curtains	$33.00 ea.	" "

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Asbestos Product	Cost	Replacement Product	Cost (1972)	Comments
Asbestos Welding Blankets	$37.00	White Pyrotex safety blanket 1-1/2", 2400°	$320.00 ea.	For extreme heat
Asbestos Cloth Heat Shield	$6.70 sq.yd.	Sil-Temp	$16.00 sq. yd.	Good protection from heat, low strength
Asbestos Cloth to Wrap Hoses on Electric Furnaces	$6.70 sq.yd.	Sil-Temp	$16.00 sq. yd.	Not fully satisfactory
Aluminized Asbestos Coats	$140.00 ea.	Aluminized Pre-Ox Coat Nor-fab 400 - 19 oz. Nor-fab 900 - 16 oz.	-	Approved for Corporation use for molten metal exposure
		Alum/PFR Rayon - 19 oz. Alum/Core Spun	-	" "
Asbestos Steam Line Insulation	N/A	Fiberglass steam line insulation	$2.63 per 3' length for 3/4" pipe	Satisfactory
Transite Board	-	-	-	No suitable replacement

USX0000471

Asbestos Product	Cost	Replacement Product	Cost (1972)	Comments
Asbestos Brake Lining	-	-	-	No suitable replacement

MATERIAL	PRODUCT (MANUFACTURER)	COMMENTS
I. Thermal Insulation		
Blankets/Curtains	Fabrasil (Hitco)	Best tried to date, in respect to price and durability. Fibres do not block so we get good user acceptance. Resists heat to 1000° F. Costs $13.25/sq. yd. (50-yd. roll).
	Refrasil(Hitco)	Expensive but a good material. Resists heat to 3100° F. Costs $46.00/sq. yd.
	Pyrotex Zetex (Hitco)	Will not withstand abrasive wear or rough handling. Fibres block when handle causing skin irritation. Poor user acceptance. Resists heat to 1100° F. Costs $30.00/sq. yd.
	Kaowool (Babcock & Wilcox)	Good for wrapping pipes. Cheap. $1.35/sq.yd. Comes in large rolls found in Boiler Shop.
	Fiberfram (Carborundum)	Used in different departments. Has very good strength and can withstand temperatures to 1427° C. (2600° F.).
Gloves/Mitts	Kevlar (DuPont)	Comfortable, good heat resistance to about 600° F. Superior resistance to curling. Found to be bulky. Not very good beyond 600° F. Some complaint about breakdown of "glass" fibres? Not suitable for molten metal exposure.

MATERIAL	PRODUCT (MANUFACTURER)	COMMENTS
Gloves/Mitts (Continued)	Zetex (Newtex)	Texturized silica. Mitt is still on trial in various departments. Complaint--being glass based, it is extremely itchy. Complaint--fumes arising from gloves when applied to hot material.
		"Boiler Shop appears to like this mitten." Costs $17.00.
	Nor-fab 400	Soft, not itchy to the hand, has excellent abrasion resistance. Does not "fracture" when bent. Comment has been made that it stands up well to heat.
	Leather	Used for welding glove. Good up to about 800° F., then dries out and quickly hardens. Still looking for suitable substitute.
	Pyrotex (Kulka-Hamilton)	Hot metal handling mitt. Proved to be a satisfactory substitute for asbestos mitts. Withstands heat to 1100° F. and costs about $31.00 (pr.). Presently being used in the Boiler Shop and may be expanded to other departments for tests.
		Aluminized asbestos--thin therocell lining backed with double-tanned chrome leather! This has been found very satisfactory and outlasts present gloves used in steelmaking. Costs $23.00.

MATERIAL	PRODUCT (MANUFACTURER)	COMMENTS
Coats	Pre-Ox (Gentex)	Polyacrylonitrile fibre stabilized with Neoprene offers superior splash resistance. Coat is not durable at cost of $210.00. Life is 4-6 weeks. Also found aluminum cracking and fabric shedding.
	Aluminized PFR Rayon Nor-fab 400-19 oz. Nor-fab 900-16 oz.	Approved for Corporation use.
	Kevlar (DuPont)	Suitable up to temperatures around 600° F. Very expensive—$300.00.
Spats(Leggings)	Spats: Chrome Leather; Wool with Leather Flare; PFR Canvas Duck Leggings: Chrome Leather; Alum/PFR Rayon; Alum/Nor-fab 400; Alum/Nor-fab 900	Corporation approved.
Pipe Lagging	Thermo "12" (Johns-Manville)	Calcium silicate material. Presently it is replacing all asbestos at this time. Problem area—"loose glass fibres". A new product known as "K-Carb" from England is being investigated as a possible replacement for "Thermo 12". Very little is known other than the product is carbon based and can withstand temperatures to 2000° C.

MATERIAL	PRODUCT (MANUFACTURER)	COMMENTS
Tubes and Sleeves	Fabrasil (Hitco) Refrasil (Hitco)	These materials, which were mentioned earlier as replacements for asbestos blankets, also look promising as replacements for tubes and sleeves. As far as we can determine, this material is still being investigated.
Furnaces	Fiberfrax (Carborundum)	Appears to be a very popular replacement for asbestos. Being used around the furnace doors. Comments from the mills indicate that this material is ideal.
Millboard	Fiberfrax (Carborundum)	Product seems to do the job. Waiting for further results.
Hot Top	No suitable substitutes at this time.	
II. Gaskets-Spacer-Packing		
Gaskets	At present, no suitable gasket substitute has been found. Problem area!	Possible substitutes: 1) S.I.R. Gasket (Chemplast, Inc.) This material is a stainless insert reinforced gasket of Teflon. Appears to work good against corrosion. More information is needed. 2) Garlock Blue-Gard. (Cold Industries) Waiting for information.
Braided Packing	Braided Kevlar #5200 (Garlock)	This is a new material being tested at the Boiler Shop. Presently being evaluated for medium heat applications. Up to 500^{o} C. Costs $31.05. From indications so far, they are happy with this material.

MATERIAL	PRODUCT (MANUFACTURER)	COMMENTS
Steampacking	No substitutes yet.	They have tried Teflon base packing but does not meet our temperature demands.
Rope Packing	Kaowool (Babcock & Wilcox)	Used extensively by utilities due to the cost of this material, which is approximately $1.35. This material is economical and appears to be doing a good job in this area. Complaint--some departments find this material as being an irritant.
	Thermo-Ceram (Garlock)	This is a new material which has been used for several months as gland packing on the oxygen inlet on fce. lances (oxy. roof lance). This application has proved satisfactory. The material resists heat to 2300° F., and the cost is $33.25/lb. Cost per lance--$5.75 (asbestos rope--$3.25).
Paper	Refrasil (Hitco)	Not strong enough for certain applications.
	Cerafelt	This material was found to be an irritant.
	Fiberfrax 440 (Carborundum)	This material is being tested at the Boiler Shop. No comment at this time.

III. Friction Products

Brake Shoes Cranes/Hoists/Der- Clutch Facings	To date no suitable substitutes have been found.	

	MATERIAL	PRODUCT (MANUFACTURER)	COMMENTS
	Coating Wipes	Kevlar (DuPont)	We have successfully replaced the use of asbestos wipes on our galvanized units. It is an extremely strong fibre, expensive, but the life is excellent.
IV.	Pollution Control		
	Baghouse Filters	Alpha Floc	This is a cellulose fibre with a life span of two years. The material cracks easily. Not regarded as a replacement.
V.	Electrical Products		
	Wire Control Boards	To date all electrical insulation is being replaced with a high-temperature plastic or Teflon material. This material makes a satisfactory replacement.	
	Tape	Refrasil (Hitco)	The tape has the strength properties required and appears to be quite successful. Most of the tape in our departments have been switched to this material. Costs $2.00/ft. Can be obtained in many sizes.
VI.	Welding Electrodes	?Switched from asbestos to wood fibres?	
1.	Chemically Resistant Materials		
	Cement Asbestos Plastic Asbestos	Teflon	Very little information at this time.

APPENDIX 3, Part C

ASBESTOS SUBSTITUTES - USS

APPENDIX J, Part C

Asbestos Substitutes - USS

Asbestos Products	Cost of Asbestos (1972)	Substitute Material Manufacturer or Supplier	Cost of Substitute Material (1972)	Comments on Performance, Quality, Life Expectancy, Etc. of Substitute Material
Asbestos Rope	Cost Not Obtained	Fiberfrax rope, paper rope	Cost Not Obtained	Blast furnaces, coke oven door, pit recuperator, concast - dummy bar heads
Asbestos Tape	•	Rotex tape Refrasil tape Fiberglass tape	•	Concast - dummy bar rolls Ironmaking - mudgun cables and motor connections
Asbestos Gasket Material & Millboard	•	Bab Rotex 1200 fire blankets Refrasil blanket Flibrico blanket Fiberfrax	•	Burning, welding protection, furnaces, foundry, shirtblocks, 48" pits, false doors, recuperator plates, door frames, coke ovens, plant security
Flintguard M100-48	•	Suitable substitute not yet found	•	Insulating valves and pumps
Asbestos Paper and Cloth	•	Rotex blanket material Fiberfrax paper	•	Welds, asbestos sleeves, slab caster, shirtblocks, coke oven doors
Brake Shoes	•	Suitable substitute not yet found	•	Cranes, hoists, mobile equipment, clutches
Glue containing asbestos	•	Flibrico drum fiber stick	•	Fiber gluing

APPENDIX 3, Part C

Asbestos Substitutes - USS

Asbestos Products	Cost of Asbestos (1972)	Substitute Material Manufacturer or Supplier	Cost of Substitute Material (1972)	Comments on Performance, Quality, Life Expectancy, Etc. of Substitute Material
Insulation	Cost Not Obtained	8210 block insulation Mineral fiber coating Stay-on insulation Superex block insulation	Cost Not Obtained	Pit floors, fill for reheat furnace uprights, engine exhaust, crane cabs, pits, coke oven doors, bulkheads, blast furnace stoves, soaking pit walls, reheat furnaces
Asbestos Fiber	•	Fiberfrax bulk fiber	•	Furnace insulation
8" x 12" A632 DWI	•	8" x 12" Ro634 aluminized hand pads	•	Hand protection at bar shears
Expansion ring on stopper	•	Phased out by sliding gates	•	61 B.O.S.P. ladles
Asbestos Mitts	•	Dub Kevlar gloves	•	Hand protection
Asbestos Gloves	•	Aluminized rayon gloves	•	Hand protection
TD2600 Safeco Asbestos Backed Mitts	•	RP105 Safeco scarfer's mitts	•	Hand protection, scarfing
Safety/Ferron Non Skid Coating	•	Suitable substitute not yet found	•	Floor covering
Asbestos Sheets - Compressed Styles 900, 7735, 7021; Transite	•	Suitable substitute not yet found	•	Electrical uses
TD191 863012 Asbestos Spat	•	Aluminized wool spats	•	Ankle protection

APPENDIX 3, Part C

Asbestos Substitutes - USS

Asbestos Products	Cost of Asbestos (1972)	Substitute Material Manufacturer or Supplier	Cost of Substitute Material (1972)	Comments on Performance, Quality, Life Expectancy, Etc. of Substitute Material
Nickelclad Hi Temp-stranded Wire	Cost Not Obtained	Suitable substitute not yet found	Cost Not Obtained	Electrical uses
Aluminized Asbestos Coats	•	Aluminized wool and aluminized rayon coats	•	Hot metal splash protection
Ceiling Tiles	•	2' x 4' fireated tiles	•	Ceilings
Curtains	•	Clear plastic curtains for sound	•	Heat and sound barriers
Personal Prot. Equipment Aluminized splash coat - used to protect pouring crews and strand cast workers.	$133.00	Aluminized rayon coat Delaware Valley Safeguards Loles Road, off Rt. 183, R.D. #1 [illegible], Pa. 19333	$115.79	This garment replaced asbestos because of weight, durability, and quality, life expectancy about equal.
Aluminized Hood	$ 44.00	Aluminized Rayon Hood Delaware Valley Safeguards	$ 51.79	Same Comment as Splash coat.
Aluminized Sleeves	$ 16.00	Cape Jackets Delaware Valley Safeguards	Went to Cape Jackets $ 67.30	Did away with sleeves - due to minimal use.
Aluminized Gloves	$ 24.00	NorFab Gloves Delaware Valley Safeguards	$ 23.90	Gloves, mittens, cape jackets, and aprons all perform similar to the asbestos products.

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APPENDIX 3, Part C

Asbestos Substitutes - USS

Asbestos Products	Cost of Asbestos (1972)	Substitute Material Manufacturer or Supplier	Cost of Substitute Material (1972)	Comments on Performance, Quality, Life Expectancy, Etc. of Substitute Material
Aluminized Mittens	$ 25.30	NorFab Mittens Delaware Valley Safeguards	$26.50	
Cape Jackets - used to protect scarfers.	$ 67.90	Aluminized Rayon Delaware Valley Safeguards	$87.30	
Aprons - protect pouring crews, Strand cast workers, scarfers & burners.	$ 55.00	Aluminized Rayon Delaware Valley Safeguards	$65.00	
Asbestos Tape Used for insulation by Electric Shop on motors, armatures, hoses.	Price Varies with diameter over 3/8" cost $9.56 for 100'	Glass Insulation Tape Westco, Phila., Pa. or Tescot, Wilmington, Delaware	Price varies with diameter, over 3/8" cost $2.50 for 66 ft.	Substitute contains a better quality and longer life expectancy.
Asbestos Sleeving Used to cover wires throughout the plant.		Silicon glass sleeving, Smith of Philadelphia	$ 40.00 for 100' of 5/16"	Performs as well as asbestos if not better.
Asbestos Blankets Used as fire stop for welding and burning operations.	1977 price $ 16.50	Fire or Thermoglass Blankets J. T. Stevens	1977 price $22.50 New $31.50	New blankets are stronger physically, are easier to handle and have a longer life expectancy than asbestos.
Asbestos Rope Used to seal molds (Mold Prep) and pack dummy bar -- Strand Cast.	$ 90.00 per roll	Fiberfrax rope Carborundum	$221.00 per roll	

USX0000483

APPENDIX 3, Part C

Asbestos Substitutes - USS

Asbestos Products	Cost of Asbestos (1972)	Substitute Material Manufacturer or Supplier	Cost of Substitute Material (1972)	Comments on Performance, Quality, Life Expectancy, Etc. of Substitute Material
Asbestos Slow-cool Blankets Used for clad packs	Not available N/A at time of survey.	Fiberglass Lagging Fabric Pecor-1900 N. 6th Street Philadelphia, Pa.	N/A	Fiberglass blankets do not hold the heat as well as asbestos.
Pipe Insulation	N/A	Fiberglass Insulation Certainteed Corp. Valley Forge, Pa.	Varies according to diameter, examples 1/2" 304 ft. Cost $867.00 3/4" 304 ft. Cost $478.00 3" 1000 ft. Cost $1600.00	Fiberglass, although purchase price is higher than asbestos overall cost, is lower because it is less time and labor consuming.
Asbestos to patch furnaces and pits fabricated on Stick-Tite asbestos.	N/A	Kao-Wool Babcox and Wilcox 130 Strafford Ave. Wayne, Pa. 19087	Varies according to density. 4" density 1.02 sq. ft. 6" density .72 sq. ft.	Easier to work with. Much easier to apply, can be cut to exact size.
		Corwool C-E Refractories Valley Forge, Pa.	.09 square ft.	Similar to Kao-wool, comes in wider sizes than Kao-wool.
		Monoblock-Block Insulation Michael Creed, Inc. Medford, New Jersey	.01 a board ft.	
Asbestos-used to wrap cylinders, plungers, etc. before welding, to protect against weld splatter.	N/A	Siltemp Protective Material E. H. Joseph Norristown, Pa.	$ 14.00 a yard	Much easier to drape over materials.
Asbestos - used for vertomatic welder, L.W. #1.	N/A	Sticktite Refractory Material-C.E. Refractories Valley Forge, Pa.	N/A	Substitute product performs as well, if not better, than asbestos.

USX0000484

APPENDIX 3, Part C

Asbestos Substitutes - USS

Asbestos Products	Cost of Asbestos (1972)	Substitute Material Manufacturer or Supplier	Cost of Substitute Material (1972)	Comments on Performance, Quality, Life Expectancy, Etc. of Substitute Material
Garlock Packing [illegible]	4.30/lb.	Garlock SynthePak (non-asbestos) [illegible]	6.00/lb.	Plant general
Garlock Packing [illegible]	6.[illegible]/lb.			Plant general
Garlock Packing [illegible]	6.[illegible]/lb.	[illegible]	7.00/lb.	Plant general
John Crane [illegible] Garlock [illegible]	6.[illegible]/lb.			Satisfactory
Garlock [illegible]	7.[illegible]/lb.	[illegible]	9.00/lb.	Satisfactory
Sheet Packing [illegible]	1.[illegible]/lb.	Blueguard [illegible]		Plant general - limited experience.
Sheet Packing [illegible]	1.[illegible]/lb.	Blueguard [illegible]		Plant general - limited experience.
Pouring Coats Aluminized Asbestos 303LMB-AAP Type 75	92.50/coat	Alm. Pro Co.	126.10/coat	Alm-Pro. Co - without any noxious-fabric shedding and cracking plus cost variable.
		Aluminized Rayon 317 [illegible] 19 oz. (Both Alm. Pro Co & Aluminized Rayon used, in Blast Fur., TOC, Elec. Fur., Con Cast Burn & Weld)	85.52/coat	Alm-Rayon - limited experience but appears to be very satisfactory.

USX0000485

APPENDIX 3, Part C

Asbestos Substitutes - USS

Asbestos Products	Cost of Asbestos (1972)	Substitute Material Manufacturer or Supplier	Cost of Substitute Material (1972)	Comments on Performance, Quality, Life Expectancy, Etc. of Substitute Material
Asbestos Gloves. Silverbestos 5110-A1-AD-0	11.62/pr.	Aluminized Rayon back Kevlar/Nomex palm. Used Blast Fur., Elec. Fur., Con Cast, TOC, Burn & Weld	30.50/pr.	Alm. Silverbestos not the best glove, will not take the abrasive use from the department indicated. Alm-Kevlar/Nomex will take the abrasive use by cost doubles comparable for protection.
Asbestos Mittens 9-M-11-L	0.76/pr.	No Substitutes - Tried Kevlar possibility. Used in all of the above depts. plus Finish, Will Not Beds, Foundry, Shops, Plant General		Kevlar mitten could be very costly, approximate cost - $25.00/pr.
Asbestos Cloth	6.70/sq. yd.	Garlock #1200 THERMO SIL GLASS Fibre Cloth P199-0170	7.02/sq. yd.	Suitable for less severe heat applications. Good mechanical strength.
Asbestos Blanket		Carborundum Dura Felt Blanket P199-0179	.7225/sq. yd.	Suitable for higher heat application. Poor mechanical strength.
Asbestos Rope		Garlock Thermo-Ceram Rope P199-0154	9.51/lb.	Poor substitute. Especially poor mechanical strength.
Asbestos Paper				No suitable substitute. We have discontinued its use, however.

APPENDIX J, Part C

Asbestos Substitutes - USS

Asbestos Products	Cost of Asbestos (1972)	Substitute Material Manufacturer or Supplier	Cost of Substitute Material (1972)	Comments on Performance, Quality, Life Expectancy, Etc. of Substitute Material
Transite Board A920				No suitable substitute. We have discontinued buying it, but there are still some scraps in the plant.
Asbestos Brake Lining A902-B912-B187 - A912				No suitable replacement. Plant general use. Crane, etc.
Asbestos Pipe Insulation	No longer available	J.M. Fiberglas pipe insulation 1" pipe size	1.49/lin. ft.	
Asbestos Pipe Insulation	also	J.M. Fiberglas pipe insulation 1-1/2" pipe	2.94/lin. ft.	
Asbestos Insulated Wire	Numerous sizes & conductors			Engineering and Electric Construction have not approved silicone rubber insulation because of lower temperature rating.
Asbestos Roll Grade "C"	1,286.00	(RR29)(Cold Strip Area) (RR600C(Experimental Stage)	1,309 1,335	All our asbestos furnace rolls are sent to an outside source to be rebuilt and returned. We are in the process of testing non-asbestos rolls.

APPENDIX 3, Part C

Asbestos Substitutes - USS

Asbestos Products	Cost of Asbestos (1972)	Substitute Material Manufacturer or Supplier	Cost of Substitute Material (1972)	Comments on Performance, Quality, Life Expectancy, Etc. of Substitute Material
Asbestos Mitten w/o leather 6-M-11-8	5.96/pr.	No substitutes tried - Kevlar possibility		Kevlar mitten would be very costly-approximate cost $25/pr.
Aluminized Asbestos back/leather palm 54110-AB	11.98/pr.	Aluminized Rayon/back leather palm.	10.95/pr.	Aluminized Rayon back - very satisfactory replacement.
Rope 3/8 8172-3021		Thermoceram	12.00/lb.	This product very satisfactory for furnace use.

UNITED STATES STEEL CORPORATION
HOMESTEAD WORKS

CENTRAL MAINTENANCE DIVISION
JANUARY 13, 1977

MEETING MINUTES
SAFETY

C. F. STRAUSS, DIVISION SUPERINTENDENT - PRESIDING
G. R. Topping, Assistant Division Superintendent
T. C. Singleton, Superintendent of Shops
S. Simko, Superintendent - Valley Machine Shop
H. C. Tartler, General Turn Foreman
W. E. Allen, Supervisor - Staff Services
F. Potocnik, Supervisor - Field Scheduling
T. M. Simkovic, General Foreman - Electric Shop
A. E. Smith, General Foreman - Pipe & Rigging
R. J. Shuder, General Foreman - Boiler, Weld, & Tin
F. Zappa, Foreman Relief - Masonry, Carp. & Paint
G. Zdrale, Cost Analyst
C. J. Ricards, Master Mechanic
K. Pyrek, Secretary

SAFETY

1. UNFINISHED ITEMS

A. CAST IRON BRAKE WHEELS: All available wheels have been installed. More wheels are on order.

B. PCBs: Engineering is reviewing information on this subject.

C. HI-LIFT: Shock absorbers were installed on # 3624 and #3683 hi-lifts, and we are not satisfied with the results. We will again write to Yale for further recommendations. In the meantime, hand hooks will be used.

D. LORAIN INCIDENT: Relative to an incident occurring at Lorain Works, an addendum to CM-3 will be developed to encompass use of red lights.

E. LOST TIME AT FAIRFIELD WORKS: Bulletin 76-25 - Wharf Helper sustained second and third degree burns over 20% of his body when clothing caught on fire while standing near salamander. Waiting on reply from Masonry Department.

F. GARY FATALITY: Bulletin 76-26 - Passed out investigation on fatality where man's arm was pulled into skip hoist. Waiting on reply from Shuder.

USX0000506

G. HOUSEKEEPING INSPECTIONS: All inspections needing work were given to the General Foremen involved. Comply and return to Strauss.

H. WEEK-END PROJECT: Review all contact cards. Make sure personnel have been contacted on all bulletins. Check safe job procedure and observation contacts. Waiting on reply from Simkovic, Barry, and Shuder.

I. LADDERS: Survey your ladders to be sure they are in good condition. Waiting on reply from Simkovic, Barry, and Shuder.

J. GARY LOST TIME: Bulletin CM-77-X-1 - Motor inspectors were burned when screwdriver grounded itself causing a flash. Waiting on reply from Shuder.

K. ET LOST TIME: Bulletin CM-77-X-2 - Wireman was on scaffold when it fell. Contact your people anytime you have tubular or pipe scaffolds over two tiers, they must be secured. Waiting on reply from Smith and Shuder.

L. MOBILE EQUIPMENT TRAINING PROGRAM: A training program was developed by A. Smith. This will be reviewed and a decision will be made on whether or not this will be a division procedure.

M. LOST TIME AT GARY WORKS: CM-77-X-3 - time card blew from man's hand and when he went to pick it up, he stepped into a puddle of hot water. Waiting on replies from Smith and Shuder.

2. WEEK-END PROJECT: Each foreman is to survey two pieces of equipment. They should be checked for back-up alarm, seat belts, condition of cab or interior, and windshields. Replies must be sent to Strauss by January 18.

3. AUTOMOTIVE SAFETY: Reviewed letter on automotive safety relative to a recent injury in the plant to a woman whose ankle was broken when a car moved before she was fully seated. Instruct all mobile equipment operators to make sure all passengers are fully seated, or completely out of the vehicle when leaving, before moving.

4. PLANT INJURY: Production Planning Inventory Clerk was walking from gate to 160" Mill when he sprained his ankle.

5. SAFETY ACTIVITY: Reviewed safety activity for the past week.

6. ASBESTOS: OSHA has ruled that we can use Asbestos wearing apparel. This means our only asbestos problem is in the Masonry Dept. when they use brick with asbestos during rebuilds. The men involved in this operation must have an annual physical, and rebuilds must be monitored annually.

7. LIGHTS: A light on an outdoor pole at Saxonburg fell off. Simkovic to check out areas to make sure the same cannot happen here.

8. SAFETY PERFORMANCE: Reviewed year end safety performance of each shop.

MEETING ADJOURNED: 8:50 a.m.

USX0000507

C.F. Strauss

OPERATIONS

1. UNFINISHED ITEMS

   A. HOOK BLOCKS AND EQUALIZER BARS ON CRANES: No further progress.

   B. CRAFT BACKLOG SYSTEM: Coming along well.

2. UNION MAN AND GUARD ALTERCATION: During the Christmas holiday, Foreman from Structural called the gate to get clearance for a union man. Gate would not take clearance from foreman. When union man came in and guard would not give him clearance, they began to fight. During the New Year Holiday, the same incident occurred involving the same two people. As a result of this, please make it known that all union officials must be cleared through the division personnel office, who will then call Personnel Services. If you are trying to get clearance on the week-end, call the personnel services supervisor on call for the week-end.

3. APPROPRIATION REQUEST: Discussed letter on appropriation requests. If you have an appropriation request over $100,000, see Lou Ross.

4. COST OBJECTIVE PROGRAM: Be familiar with what is expected of you and follow up on it.

5. INDUSTRIAL STUDIES CLASSES: If you have any foremen who have not taken the "Innovative Management" and "Modern Labor Relations" courses, try to have them attend. Classes will start on February 7.

6. UNITED STEELWORKERS ELECTION: Strauss passed out a report by Bruce Johnson on the election.

7. SALEABLE HOURS: There was a big miss in forecasted saleable personnel. Masonry forecasted 127, and came in 144. Weld Shop forecasted 60 and came in at 89. Boiler Shop forecasted 70, came in 82. We were 41 people over our forecast. Make sure we do a good job on our forecasts.

8. WIRE ROPE SLINGS: Strauss gave out a few catalogs on Wire Rope Sling which we will be getting from New Haven.

9. 1976 OBJECTIVES: In 1976, Central Maintenance saved $1,366,000.

10. OPERATIONS: For the next 5 weeks:

    48" Mill - 0, 0, 4, 0, 0;
    100" Mill - 10, 8, 5, 5, 5,;
    160" Mill - 12, 12, 10, 10, 10;
    #1 Side - 9, 8, 6, 5, 5;
    #2 Side - 10, 10, 8, 8, 8.

MEETING ADJOURNED: 9:15 a.m.

UNITED STATES STEEL CORPORATION
HOMESTEAD WORKS

CENTRAL MAINTENANCE DIVISION
JANUARY 20, 1977

MEETING MINUTES
SAFETY

G. R. TOPPING, ASSISTANT DIVISION SUPERINTENDENT - PRESIDING
T. C. Singleton, Superintendent of Shops
S. Simko, Superintendent - Valley Machine Shop
H. C. Tartler, General Turn Foreman
W. E. Allen, Supervisor - Staff Services
F. Potocnik, Supervisor - Field Scheduling
T. M. Simkovic, General Foreman - Electric Shop
A. E. Smith, General Foreman - Pipe & Rigging Shops
R. J. Shuder, General Foreman - Boiler, Weld, and Tin Shops
M. T. Barry, General Foreman - Masonry, Carpenter, and Paint
K. Pyrek, Secretary

SAFETY

1. UNFINISHED ITEMS

A. CAST IRON BRAKE WHEELS: Brake wheels are starting to come in.

B. PCBs: Engineering is reviewing information on this subject.

C. HI-LIFT: Shock absorbers will be installed on hi-lift involved in last year's accident. If we are not satisfied with the results and Yale does not come up with anything better, then Yale will be considered an unacceptable bidder in Homestead.

D. LORAIN INCIDENT: Relative to an incident occurring at Lorain Works, an addendum to CM-3 will be developed to encompass use of red lights.

E. LOST TIME AT FAIRFIELD WORKS: Bulletin 76-25: Wharf Helper sustained second and third degree burns over 20% of his body when clothing caught on fire while standing near salamander. Comply with recommendations and reply to Strauss.

F. HOUSEKEEPING INSPECTIONS: All inspections needing work were given to the General Foremen involved. Comply with and return to Strauss.

G. LADDERS: Survey your ladders to be sure they are in good condition.

H. ET LOST TIME: Bulletin CM-77-X-2 - Wireman was on scaffold when it fell. Comply with recommendations and reply to Strauss.

I. MOBILE EQUIPMENT TRAINING PROGRAM: A training program was developed by A. Smith. This procedure is in the process of being duplicated.

J. LOST TIME AT GARY WORKS: Bulletin CM-77-X-3 - time card blew from man's hand and when he went to pick it up, he stepped into a puddle of hot water. Waiting on reply from Shuder.

K. ASBESTOS: OSHA has ruled that we can use Asbestos wearing apparel. This means our only asbestos problem is in the Masonry Department when they use brick with asbestos during rebuilds. The men involved in this operation must have an annual physical, and rebuilds must be monitored annually.

2. SAFETY PERFORMANCE: Reviewed year-end accident summary. Of a total 205 lost time injuries, 61% were due to violations.

3. SOUTH WORKS FATALITY: Bulletin CM-77-X-4 - Reviewed lost-time injury to Pipefitter who burned on grease line when flame suddenly erupted, engulfing legs of deceased.

4. YOUNGSTOWN LOST TIME INJURY: Heater sustained laceration of finger and thigh, multiple contusions and abrasions of lower chest and abdomen, including three broken ribs, and internal injuries. Injured and fellow employee were standing on charger's platform. The bearing pipe, which is a water-cooled structural member, exploded at an elbow. The explosion occurred when the cooling water froze at the feed and discharge ends of the pipe, allowing the furnace heat to turn the water to steam. KEY POINT: During extremely cold weather, certain utility lines are subject to freezing. Precautions must be taken to keep coolant water, hydraulic fluids, etc., flowing.

5. STRUCTURAL INJURY TO FOREMAN: Foreman sustained fracture to right middle finger when injured placed his hand on lifting link of traveling table as it was being lowered into place by crane. The link shifted, catching his finger between the link and the side gaurd on the table.

6. RECERTIFICATION OF CRANEMEN: All EOT cranemen should be recertified annually. Develop a check-off list on which you can test your cranemen.

7. WALKWAYS: Fall accidents are up; hand and finger injuries are also up. Make sure walkways are clear and salted.

8. MEDICAL DIRECTOR: Dr. Marshall will replace Dr. Evans as new medical director.

9. CRANE INCIDENTS: In 1976, there were 472 crane incidents. 188 of these involved dropped lifts. Review all your crane incidents for the year. Analyze the causes. Look at your recommendations to prevent a similar occurrence.

MEETING ADJOURNED: 2:33 p.m.

C. Strauss

USX0000504

OPERATIONS:

1. UNFINISHED ITEMS

   A. HOOK BLOCKS AND EQUALIZER BARS ON CRANES: No further progress.

   B. CRAFT BACKLOG SYSTEM: This system will go into effect in the Pipe Shop as soon as their clerk is back from being off sick.

   C. INDUSTRAIL STUDIES CLASSES: If you have any foremen who have not taken the "Innovative Management" and "Modern Labor Relations" courses, try to have them attend. Classes will start on February 7.

   D. WIRE ROPE SLINGS: Strauss gave out a few catalogs on wire rope sling which we will be getting from New Haven.

2. EMPLOYEE SUGGESTION PROGRAM: Take care of any suggestions that have not been resolved.

3. OPERATIONS: for the next 4 weeks:

   48" Mill - 0, 4, 4, 0;
   100" Mill - 10, 5, 5, 5;
   160" Mill - 12, 12, 10 10;
   #1 Side - 10, 5, 5, 5;
   #2 Side - 11, 8, 8, 8.

MEETING ADJOURNED: 2:41 p.m.

PLAINTIFF'S EXHIBIT

To: M. T. Barry
General Foreman
Masonry
Central Maintenance

United States Steel Corporation

Interorganization Correspondence

Date: July 28, 1981

From: T. R. McCune
General Supervisor Safety
Homestead Works

Subject: HEALTH HAZARDS OF MASONRY WORK

Many types of cement (asphalt, tar, portland, clay, etc.) as well as many types of bricks (fire, acid resistant, semi-silica, etc.) are used by the Masonry craft. Additives such as coal tar, chromates, silica and asbestos to a particular cement or brick may present significant health hazards to the lungs and skin of the working force.

Dusts are the major health hazard in refractory setting and bricklaying. Dusts generated when mixing mortar and gunning refractories contain crystalline silica, chromium, calcium oxide and aluminum oxide. Dust generated by brick saws, chisels, grinders and dry sweeping contain potentially hazardous levels of free silica (quartz, cristobalite, tridimite). Inhalation of free silica can lead to a respiratory disease called silicosis, a progressive disease which diminishes lung capacity and can cause increased susceptibility to tuberculosis. Dusts from refractories can cause eye and skin irritation, dermatitis and irritation to the respiratory tract. In addition, some workers may develop allergic sensitivity to certain constituents of refractory dust, especially hexavalent chromium and coal tar.

Ventilation and good work practices are the most effective methods of controlling worker exposures to dusts. Whenever possible, concrete and mortar should be mixed outdoors and wet. When mixing, workers should stand upwind so dusts are blown away from them. When mixing must be done indoors, portable fans or blowers should be used to remove dust. If ventilation cannot be provided, mixing should be done in drafts from stairwells or open windows to minimize dust exposure. If mixing must be performed indoors or in spaces which cannot be ventilated, a N.I.O.S.H. approved dust respirator should be used.

Wet sawing does not usually generate significant amounts of dust; however, dry sawing and grinding can create hazardous dust levels. Operators of dry masonry table saws, hand held saws and grinders should wear N.I.O.S.H. approved dust respirators especially when working indoors. Safety glasses or goggles must be worn when sawing or grinding to protect the eyes from dusts, chips and flying particles.

Many particles which can cause respiratory disease (such as silicosis and asbestosis) are too small to be seen with the naked eye. The amount of dust which can be seen in air is not a good indication of health hazards which may be present.

Skin irritation, another health hazard of masonry workers, may be caused by mortars and refractories. Chemicals used in mortar and refractories can produce dermatitis from skin contact with the plastic (wet) or dry materials. Dry, cracked, scaly skin on the backs of the hands, between the fingers and on the wrists and arms are common symptoms of dermatitis.

The best way to prevent dermatitis or skin irritation is through the use of gloves, barrier creams and long sleeved shirts. Some workers are more susceptible to skin irritation than others, however, all workers should be encouraged to practice good personal hygiene, including washing frequently and showering after work. Workers can develop an allergic sensitivity to cements over a period of time, even though no immediate symptoms are noticed.

Cleaning solutions used to remove mortar stains from finished wall sections can present hazards. Hydrochloric (muriatic) acid and other acid cleaners are often used. These liquids can be dangerous during the mixing and brushing operations, mainly causing chemical burns of the skin and eyes.

The best ways to prevent skin and eye injury when using cleaning solutions are to use protective equipment and follow safe work practices. Acid cleaning solutions should always be prepared by adding acid to water in a non-metalic (plastic or rubber) container. Goggles or face shields and gloves should always be used when handling and mixing concentrated acids. Rubber aprons will protect clothing from chemical splashes. When applying acids, gloves and long handled brushes should be used to prevent skin contact. Safety glasses and goggles are a necessity to protect the eyes from chemical splashes and spattering.

A fifteen minute supply of running water should be provided at the work-site for flushing the skin and eyes in the event of an acid splash or spill. Workers should be trained to respond to an acid splash emergency including methods of flushing the eyes with water and otherwise assisting themselves or other workers who have come in contact with dangerous chemicals.

Water proofing compounds such as silicone and asphalt based liquids can present hazards during handling and application. Asphalt and silicon based waterproofing compounds can cause skin and eye irritation and hazardous vapors may be generated during application. Adequate ventilation should be provided and the proper protective equipment worn during use of these materials. Always read the warning labels on product containers before using to assure safe storage and handling proceedures. Obtain the manufacturer's Material Safety Data Sheet to assure the safe use of chemical products.

Solvents used to clean tools should be chosen with regard to their fire hazards. Flammable liquids such as gasoline, naphta and lacquer thinner should not be used. Mineral oil or any of the common safety solvents should be used for tool clean-up. Employees should never clean hands or arms with solvents; skin dryness and irritation may result. Waterless hand cleaners should always be used in place of solvents.

Certain tile and refractory setting requires the use of epoxy cements and grouts. These systems frequently use amine curing agents. Amine vapors are given off during the mixing and curing stages. Some are severe eye, skin and lung irritants. Although some workers may exhibit greater sensitivity than others, repeated contact with amines can cause sensitization. Sensitization to amines can develop in a manner that the first few times a worker handles epoxies, no symptoms appear, but after repeated contacts, he may suddenly develop an allergic type reaction.

Workers using epoxies should protect their skin and eyes by using gloves, long sleeved shirts and safety glasses. Washing facilities must be available. When epoxies are applied indoors, ventilation must be provided while the epoxy is applied and cures. Workers should be instructed to use extreme care in the use of all epoxies and to be alert to eye, skin or respiratory irritation which may be symptoms of sensitivity to amines.

Thermal and acoustical insulation work may involve employee exposures to asbestos, mineral wools, fiberglass and Kaowool. Some of these insulating materials can cause irritation to the skin, eyes and respiratory tract. The serious health hazards of asbestos have been widely publicized and are well known. At the Homestead Works, there should be no reason for the installation of new asbestos containing insulation. Non-asbestos products are now available for nearly every application where asbestos was previously used. Non-asbestos substitutes should be used whenever possible; all exceptions must be cleared with the Safety Office.

Fiberglass, mineral wool and other fiberous insulations can be very irritating to the skin, eyes, nose and throat. When these materials are handled, fibers can cling to the skin and penetrate causing itching. This irritation can leave the skin vulnerable to infection. These fibers are also respiratory tract irritations. In addition, fiberglass has been known to cut and scar the eyeball, causing possible vision imparement.

The best way to protect employees from skin irritation is to prevent skin contact with materials which give off fibers. This is done by wearing proper clothing, ie., gloves, eye protection, and long sleeved shirts buttoned at the collar and cuff. Personal hygiene such as frequent washing to remove particles from the skin and regular changing of work clothes will reduce the chance of irritation developing. Workers should be advised to report even minor skin irritations so they can be treated before complications (such as infections) develop. When handling and installing any of these insulation materials, workers should be protected from respiratory hazards by ventilating the work area. If ventilation is not possible, approved respirators must be used.

The purpose of this memo is to inform you of the recognized hazards inherent in masonry work. It is also intended to alert Management to their responsibility under Section 14 of the Basic Labor Agreement to inform employees of toxic and hazardous substances in their work environment. It is Management's responsibility through employee training to:

Impress on the workers the need for constant awareness of all aspects of safety and health.

Instruct employees in the proper handling, storing, mixing use and disposal of hazardous substances.

Train employees in the proper use of protective safety equipment such as respirators, hearing protection and safety belts.

Train employees in good personal hygiene practices to prevent the ingestion of toxic substances and to minimize the risk of skin irritation.

Promote good housekeeping to reduce accidents and fire hazards.

It is the employees responsibility under the same Agreement to properly utilize and care for the safety equipment provided and to assume personal safety responsibility in minimizing his exposure to hazardous and toxic materials. Hazardous materials and chemicals can be utilized safely; recognizing the dangers and taking the necessary precautions is the key.

F. R. [signature]

FJP/TRM/ch

USX0000491

To: Mr. A. S. Patterson
General Supervisor of Safety
Homestead Works

United States Steel Corporation

PLAINTIFF'S EXHIBIT

Interorganization Correspondence

14

Date: October 18, 1979

From: W. C. James, Manager
Environmental Health

Subject: Guidelines for Removal and Disposal of Asbestos Materials

As requested, we have reviewed your draft of the subject guidelines and offer the following suggestions and/or clarifications:

1. Work Practices

In addition to thoroughly wetting the asbestos material with water, dust generation should be minimized by removing it in as large of sections as possible. That is, the amount of fracturing should be minimized.

2. Personal Protective Equipment

If the asbestos is thoroughly wetted and the operation is in an area of good general ventilation, air purifying respirators should be adequate in reducing employee exposures to below the permissible time-weighted average or ceiling levels. Where such respirators are used, they should have specific NIOSH approval for protection against asbestos-containing dusts. If the operation is conducted in a confined area where the asbestos material cannot be adequately wetted, air monitoring should be conducted to determine employee exposure levels. If such air sampling shows asbestos exposures to be well in excess of permissible limits, powered air purifying respirators or Type "C" supplied air respirators should be provided in accordance with paragraphs d(2)(ii) and d(2)(iii) of the OSHA Asbestos Standard.

3. Personal Hygiene

a. Employees involved in the removal and disposal of asbestos materials should be instructed to wash hands, face and forearms prior to drinking, eating or smoking.

b. Contaminated work clothing should be thoroughly vacuum cleaned prior to removal. Coveralls or similar whole body clothing is recommended.

4. Housekeeping

Dry sweeping of the asbestos debris should be prohibited. Vacuum cleaning methods should be utilized on floors and other exposed surfaces contaminated with asbestos.

Guidelines pertaining to the collection, labeling and disposal of asbestos waste appear to be sufficient to protect employee health and to comply with government regulations.

W. C. James

W. C. James

JFQ/mdd

To: Safety & Environmental Health Representatives
Steel Operations
Ore, Stone & Lake Shipping Operations
Texas Uranium Operations
Research Laboratory
Chief Mine Inspectors - Coal Operations
Division Safety Representatives

United States Steel Corporation

Interorganization Correspondence

Date: October 17, 1980

From: J. B. Masaitis
Assistant Manager
Environmental Health

PLAINTIFF'S EXHIBIT

Subject: Procedures for Removing Insulation Materials Containing Asbestos

Attached is the procedure we recommend to be used for removing asbestos insulation materials. Use of this procedure should effectively control employee exposure to airborne asbestos fibers.

J B Masaitis

JFQ/mdd
Attachment

USX0000353

PROCEDURES FOR REMOVING INSULATION MATERIALS CONTAINING ASBESTOS

Both OSHA and MSHA have established a permissible exposure level of 2 asbestos fibers, longer than 5 microns, per cubic centimeter of air over an 8-hour work period. In addition, both agencies have set a maximum concentration of 10 fibers per cubic centimeter of air, longer than 5 microns, which is not to be exceeded at any time during the workday.

The teardown or removal of asbestos insulation materials from walls, ceilings, steam pipes, furnaces, etc., has the potential to generate atmospheric asbestos concentrations well in excess of these exposure limits. In the event that any such material is to be removed from any area or operation at a U. S. Steel facility, the following control measures are recommended as guidelines to minimize employee exposures to airborne fibers.

A. Work Practices - to minimize dust generation

1. Prior to handling, the insulation should be thoroughly wetted with water.

2. The insulation should be removed in as large of sections as possible. That is, the amount of fracturing should be minimized.

3. Where the insulation must be cut, hand tools, such as chisels or knives, are preferable rather than hand saws or power tools.

4. The insulation should be collected and placed in sealed, labeled impermeable bags or other closed impermeable containers. The labels should state:

CAUTION

CONTAINS ASBESTOS FIBERS

AVOID CREATING DUST

BREATHING ASBESTOS DUST MAY CAUSE

SERIOUS BODILY HARM

B. Personal Protective Equipment

All employees involved in the operation should be required to wear NIOSH-approved respirators. The use of a particular type respirator shall be determined by the exposure level as outlined below.

Air Purifying Dust Respirator (Must have specific NIOSH approval for protection against asbestos-containing dusts) Ex. - MSA Comfo II-Type F filter - Norton Model 7506	- Not more than 10 times the 8-hr. time-weighted average exposure level or the ceiling concentration.
Powered Air Purifying Respirator	- Not more than 100 times the TWA exposure level or ceiling concentration.
Type "C" Supplied Air Respirator	- Not more than 1000 times the TWA exposure level or ceiling concentration.

If the asbestos is thoroughly wetted, hand tools are used to remove the asbestos, and the operation is in an area of good general ventilation, air purifying respirators should be adequate to reduce employee exposures to below the permissible levels. Respirator wearers should be instructed to wash the respirators and change filters, where applicable, daily. They should also be given proper fitting instructions. Due to the extremely hazardous nature of asbestos, it is important to comply with the appropriate regulations governing the use of respiratory protection. For those facilities under OSHA jurisdiction, these regulations are stated in 29 CFR 1910.134. MSHA requires a respirator program consistent with the provisions of ANSI Z88.2-1969.

C. Monitoring

The employees' asbestos exposures; i.e., those removing the insulation and other employees, such as operating personnel who may be exposed to the insulation dust, should be monitored at the beginning of the operation and periodically thereafter until the exposure levels are established. It is not necessary to monitor each employee exposure during every monitoring period. Breathing-zone samples should be collected on open-face 37mm Millipore Type AA filters with a sampling rate of 2.0 liters/minute. The sampling time is determined by the total particulate concentration. Sampling periods of 15 minutes to 8 hours are acceptable. Since the individual fibers must be counted microscopically, the sample must not be too heavy. A slight filter discoloration is acceptable. Environmental Health-Pittsburgh will conduct the asbestos counting.

D. Personal Hygiene

1. The employees should be instructed to wash hands, face and forearms prior to drinking, eating or smoking.

2. The contaminated work clothing should be thoroughly vacuum cleaned prior to removal. Coveralls or similar whole body clothing is recommended.

E. Housekeeping

Dry sweeping of the insulation should be prohibited. Vacuum cleaning methods should be utilized on floors and other exposed surfaces contaminated with asbestos.

F. Restricted Area

All employees whose work does not require occupancy in the area of insulation removal should be prohibited.

G. Training

The employees should be instructed to the hazards of asbestos and the precautionary measures that are being taken to control their exposures.

H. Disposal

Asbestos waste should be accumulated separately from other refuse, and the local haulers contracted to dispose of this material must be informed that the waste products contain asbestos.

JFQ/mdd
10/17/80

Exb #17

PLAINTIFF'S EXHIBIT

IN THE COURT OF COMMON PLEAS OF WASHINGTON COUNTY, PENNSYLVANIA

CIVIL DIVISION - ASBESTOS

JOHN PATTERSON, Executor of The Estate of Vonida J. Patterson, and JOHN PATTERSON, Individually,

Plaintiffs,

vs.

USX CORPORATION; A-BEST PRODUCTS CO.; GARLOCK, INC.; GEO. V. HAMILTON, INC.; OWENS-CORNING FIBERGLAS CORP.; PITTSBURGH-CORNING CORPORATION; OWENS-ILLINOIS, INC.; HARBISON WALKER REFRACTORIES, DIVISION OF DRESSER INDUSTRIES, INC.; HARBISON WALKER REFRACTORIES, DIVISION OF INDRESCO, INC.; GENERAL REFRACTORIES CO.; NORTH AMERICAN REFRACTORIES CO.; THE BABCOCK & WILCOX CO.; COMBUSTION ENGINEERING CO.; FERRO ENGINEERING, DIVISION OF OGLEBAY NORTON CO.; FOSECO, INC.,

Defendants,

vs.

A.P. GREEN REFRACTORIES COMPANY; FLEXITALLIC GASKET COMPANY; GAF CORPORATION; THE GAGE COMPANY; QUIGLEY COMPANY; UNITED STATES GYPSUM COMPANY,

Additional Defendants.

No.: 95 - 359

Nature of this Document:
STIPULATION AS TO MEDICAL RECORDS OF USX CORPORATION RELATING TO JOHN PATTERSON

Filed on behalf of Plaintiffs

Plaintiff's Counsel Of Record:

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IN THE COURT OF COMMON PLEAS OF WASHINGTON COUNTY, PENNSYLVANIA

CIVIL DIVISION - ASBESTOS

JOHN PATTERSON, Executor of The Estate of Vonida J. Patterson, and JOHN PATTERSON, Individually, Plaintiffs, vs. USX CORPORATION; A-BEST PRODUCTS CO.; GARLOCK, INC.; GEO. V. HAMILTON, INC.; OWENS-CORNING FIBERGLAS CORP.; PITTSBURGH-CORNING CORPORATION; OWENS-ILLINOIS, INC.; HARBISON WALKER REFRACTORIES, DIVISION OF DRESSER INDUSTRIES, INC.; HARBISON WALKER REFRACTORIES, DIVISION OF INDRESCO, INC.; GENERAL REFRACTORIES CO.; NORTH AMERICAN REFRACTORIES CO.; THE BABCOCK & WILCOX CO; COMBUSTION ENGINEERING CO., FERRO ENGINEERING, DIVISION OF OGLEBAY NORTON CO.; FOSECO, INC., Defendants, vs. A.P. GREEN REFRACTORIES COMPANY; FLEXITALLIC GASKET COMPANY; GAF CORPORATION; THE GAGE COMPANY; QUIGLEY COMPANY; UNITED STATES GYPSUM COMPANY, Additional Defendants.	No. 95 - 359

STIPULATION AS TO MEDICAL RECORDS OF
USX CORPORATION RELATING TO JOHN PATTERSON

John Patterson, Plaintiff, and USX Corporation, one of the Defendants in the above-captioned matter, hereby stipulate and agree that the attached charts, titled "Medical Records of John

Patterson Related To Accidents/Illnesses" and "Medical Evaluations" are true and correct summaries of all of the medical records in the possession of or subject to the control of USX Corporation relating to its former employee, John Patterson.

CEISLER RICHMAN SMITH LAW FIRM

Date: 11/27/95

By: Stephen I. Richman, Esq.
Counsel for Plaintiffs

USX CORPORATION

Date: 11/22/95

By: David A. Luptak, Esq.

/ras/Pattersn/Medical.stp

PATTERSON V. USX

* * * * * * * * * *

MEDICAL RECORDS OF JOHN PATTERSON
RELATED TO ACCIDENTS/ILLNESSES

DATE OF INCIDENT AND DESCRIPTION	LAST DAY WORKED	RETURNED TO WORK
8/22/53 - Amputation of tip of left third finger.	8/21/53	10/12/53
12/13/65 - Received burns on neck when light bulb exploded at work. No lost time. Work-related.	12/13/65	12/13/65
10/13/65 - Contusions on knees when fell down cellar stairs.	10/13/65	11/5/65
5/20/66 - Abrasions on wrist and leg when knocked down at work. No lost time. Work-related.	5/20/66	5/20/66
9/15/69 - Cut right thumb at work. No lost time. Work-related.	9/15/69	9/15/69
7/16/70 - Superficial burn on left lower lid and bulbar conjunctiva, left eye, when hot brick flew in eye while working. Under treatment to 7/29/70. On date of accident treated at 8:30am and returned to work at 10:30am. No lost time. Work-related.	7/16/70	7/16/70
6/17/72 -While burning wood, received third-degree burn to left upper arm which became infected.	6/15/72	7/2/72
11/11/72 - Hit head at home and received hematoma and slight laceration above right eyebrow. Sent to emergency by foreman on 11/12/72 to be checked out. No treatment given.	11/12/72	11/12/72
4/7/79 - Got chemical in right eye while working and sent to emergency room for treatment. Had keratoconjunctivitis, moderately severe in right eye. Returned to work same day. Remained on light duty until 4/18/79. No lost time. Work related.	4/7/79	4/7/79

DATE OF INCIDENT AND DESCRIPTION	LAST DAY WORKED	RETURNED TO WORK
5/16/80 - Hospitalized (depression and alcohol) until 5/28/80.	5/16/80	6/8/80
10/19/81 - Acute appendicitis and appendectomy. Hospitalized 10/20/81 to 10/29/81.	10/19/81	12/4/81
10/14/83 - Herpes Zoster (Shingles).	10/14/83	11/28/83

JOHN PATTERSON

MEDICAL EVALUATIONS

DATE	P.E.	C X R	P.F.T.
5/28/47	X		
9/11/53	X		
9/14/53	X		
10/12/53	X		
6/24/63		X	
11/2/76	X	X	X
11/18/77	X		X
11/15/78	X	X	X
11/20/79	X	X	X
10/6/80	X	X	
Undated			X
12/15/81	X		X
1/3/83	X		
7/31/83			X
1/13/84	X	X	X
TOTAL NUMBER:	12	6	8

GLOSSARY

P.E. = Physical Examination

C X R = Chest x-ray

P.F.T. = Pulmonary Function Test

Tom : For your information
B 12-22-82

GUIDELINES FOR MEDICAL SURVEILLANCE

ASBESTOS EXPOSURE

The following guidelines for medical surveillance shall be followed in all United States Steel Corporation operations whenever exposure to asbestos occurs.

1. All employees exposed to asbestos shall be provided (or made available) a comprehensive medical examination prior to first employment in an occupation exposed to airborne concentration of asbestos fibers. These medical examinations will be required for any 7- to 8-hour time-weighted average concentration of 0.1 fibers/cc, or for a greater concentration. (The OSHA Asbestos Standard permits this examination to occur within 30 calendar days of the first exposure.)

   Annually thereafter and within 30 calendar days before or after termination of employment in an occupation exposed to airborne concentration of asbestos fibers requiring a medical examination as designated above, a physical examination shall be provided or made available to these employees.

   Whenever pleural thickening is found on any routine chest x-ray on an individual who has had any airborne asbestos exposure, this individual shall be kept under yearly medical surveillance.

   The minimum components of the examination shall be:

   (a). A medical history, including a respiratory questionnaire to elicit symptomatology of respiratory disease.

   (b). A 14" x 17" chest x-ray - posterior-anterior view. Whenever there is evidence of pleural response, right and left oblique views and expiratory posterior-anterior view should be taken to confirm or rule out pleural findings.

   (c). Pulmonary Function testing to include forced vital capacity (FVC) and forced expiratory volume at 1 second (FEV_1).

2. A complete work history shall be taken on initial assignment to an occupation where exposure to airborne concentration of asbestos fibers will occur. This is particularly important if changes in the chest x-ray begin to occur. The work history will include all work experiences in United States Steel and other non-United States Steel work experiences to determine extent of exposure to asbestos. In order to be complete, military exposures, i.e. ship and shipyard exposures; hobbies; exposures of family members (father, brothers, grandfathers, mother, sisters, etc.) who might have brought asbestos fibers home on their clothing; living (home) location (geographic) for proximity to asbestos mining or manufacturing plant; and play areas

in relation to discarded wastes from asbestos factories. The Environmental Health unit (corporate headquarters or plants) will be helpful in evaluating the extent of work exposures.

3. The chest x-ray should be read by at least two United States Steel physicians or physicians selected by the plant physicians. Any positive chest x-ray shall be read by a "B" reader for confirmation of the findings. It is permissible to contract with a "B" reader to read all x-rays in this program. (A "B" reader is certified following successful completion of qualifying examination of 125 chest x-rays by NIOSH and the American College of Radiology.)

4. A clinical evaluation leading to a diagnosis and recommendations will be made.

   (a) Correlate all medical findings - history, physical findings, chest x-ray interpretation, pulmonary function results, and any other medical information -- with the environmental exposure data.

   (b) Referral to a pulmonary specialist to assist in this evaluation may be done at the option of the plant medical director or other examining physician.

   (c) Referral of the chest x-ray to another "B" reader may occasionally be necessary for the proper interpretation of the x-ray.

5. The clinical evaluation will result usually in a diagnosis of one of the following in descending order of importance:

   (a) Asbestosis - pulmonary infiltrate of s, t, u type almost always, with or without pulmonary function decrements, and with or without pleural thickening or plaques (with or without calcification). Record on OSHA-200 Log as "Asbestosis".

   (b) * Pleural thickening with history of asbestos exposure - bilateral pleural thickening or plaques (with or without calcification) and with or without pulmonary function decrements. Without pulmonary function decrements, no need to refer unless requested by employee. Record on OSHA-200 Log as "Pleural thickening with history of asbestos exposure".

   (c) * Pleural thickening with history of asbestos exposure - unilateral pleural thickening or plaques (with or without calcification) and with or without pulmonary function decrements. Without pulmonary function decrement, no need to refer unless requested by employee. Record on OSHA-200 Log as "Pleural thickening with history of asbestos exposure". This diagnosis is one of elimination from 5.(d).

The language for OSHA-200 Log recording for (b) and (c) has been agreed upon in a meeting held October 1, 1980 of Personnel, Medical, Labor Relations, Safety & Environmental Health, Law, and Workers' Compensation & Casualty representatives.

(d). Unilateral pleural thickening or plaques with or without adequate history of asbestos exposure (with or without calcification) and with or without pulmonary decrements. The most likely explanation for the pleural thickening in this (d) group is one of the following: infection (pleural effusion) or hemorrhage, callous from rib fracture, radiation fibrosis, scleroderma, chronic mineral oil aspiration, metastatic disease, lymphoma, myeloma or a combination of these. DO NOT RECORD ON OSHA-200 LOG. Normal anatomical shadows -- pectoral shadow area, extra pleural fat deposits, serratus and external oblique muscle shadows can usually be ruled out by the above mentioned (1.(b)) techniques.

(e). Pulmonary Function Decrement only - Emphysema. It is important to establish whether this is result of occupational exposure or is due to non-occupational origin. Differentiation between obstructive and restrictive disease must be made. Do not record on OSHA-200 Log unless occupationally related. Define cause if so recorded.

(f). Normal Chest - further follow-up testing failed to substantiate suspicions in original chest x-ray or pulmonary function tests. The role of smoking in any pulmonary function decrement must be carefully evaluated. Diffusing capacity determinations may be helpful in ruling out pulmonary fibrosis and probably should be done. In coke plants, the possibility of coalworkers pneumoconiosis with or without focal emphysema must always be ruled out.

6. Recommendations to the physician in discussing findings with the affected employees:

(a). All employees must be told of any positive findings found during his/her examination and the United States Steel physician evaluation (also consultant if used) of these findings. Recorded exposure levels should also be given to the employee. Because of proper handling of asbestos today, these environmental levels should ordinarily be helpful in allaying any fears of continued exposure to hazardous levels.

(b). Pulmonary infiltrate due to asbestos exposure with or without pleural reaction. Shall be advised that this response is due probably to exposures of many years past. Depending upon the pulmonary function finding, the risk of continued decrement is probably directly correlated to continued smoking especially if any continued exposure is properly handled by respiratory protection and is of very minimal, if any, monitored value. The corporate headquarters Environmental Health unit shall prescribe the approved manner of handling any continuing exposure. To be followed every year unless pulmonary function is decreased, then at shorter intervals if clinically indicated. Every effort should be made to get the individual to STOP SMOKING if he/she is a smoker. The risk of lung cancer in those with parenchymal infiltrate is up to sixteen (16) times the risk of a non-smoker with the same exposure and ninety (90) times that of a worker who is a non-smoker and not exposed to asbestos.

(c). Bilateral or unilateral pleural thickening or plaques due to asbestos exposure (with or without calcification). Should be advised that this response is the result of many years of low level of exposure. This also should not progress if the exposure has been eliminated or properly controlled by proper handling of asbestos and by respiratory protection if exposure continues. Depending upon the pulmonary function findings, the risk of continued decrement is directly correlated with continued smoking especially if any continued exposure is properly handled by respiratory protection and is of very minimal, if any, monitored value. The corporate headquarters Environmental Health unit shall prescribe the approved manner of handling any continuing exposure. To be followed yearly unless there is a decrement in pulmonary function, then at shorter intervals if clinically indicated. Every effort should be made to get the individual to STOP SMOKING if he/she is a smoker. The risk of lung cancer in those with bilateral pleural thickening or plaques is two and one-half (2-1/2) times those without pleural reaction.

(d). Unilateral pleural thickening or plaques (with or without calcification) not the result of exposure to asbestos. Continue to follow on a yearly basis.

(e). Emphysema - if believed due to occupational exposure - follow yearly unless otherwise indicated or requested by employee.

If believed to be non-occupational, then referral to private physician, if appropriate - follow yearly.

(f). Normal - yearly follow-up.

7. Environmental Monitoring. Will be carried out by the Environmental Health unit (corporate headquarters or plants) according to requirements of the OSHA Asbestos Standard.

Title 29—LABOR

Chapter XVII—Occupational Safety and Health Administration, Department of Labor

PART 1910—OCCUPATIONAL SAFETY AND HEALTH STANDARDS

Standard for Exposure to Asbestos Dust

On December 7, 1971, an emergency temporary standard concerning exposure to asbestos fibers was published in the FEDERAL REGISTER (36 F.R. 23207). In accordance with section 6(c)(3) of the Williams-Steiger Occupational Safety and Health Act of 1970 a notice of proposed rulemaking regarding a permanent standard for exposure to asbestos fibers was published in the FEDERAL REGISTER on January 12, 1972 (37 F.R. 466). The notice invited interested persons to submit both orally and in writing, data, views, and arguments concerning the proposal.

On or about January 24, 1972, the Advisory Committee on Asbestos Dust was established and requested to make written recommendations with regard to the proposed standard on asbestos. On or about February 1, 1972, the Department of Health, Education, and Welfare transmitted to the Secretary of Labor a criteria document containing Recommendations for an Occupational Exposure Standard for Asbestos by the National Institute for Occupational Safety and Health (NIOSH). Public notice was given of the receipt of the recommendations and their availability for inspection and copying. On or about February 25, 1972, the Advisory Committee on Asbestos Dust submitted its written recommendations to the Assistant Secretary of Labor for Occupational Safety and Health.

Pursuant to the notice of rule making, a hearing was held on March 14 through 17, 1972, for the purpose of receiving oral data, views, and arguments concerning the proposed standard. On or about March 31, 1972, the presiding hearing examiner certified to the Assistant Secretary of Labor for Occupational Safety and Health the record of the proceeding. The record includes prehearing written comments, a transcript of the oral presentations made at the hearing, and numerous exhibits received during the course of the hearing or within the period allowed after the close of the hearing.

The proposed standard dealt with (1) permissible concentrations of asbestos fibers; (2) methods of compliance; (3) warning signs; (4) monitoring; (5) medical examinations; and (6) recordkeeping. Each of these major proposals elicited comments, arguments, objections, and counterproposals. They all have been evaluated and considered.

1. *Acceptable concentrations of asbestos dust.* The proposed standard would limit occupational exposure to 8-hour time-weighted average (TWA) airborne concentrations of asbestos dust not exceeding five fibers longer than five micrometers per milliliter. Concentrations above five fibers but not to exceed 10 fibers (ceiling concentration) would be permitted up to 15 minutes in an hour, but for not more than 5 hours in any one 8-hour day.

NIOSH in effect has recommended that the five-fiber TWA and 10-fiber peak concentrations be permitted only for 2 years. Thereafter, TWA concentrations should be not more than 2 fibers per cubic centimeter (cm³) of air, and peak concentrations should not exceed 10 fibers/cm³, with no time restriction. Numerous objections and counterproposals have been made with regard to both the limits of asbestos fiber concentrations and the time periods to comply with them. Some, for example, have recommended return to a 12-fiber standard of an earlier day, i.e., a level adopted under the Walsh-Healey Public Contracts Act in 1969. Others have recommended a two-fiber standard to become effective in 6 months, then a one-fiber standard for 2 years, and finally a zero-fiber standard after 2 years. These recommendations give a fair indication of the wide spread of the counterproposals.

No one has disputed that exposure to asbestos of high enough intensity and long enough duration is causally related to asbestosis and cancers. The dispute is as to the determination of a specific level below which exposure is safe. Various studies attempting to establish quantitative relations between specific levels of exposure to asbestos fibers and the appearance of adverse biological manifestations, such as asbestosis, lung cancers, and mesothelioma, have given rise to controversy as to the validity of the measuring techniques used and the reliability of the relations attempted to be established. Because of the long lapse of time between onset of exposure and biological manifestations, we have now evidence of the consequences of exposure, but we do not have, in general, accurate measures of the levels of exposure occurring 20 or 30 years ago, which have given rise to these consequences. There are also controversies concerning the relative toxicity of the various kinds of asbestos, and varying hazards in different workplaces.

It is fair to say that the controversy has centered in the area between a two-fiber TWA concentration and five-fiber TWA concentration, with variations on the time needed for compliance. Many employers support a five-fiber TWA. Most medical opinion is divided between a two-fiber standard and a five-fiber standard.

In view of the undisputed grave consequences from exposure to asbestos fibers, it is essential that the exposure be regulated now, on the basis of the best evidence available now, even though it may not be as good as scientifically desirable. An asbestos standard can be reevaluated in the light of the results of ongoing studies and future studies, but cannot wait for them. Lives of employees are at stake.

It is concluded that there should be one minimum standard of exposure to asbestos applicable to all workplaces exposed to any kind, or mixture of kinds, of asbestos. Reasons of practical administration preclude a variety of standards for different kinds of asbestos and of workplaces. Also, while the evidence tends to show that crocidolite, for instance, is more harmful than chrysotile, the evidence is not sufficient to establish separate standards for varieties of asbestos.

Because there must be one standard governing exposure to all varieties of asbestos, and to workplaces apparently more hazardous than others, because some present employees with regular exposure to asbestos have probably already accumulated great doses of asbestos fibers, due to higher levels of exposure in the past, because it appears that levels of exposure which may be safe with regard to asbestosis are not safe with regard to mesothelioma, because the statute requires the protection of every employee, even of one who may have regular exposure to asbestos during a working life which may reach, or even exceed, 40 years; and because of several other considerations which have been urged and are reflected in the record of the proceeding, the conflict in the medical evidence is resolved in favor of the health of employees. As of July 1, 1976, TWA concentrations of asbestos fibers longer than 5 micrometers will not be allowed to exceed two fibers cc., with a ceiling value of 10 fibers cc. The current TWA concentrations of five fibers and

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ceiling concentrations of 10 fibers/cc, will be permitted until July 1, 1976. This will be a transitional period deemed necessary to allow employers to make the needed changes for coming into compliance with the more stringent standard.

The record shows that the many work operations subject to the single asbestos standard (textile, manufacturing, industrial, and marine installation, etc.) will meet varying degrees of difficulty in complying with the standard. In some plants, extensive redesign and relocation of equipment may be needed. It appears, however, the delay in the effective date of the two-fiber standard will provide all employers a reasonable time to comply. At the same time, so long as the ceiling limit is complied with, no harm is reasonably expected to result from exposures during the transitional period.

2. *Methods of compliance.* It has been pointed out by many persons, that protection against asbestos fibers is best obtained by controlling the generation of fibers first, and secondly, by controlling the dispersion of released fibers into the ambient air of the workplaces. Therefore, the standard requires feasible technological controls and appropriate work practices as the primary means of compliance. Rotation of employees as a way of meeting the TWA concentration requirement is allowed only in stated exceptional circumstances, because, as a general rule, it would be difficult to implement. Personal protective equipment, such as respirators, cannot be relied upon because, among other reasons, they may be so uncomfortable as to be burdensome, except for short periods of time. Therefore, it is expected that respirators and shift rotation will be used during the period necessary to install engineering controls and to train employees in sound work practices, but, after technological compliance has been achieved, their use must be limited to special work situations and emergencies. Where both are practicable, shift rotation is required.

3. *Labeling.* The proposed standard stopped short of requiring labeling asbestos and asbestos-containing products. The proposed standard would have required only warning signs at locations where asbestos hazards are present. However, labeling, rather than warning signs, has proved to be a point of controversy. Both NIOSH and the Advisory Committee on Asbestos Dust recommended labels for asbestos products and containers, and these recommendations became very controversial in the course of the proceeding. Many counterproposals have been made as to the language of the warning as well as to the products to be subject to the labeling requirements. Employers, in general, strongly contend that (1) finished products which effectively entrap asbestos fibers, so that these would not be released in the normal use of the products, should not be required to be labeled; and (2) words such as "danger" and "cancer" are unwarrantedly alarming.

Both contentions have merit, and the standard has been changed accordingly.

4. *Monitoring.* The proposed standard would have required personal monitoring and environmental monitoring. Many issues have been raised concerning the availability and reliability of measuring instruments, frequency of monitoring, and conditions in which monitoring should be required. The adopted standard takes the objections into consideration. It requires periodic monitoring at intervals no longer than 6 months, thus allowing considerable time and discretion, and prescribes the use of the membrane filter method, which is an acceptable method for determination of asbestos fibers.

It has also been recommended that employees or their representatives should have an opportunity to observe the monitoring. The recommendation has been accepted.

5. *Medical examinations.* The proposed standard would only require an appropriate medical examination on a periodic basis. The generality of the proposal has attracted many objections and also many helpful comments. The recommendations of NIOSH and of the Advisory Committee on Asbestos Dust were much more specific with respect to both frequency and type of medical examinations to be required. The comments vary as to the class of employees to be examined and as to the frequency of the examinations.

The adopted standard requires medical examinations both at the beginning and the termination of employments exposed to concentrations of asbestos fibers, and also requires annual medical examinations of every employee exposed to airborne concentrations of asbestos. It has been pointed out that in certain industries, such as construction, an employee may work for several employers during the same year. Accordingly, the standard does not require either preemployment, or termination, or periodic examination of any employee who has been examined in accordance with the standard within the past year.

One question which has been raised goes to whether the employer or the employee should be allowed to choose the examining physician. The standard gives the option to the employer. Since some employers already have a medical examination program in operation, and also have medical departments with some expertise in the diagnosis of asbestos-related diseases, it seems more reasonable to permit them to utilize the present programs and expertise, than to permit an employee to choose a private general practitioner.

6. *Records.* The standard as proposed and as adopted, requires maintenance of records of monitoring and of medical examinations. Most of the controversy in this area has revolved around the question whether an employer should be allowed to have access to the results of the required medical examinations. The apprehension of those who have argued against employer access is based on the expectation that some employers will use the medical examinations as a means of screening employment applicants, and worse, as grounds for discharging current employees, who show signs of being affected by exposure to asbestos. Since the purpose of the medical examinations is to monitor the health of employees exposed to the hazards of asbestos, employers cannot in reason be granted the privilege of refusing to disclose to their employers results of occupational exposure. It does not make sense to require employers to provide medical examinations if they cannot know and use the results of the examinations. For these reasons the standard provides that employers may have a restricted access to some medical information.

On the other hand, there is no intention to allow employers to abuse medical information obtained pursuant to the Act, to the detriment of employees. Therefore, the administration of the medical records requirement will be closely watched, and, in cases of abuse, appropriate action will be considered.

The issues discussed above are believed to be the major ones. Numerous other issues have been raised in the rulemaking proceedings. Some have been referred to incidentally. Many recommendations, for instance, about work practices, are so obviously meritorious that their adoption needs no exposition here. Other recommendations and many objections have not been adopted for a variety of reasons which should be manifest. Several, for instance, have recommended the use of respirators only pursuant to a variance, or in cases of emergency and occasional short-term exposures. The recommendation with respect to variances undoubtedly has many merits, but is considered administratively impractical.

Accordingly, after consideration of the whole record of the proceeding, and pursuant to sections 6(b) and (c) and 8(c) of the Williams-Steiger Occupational Safety and Health Act of 1970 (84 Stat. 1593, 1596, 1599; 29 U.S.C. 655, 657), 29 CFR 1911, and to Secretary of Labor's Order No. 12-71 (36 F.R. 8754), Part 1910 of Title 29 of the Code of Federal Regulations is amended as set forth below.

(1) Section 1910.93 is amended by revising Table G-3 to read as follows:

§ 1910.93 Air contaminants.

* * * * *

TABLE G-3—MINERAL DUSTS

Substance	Mppcf	Mg/m³
Silica:		
Crystalline:		
Quartz (respirable)	[illegible]	[illegible]
Quartz (total dust)	[illegible]	[illegible]
Cristobalite: Use ½ the value calculated from the count or mass formulae for quartz.		
Tridymite: Use ½ the value calculated from the formulae for quartz.		
Amorphous, including natural diatomaceous earth	[illegible]	[illegible]
Silicates (less than 1% crystalline silica):		
Mica	[illegible]	
Soapstone	[illegible]	
Talc	[illegible]	
Portland cement	[illegible]	
Graphite (natural)	[illegible]	
Coal dust (respirable fraction less than 5% SiO₂)		[illegible]
For more than 5% SiO₂		[illegible]
Inert or Nuisance Dust:		
Respirable fraction	[illegible]	[illegible]
Total dust	[illegible]	[illegible]

NOTE: Conversion factors— [illegible]

[illegible]

Aerodynamic diameter (unit density sphere)	Percent passing selector
[illegible]	[illegible]

[illegible]

2. A new § 1910.93a is added to Part 1910, reading as follows:

§ 1910.93a Asbestos.

(a) *Definitions.* For the purpose of this section, (1) "Asbestos" includes chrysotile, amosite, crocidolite, tremolite, anthophyllite, and actinolite.

(2) "Asbestos fibers" means asbestos fibers longer than 5 micrometers.

(b) *Permissible exposure to airborne concentrations of asbestos fibers*—(1) *Standard effective July 7, 1972.* The 8-hour time-weighted average airborne concentrations of asbestos fibers to which any employee may be exposed shall not exceed five fibers, longer than 5 micrometers, per cubic centimeter of air, as determined by the method prescribed in paragraph (e) of this section.

(2) *Standard effective July 1, 1976.* The 8-hour time-weighted average airborne concentrations of asbestos fibers to which any employee may be exposed shall not exceed two fibers, longer than 5 micrometers, per cubic centimeter of air, as determined by the method prescribed in paragraph (e) of this section.

(3) *Ceiling concentration.* No employee shall be exposed at any time to airborne concentrations of asbestos fibers in excess of 10 fibers, longer than 5 micrometers, per cubic centimeter of air, as determined by the method prescribed in paragraph (e) of this section.

(c) *Methods of compliance*—(1) *Engineering methods.* (i) *Engineering controls.* Engineering controls, such as, but not limited to, isolation, enclosure, exhaust ventilation, and dust collection, shall be used to meet the exposure limits prescribed in paragraph (b) of this section.

(ii) *Local exhaust ventilation.* (a) Local exhaust ventilation and dust collection systems shall be designed, constructed, installed, and maintained in accordance with the American National Standard Fundamentals Governing the Design and Operation of Local Exhaust Systems, ANSI Z9.2-1971, which is incorporated by reference herein.

(b) See § 1910.6 concerning the availability of ANSI Z9.2-1971, and the maintenance of a historic file in connection therewith. The address of the American National Standards Institute is given in § 1910.100.

(iii) *Particular tools.* All hand-operated and power-operated tools which may produce or release asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section, such as, but not limited to, saws, scorers, abrasive wheels, and drills, shall be provided with local exhaust ventilation systems in accordance with subdivision (ii) of this subparagraph.

(2) *Work practices*—(i) *Wet methods.* Insofar as practicable, asbestos shall be handled, mixed, applied, removed, cut, scored, or otherwise worked in a wet state sufficient to prevent the emission of airborne fibers in excess of the exposure limits prescribed in paragraph (b) of this section, unless the usefulness of the product would be diminished thereby.

(ii) *Particular products and operations.* No asbestos cement, mortar, coating, grout, plaster, or similar material containing asbestos shall be removed from bags, cartons, or other containers in which they are shipped, without being either wetted, or enclosed, or ventilated so as to prevent effectively the release of airborne asbestos fibers in excess of the limits prescribed in paragraph (b) of this section.

(iii) *Spraying, demolition, or removal.* Employees engaged in the spraying of asbestos, the removal, or demolition of pipes, structures, or equipment covered or insulated with asbestos, and in the removal or demolition of asbestos insulation or coverings shall be provided with respiratory equipment in accordance with paragraph (d)(2)(iii) of this section and with special clothing in accordance with paragraph (d)(3) of this section.

(d) *Personal protective equipment*—(1) *Compliance with the exposure limits prescribed by paragraph (b) of this section may not be achieved by the use of respirators or shift rotation of employees, except:*

(i) During the time period necessary to install the engineering controls and to institute the work practices required by paragraph (c) of this section;

(ii) In work situations in which the methods prescribed in paragraph (c) of this section are either technically not feasible or feasible to an extent insufficient to reduce the airborne concentrations of asbestos fibers below the limits prescribed by paragraph (b) of this section; or

(iii) In emergencies.

(iv) Where both respirators and personnel rotation are allowed by subdivisions (i), (ii), or (iii) of this subparagraph, and both are practicable, personnel rotation shall be preferred and used.

(2) Where a respirator is permitted by subparagraph (1) of this paragraph, it shall be selected from among those approved by the Bureau of Mines, Department of the Interior, or the National Institute for Occupational Safety and Health, Department of Health, Education, and Welfare, under the provisions of 30 CFR Part 11 (37 F.R. 6244, Mar. 25, 1972), and shall be used in accordance with subdivisions (i), (ii), (iii), and (iv) of this subparagraph.

(i) *Air purifying respirators.* A reusable or single use air purifying respirator, or a respirator described in subdivision (ii) or (iii) of this subparagraph, shall be used to reduce the concentrations of airborne asbestos fibers in the respirator below the exposure limits prescribed in paragraph (b) of this section, when the ceiling or the 8-hour time-weighted average airborne concentrations of asbestos fibers are reasonably expected to exceed no more than 10 times those limits.

(ii) *Powered air purifying respirators.* A full facepiece powered air purifying respirator, or a powered air purifying respirator, or a respirator described in subdivision (iii) of this subparagraph, shall be used to reduce the concentrations of airborne asbestos fibers in the respirator below the exposure limits prescribed in paragraph (b) of this section, when the ceiling or the 8-hour time-weighted average concentrations of asbestos fibers are reasonably expected to exceed 10 times, but not 100 times, those limits.

(iii) *Type "C" supplied-air respirators, continuous flow or pressure-demand class.* A type "C" continuous flow or pressure-demand, supplied-air respirator shall be used to reduce the concentrations of airborne asbestos fibers in the respirator below the exposure limits prescribed in paragraph (b) of this section, when the ceiling or the 8-hour time-weighted average airborne concentrations of asbestos fibers are reasonably expected to exceed 100 times those limits.

(iv) *Establishment of a respirator program.* (a) The employer shall establish a respirator program in accordance with

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the requirements of the American National Standards Practices for Respiratory Protection, ANSI Z88.2–1969, which is incorporated by reference herein.

b. See § 1910.6 concerning the availability of ANSI Z88.2–1969 and the maintenance of an historic file in connection therewith. The address of the American National Standards Institute is given in § 1910.100.

(c) No employee shall be assigned to tasks requiring the use of respirators if, based upon his most recent examination, an examining physician determines that the employee will be unable to function normally wearing a respirator, or that the safety or health of the employee or other employees will be impaired by his use of a respirator. Such employee shall be rotated to another job or given the opportunity to transfer to a different position whose duties he is able to perform with the same employer, in the same geographical area and with the same seniority, status, and rate of pay he had just prior to such transfer, if such a different position is available.

(3) Special clothing: The employer shall provide, and require the use of, special clothing, such as coveralls or similar whole body clothing, head coverings, gloves, and foot coverings for any employee exposed to airborne concentrations of asbestos fibers, which exceed the ceiling level prescribed in paragraph (b) of this section.

(4) Change rooms: (i) At any fixed place of employment exposed to airborne concentrations of asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section, the employer shall provide change rooms for employees working regularly at the place.

(ii) Clothes lockers: The employer shall provide two separate lockers or containers for each employee, so separated or isolated as to prevent contamination of the employee's street clothes from his work clothes.

(iii) Laundering: (a) Laundering of asbestos contaminated clothing shall be done so as to prevent the release of airborne asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section.

(b) Any employer who gives asbestos-contaminated clothing to another person for laundering shall inform such person of the requirement in (a) of this subdivision to effectively prevent the release of airborne asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section.

(c) Contaminated clothing shall be transported in sealed impermeable bags, or other closed, impermeable containers, and labeled in accordance with paragraph (g) of this section.

(e) *Method of measurement.* All determinations of airborne concentrations of asbestos fibers shall be made by the membrane filter method at 400–450 X (magnification) (4 millimeter objective) with phase contrast illumination.

(f) *Monitoring*—(1) *Initial determinations.* Within 6 months of the publication of this section, every employer shall cause every place of employment where asbestos fibers are released to be monitored in such a way as to determine whether every employee's exposure to asbestos fibers is below the limits prescribed in paragraph (b) of this section. If the limits are exceeded, the employer shall immediately undertake a compliance program in accordance with paragraph (c) of this section.

(2) *Personal monitoring*—(i) Samples shall be collected from within the breathing zone of the employees, on membrane filters of 0.8 micrometer porosity mounted in an open-face filter holder. Samples shall be taken for the determination of the 8-hour time-weighted average airborne concentrations and of the ceiling concentrations of asbestos fibers.

(ii) Sampling frequency and patterns. After the initial determinations required by subparagraph (1) of this paragraph, samples shall be of such frequency and pattern as to represent with reasonable accuracy the levels of exposure of employees. In no case shall the sampling be done at intervals greater than 6 months for employees whose exposure to asbestos may reasonably be foreseen to exceed the limits prescribed by paragraph (b) of this section.

(3) *Environmental monitoring*—(i) Samples shall be collected from areas of a work environment which are representative of the airborne concentrations of asbestos fibers which may reach the breathing zone of employees. Samples shall be collected on a membrane filter of 0.8 micrometer porosity mounted in an open-face filter holder. Samples shall be taken for the determination of the 8-hour time-weighted average airborne concentrations and of the ceiling concentrations of asbestos fibers.

(ii) *Sampling frequency and patterns.* After the initial determinations required by subparagraph (1) of this paragraph, samples shall be of such frequency and pattern as to represent with reasonable accuracy the levels of exposure of the employees. In no case shall sampling be at intervals greater than 6 months for employees whose exposures to asbestos may reasonably be foreseen to exceed the exposure limits prescribed in paragraph (b) of this section.

(4) *Employee observation of monitoring.* Affected employees, or their representatives, shall be given a reasonable opportunity to observe any monitoring required by this paragraph and shall have access to the records thereof.

(g) Caution signs and labels. (1) *Caution signs*—(i) *Posting.* Caution signs shall be provided and displayed at each location where airborne concentrations of asbestos fibers may be in excess of the exposure limits prescribed in paragraph (b) of this section. Signs shall be posted at such a distance from such a location so that an employee may read the signs and take necessary protective steps before entering the area marked by the signs. Signs shall be posted at all approaches to areas containing excessive concentrations of airborne asbestos fibers.

(ii) *Sign specifications.* The warning signs required by subdivision (i) of this subparagraph shall conform to the requirements of 20" x 14" vertical format signs specified in § 1910.145(d)(4), and to this subdivision. The signs shall display the following legend in the lower panel, with letter sizes and styles of a visibility at least equal to that specified in this subdivision.

Legend	*Notation*
Asbestos	1" Sans Serif, Gothic or Block.
Dust Hazard	3/4" Sans Serif, Gothic or Block.
Avoid Breathing Dust	1/4" Gothic.
Wear Assigned Protective Equipment.	1/4" Gothic.
Do Not Remain In Area Unless Your Work Requires It	1/4" Gothic.
Breathing Asbestos Dust May Be Hazardous To Your Health.	14 point Gothic.

Spacing between lines shall be at least equal to the height of the upper of any two lines.

(2) *Caution labels*—(i) *Labeling.* Caution labels shall be affixed to all raw materials, mixtures, scrap, waste, debris, and other products containing asbestos fibers, or to their containers, except that no label is required where asbestos fibers have been modified by a bonding agent, coating, binder, or other material so that during any reasonably foreseeable use, handling, storage, disposal, processing, or transportation, no airborne concentrations of asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section will be released.

(ii) *Label specifications.* The caution labels required by subdivision (i) of this subparagraph shall be printed in letters of sufficient size and contrast as to be readily visible and legible. The label shall state:

CAUTION

Contains Asbestos Fibers

Avoid Creating Dust

Breathing Asbestos Dust May Cause Serious Bodily Harm

(h) *Housekeeping*—(1) *Cleaning.* All external surfaces in any place of employment shall be maintained free of accumulations of asbestos fibers if, with their dispersion, there would be an excessive concentration.

(2) *Waste disposal.* Asbestos waste, scrap, debris, bags, containers, equipment, and asbestos-contaminated clothing, consigned for disposal, which may produce in any reasonably foreseeable use, handling, storage, processing, disposal, or transportation airborne concentrations of asbestos fibers in excess of the exposure limits prescribed in paragraph (b) of this section shall be collected and disposed of in sealed impermeable bags, or other closed, impermeable containers.

(i) *Recordkeeping*—(1) *Exposure records.* Every employer shall maintain records of any personal or environmental monitoring required by this section. Records shall be maintained for a period of at least 3 years and shall be made available upon request to the Assistant Secretary of Labor for Occupational Safety and Health, the Director of the National

Institute for Occupational Safety and Health, and to authorized representatives of either.

(2) *Employee access.* Every employee and former employee shall have reasonable access to any record required to be maintained by subparagraph (1) of this paragraph, which indicates the employee's own exposure to asbestos fibers.

(3) *Employee notification.* Any employee found to have been exposed at any time in airborne concentrations of asbestos fibers in excess of the limits prescribed in paragraph (b) of this section shall be notified in writing of the exposure as soon as practicable but not later than 5 days of the finding. The employee shall also be timely notified of the corrective action being taken.

(j) *Medical examinations*—(1) *General.* The employer shall provide or make available at his cost, medical examinations relative to exposure to asbestos required by this paragraph.

(2) *Preplacement.* The employer shall provide or make available to each of his employees, within 30 calendar days following his first employment in an occupation exposed to airborne concentrations of asbestos fibers, a comprehensive medical examination, which shall 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 1 second ($FEV_{1.0}$).

(3) *Annual examinations.* On or before January 31, 1973, and at least annually thereafter, every employer shall provide, or make available, comprehensive medical examinations to each of his employees engaged in occupations exposed to airborne concentrations of asbestos fibers. Such annual examination shall 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 1 second ($FEV_{1.0}$).

(4) *Termination of employment.* The employer shall provide, or make available within 30 calendar days before or after the termination of employment of any employee engaged in an occupation exposed to airborne concentrations of asbestos fibers, a comprehensive medical examination which shall 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 1 second ($FEV_{1.0}$).

(5) *Recent examinations.* No medical examination is required of any employee, if adequate records show that the employee has been examined in accordance with this paragraph within the past 1-year period.

(6) *Medical records*—(i) *Maintenance.* Employers of employees examined pursuant to this paragraph shall cause to be maintained complete and accurate records of all such medical examinations. Records shall be retained by employers for at least 20 years.

(ii) *Access.* The contents of the records of the medical examinations required by this paragraph shall be made available, for inspection and copying, to the Assistant Secretary of Labor for Occupational Safety and Health, the Director of NIOSH, to authorized physicians and medical consultants of either of them, and, upon the request of an employee or former employee, to his physician. Any physician who conducts a medical examination required by this paragraph shall furnish to the employer of the examined employee all the information specifically required by this paragraph, and any other medical information related to occupational exposure to asbestos fibers.

2. A new § 1910.19 is added to Subpart B of Part 1910, reading as follows:

§ 1910.19 Asbestos dust.

Section 1910.93a shall apply to the exposure of every employee to asbestos dust in every employment and place of employment covered by § 1910.12, § 1910.13, § 1910.14, § 1910.15, or § 1910.16, in lieu of any different standard on exposure to asbestos dust which would otherwise be applicable by virtue of any of those sections.

Effective date. Paragraph (b)(3) of § 1910.93a shall become effective July 1, 1976. All other provisions of §§ 1910.93a, 1910.93, and 1910.19 shall become effective July 7, 1972. The current emergency temporary standard remains in effect until July 7, 1972.

(Secs. 6, 8, 84 Stat. 1593, 1600; 29 U.S.C. 655, 657, 29 CFR 1910.4; Secretary of Labor's Order No. 12-71, 36 F.R. 8754)

Signed at Washington, D.C., this 2d day of June 1972.

G. C. GUENTHER,
Assistant Secretary of Labor.

[FR Doc. 72-8874 Filed 6-6-72; 8:45 am]

USX0000350

United States Steel Corporation

PLAINTIFF'S EXHIBIT 51

Interorganization Correspondence

Date: December 10, 1971

To: General Superintendents and Plant Managers
Superintendents - Personnel Services
Supervisors of Safety

From: Kenneth M. Morse, Director
Environmental Health

Subject: Threshold Limit Value for Asbestos Dust Exposure
Federal Occupational Safety And Health Act (OSHA)

In the December 7, 1971 issue of the Federal Register, the previous standard for airborne concentrations of asbestos dust was drastically reduced from that which appeared in the threshold limit list (Table G-3) of the original set of standards which appeared in the May 29, 1971 Federal Register. You may be cognizant of the considerable furor which has been developed by some people on the development of lung cancer from long-term exposure to very low concentrations of asbestos dust. While some of this information is questionable, the fact remains that it is now accepted by the Federal government with the result that the above action has been taken, and compliance with the standard is required.

The original TLV which appeared in Table G-3 of the May 29, 1971 standards was 10 fibers per cubic centimeter of air, greater than 5 microns in length (2 million particles per cubic foot of air). This has been lowered to 5 fibers per cubic centimeter of air, based on an 8-hour time-weighted average exposure, with a maximum concentration for any 15 minute period in an hour for up to 5 hours, not to exceed 10 fibers per cubic centimeter.

In view of the fact that we utilize asbestos either in sheets, for pipe covering, or in the loose form in several of our operations, which involves intermittent exposure of employees to asbestos dust, it is most important that your health and safety staff and engineering department be fully cognizant of the control measures which are required. These control measures are as follows:

1. The first effort in control must be engineering methods, where such are feasible.

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Copies to: J. E. Angle, T. W. Hunter, R. A. McClure, G. A. Jedenoff, G. F. Willard, F. H. Wickline, J. P. Marner, R. B. O'Connor, M. Bundy, D. W. Brown

2. Where engineering methods are not feasible or cannot reduce the concentrations within the limits above prescribed, respiratory protective devices must be utilized consisting of the following:

   a. Respirators meeting the U. S. Bureau of Mines Schedule 21-B, for individuals exposed to 25 fibers per cubic centimeter of air averaged over an 8-hour shift, or exposed to 50 fibers per cubic centimeter of air over any 15 minute period. A valveless respirator providing equivalent protection may also be utilized.

   b. Where the exposures involve concentrations of 250 fibers per cubic centimeter of air, averaged over an 8-hour shift, or more than 500 fibers over any 15 minute period, a powered-air supplied filter respirator of a type approved by the U. S. Bureau of Mines under their Schedule 21-B must be used.

   c. For exposures in excess of 250 fibers per cubic centimeter of air averaged over an 8-hour shift, a Type C positive pressure supplied air respirator approved by the USBM under their Schedule 19-B shall be utilized.

3. All hand or power-supplied tools which produce asbestos dust such as saws, scorers, abrasive wheels and drills shall be provided with local exhaust ventilation and dust collectors.

4. Employees exposed to the spraying of asbestos or demolition of pipes, structures or equipment covered with asbestos insulation shall be protected by the use of respiratory protective devices above mentioned.

5. Asbestos cement, motors, coatings, grout, and plaster shall be mixed in closed bags or other containers.

6. No dry sweeping or blowing of surfaces containing asbestos shall be performed and such cleanup shall be done by vacuum methods.

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The above regulations and the hazards associated with asbestos dust warrants immediate attention to determine those occupations in your facilities which utilized asbestos in any form and in determining the concentrations to which workers may be exposed. In the latter category this office will shortly be in a position to assist you in determining such concentrations. In addition, workers exposed to asbestos dust should be given pre-employment and periodic chest x-rays.

L. Marre

mt

1-5-72

LES,

LET ME KNOW IF WE HAVE ANY CONDITIONS DISCUSSED ABOVE WHICH NEED TO BE REVIEWED.

GMKing

Plate shop uses some Eagle Pilcher #66 to seal around vessels too long for their furnaces. It comes dry, in bags, is mixed with water and applied. It dries during stress relieving cycle and some dust must occur when they open doors

LEH

1-21-72 TO J. HOSTER

FOR YOUR INFORMATION.

AMERICAN BRIDGE DIV.

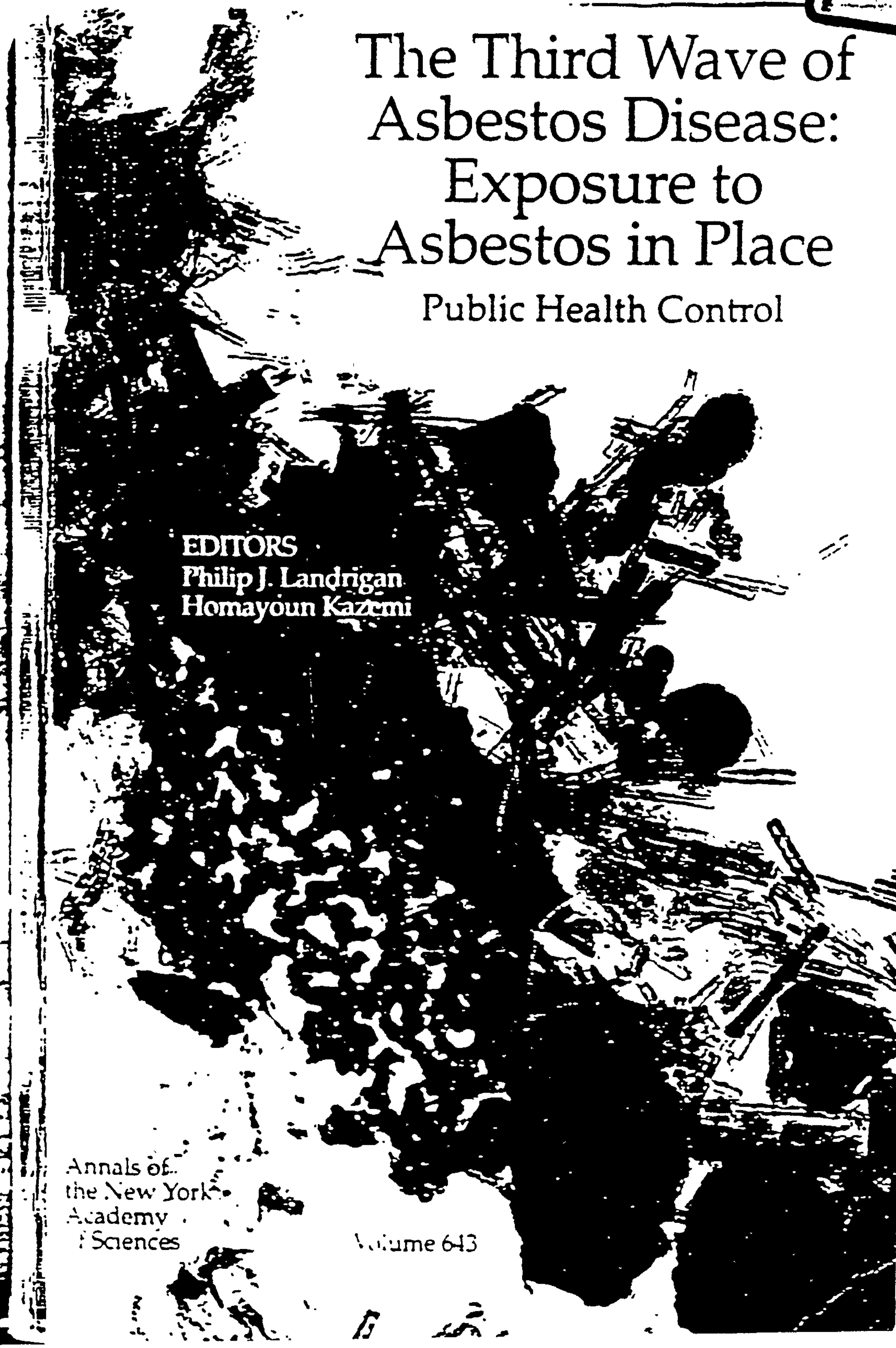
JAN 20 1972

PERSONNEL SERVICES

1991

55

PLAINTIFF'S EXHIBIT 55



The Third Wave of Asbestos Disease: Exposure to Asbestos in Place

Public Health Control

EDITORS
Philip J. Landrigan
Homayoun Kazemi

Annals of the New York Academy of Sciences

Volume 643

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Asbestos-Related Disease in Employees of a Steel Mill and a Glass Bottle–Manufacturing Plant

RICHARD S. KRONENBERG, JEFFREY L. LEVIN, RONALD F. DODSON, JOE G. N. GARCIA, AND DAVID E. GRIFFITH

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INTRODUCTION

Asbestos is a well-known health hazard. The principal diseases related to asbestos exposure are a variety of nonmalignant pleural disorders including pleural effusion, pleural plaques, and pleural fibrosis, as well as asbestosis, mesothelioma, and cancer of the lung, larynx, and gastrointestinal tract. Initially, most cases of asbestos-related disease were seen in miners, millers, and persons employed in the manufacture of asbestos products.[1] In the late 1950s and early 1960s, asbestos-related disease was reported in end-product users such as insulators, shipyard workers, and railroad workers.[2,3] More recently, workers who did not directly use asbestos have been found to be at risk.[4] In most instances this "third wave" of asbestos disease has involved persons who, while not directly using asbestos themselves, were in situations where their exposure to asbestos was fairly evident. This includes workers in the general construction trades, such as carpenters and sheet-metal workers,[5] and office workers exposed to deteriorating asbestos material.[6] Outside of the petrochemical industry, where there was extensive use of asbestos in pipe insulation, few, if any, reports of asbestos-related disease exist in workers employed in general industry. The purpose of this report is to present preliminary observations on the prevalence of asbestos-related disease in workers at two industrial sites not generally associated with asbestos exposure—a glass bottle-manufacturing plant and a steel mill.

METHODS

The workers reported in this study were referred to the Occupational Medicine Clinic of the University of Texas Health Center at Tyler for assessment of possible asbestos-related disease and other occupational diseases. The patients were identified through direct contact by attorneys, through public meetings, and by contacts made by fellow workers. All workers were encouraged to report for screening; however, this approach necessarily precluded a comprehensive survey of all of the involved workers at these two plants.

Both of the factories involved in the study were located in northeast Texas in a relatively rural area that is not heavily industrialized. The glass bottle plant operated from 1948 to 1964, when it closed primarily for economic reasons. During the

36 years of its operation this plant employed a total of approximately 1,500 workers. The steel mill also opened in 1948 and is still operating, although at a reduced capacity. A total of approximately 8,000 workers were employed at this plant during its years of operation. The extent of asbestos in place in these two factories is not known with certainty, nor is it known precisely what types of asbestos were used. In both instances asbestos was used extensively during processes that involved heating, primarily as an insulation material. The workers were all blue collar and did not include managers or office personnel. The majority of the workers had lived most of their lives in the surrounding area of East Texas. They were employed in many different areas of the plant. None of the workers reported in this study was assigned to work directly with asbestos as part of his or her usual duties and none gave a history of having worked directly with asbestos during any previous employment. In addition to being exposed to asbestos, the workers in these two factories had significant exposure to other occupational hazards including silica, mixed dusts, and a variety of organic and inorganic toxins. While it is difficult to quantitate the extent of these exposures, we estimate from the histories provided by the workers that those at the glass bottle plant had more direct silica exposure than did those at the steel mill, while the reverse was true for toxin exposure. Mixed dust exposure occurred in both.

The evaluation performed differed in the two groups of workers in that the glass bottle plant workers were more extensively evaluated. The difference in the two evaluations related primarily to the size of the two groups of workers, with the large number of steel mill workers precluding the extensive initial evaluation performed in the glass bottle plant workers. Each of the glass bottle plant workers had a complete medical and occupational history and physical examination, posteroanterior, lateral, and right and left anterior oblique chest X-ray films with ILO reading [illegible] and complete pulmonary function testing. All of the chest X-rays on the steel workers and 85% of the chest X-rays on the glass workers were read by the same B reader. The majority of the glass workers also had fiberoptic bronchoscopy with bronchoalveolar lavage (BAL). Specific pulmonary function tests in[illegible] spirometry and determination of lung volume by plethysmography, and single breath carbon monoxide diffusing capacity. Lung volumes were calculated [illegible] residual capacity measured in a [illegible] pressure constant[illegible] (CPI 2000 Sensor Medic[illegible]). Single breath carbon monox[illegible] capacity was performed using the technique of Ogilvie *et al.* [illegible] and was [illegible] normal values calculated from the equation of Miller *et al.* [illegible] lung volumes were those of Boren [illegible] for men and Gold[illegible] women. Normal values for spirometric indices were those [illegible]

[illegible] lavage was performed as previously described. [illegible] After ad[illegible] local anesthesia, a fiberoptic bronchoscope was inserted into the [illegible] tract. A total of 100 ml of normal saline solution was injected in [illegible] both the lingula and right middle lobe. The fluid was aspirated [illegible] each aliquot and filtered through gauze. Typically 80 to 100 ml [illegible] of saline solution in the BAL was recovered. A small aliquot was used for white blood cell and differential counts. Differential [illegible] determined from cytocentrifuge preparations (Cytospin II, Shandon [illegible], Sewickley, PA) which were then stained with a modified [illegible] stain (Harleco Diff-Quik, Dade Diagnostics, Aquada, PR). At [illegible] were counted using morphologic criteria to detect the percentage of [illegible] macrophages, lymphocytes, neutrophils, and eosinophils present. Total BAL [illegible] were measured with a hemocytometer. Ferruginous bodies (FB) and uncoated asbestos fibers were enumerated by means of light and transmission electron microscopy (TEM). Asbestos and other dust particles and fibers were identified by X-ray diffraction spectroscopy.[11] All of the glass workers underwent lavage unless they had significant cardiorespiratory disease or refused the procedure.

The steel mill workers were evaluated with a screening medical and occupational history and physical examination performed by an occupational medicine nurse. They also had posteroanterior and lateral chest X-ray films, as well as spirometry, but not complete pulmonary function testing. Bronchoalveolar lavage was not performed on the steel plant workers.

Asbestos-related disease in these two groups of workers was classified into one of four categories—pleural disease, asbestosis, restrictive pulmonary function, and cancer (mesothelioma or cancer of the lung, larynx, or gastrointestinal tract). A number of workers had disease in more than one category. Pleural disease was defined by the presence of pleural plaques occurring primarily over the lower lobes or diaphragm with or without calcification or by diffuse pleural fibrosis. Asbestosis was defined by a profusion score of 1/0 or greater on the ILO reading of the posteroanterior chest X-ray. In the glass bottle plant workers, restrictive pulmonary function was defined by a reduced vital capacity, a reduced total lung capacity, and a reduced diffusion along with a normal FEV_1/FVC ratio. Since only spirometry was available in the steel workers, restrictive pulmonary function was defined as a reduced FVC with a normal FEV_1/FVC ratio in that group. Whenever possible, the diagnosis of cancer was confirmed by examination of tissue. When this was not possible, the diagnosis of cancer was accepted on the basis of outside medical records or the patient's own history. The one case of pleural mesothelioma that occurred in a steel worker was diagnosed at autopsy. Since the workers at these two plants were referred for evaluation of all possible occupational diseases and not just asbestos-related disease, a number of younger workers with short exposures and latency were studied. All of the workers studied are included in the data, but only asbestos-related disease is addressed in this report.

RESULTS

The demographics of the two groups of workers are described in TABLE 1. Both groups were similar to each other and similar to other groups of workers exposed to asbestos. The majority were men and more than two-thirds were current or former cigarette smokers. The steel workers were somewhat older as a group, but both groups had a wide range of ages. Both groups were exposed for an average of around 20 years, with a latency of around 30 years.

Of the 334 glass plant workers seen, 91 or 27% had one or more categories of asbestos-related disease (TABLE 2). The most common category was pleural disease, which occurred in 38 workers or 42% of the 91 workers with asbestos-related disease. There were 22 cases of asbestosis and 12 of cancer of the lung, larynx, or gastrointestinal tract among the glass plant workers. Of these 12 cases of cancer, that of the lung was by far the most common (10 cases). The other two occurrences of cancer involved the gastrointestinal tract. Restrictive pulmonary function was seen in 19 workers.

Bronchoalveolar lavage was performed in 30% of the 334 glass workers referred for assessment (TABLE 3). The majority of the 29 workers who did not have BAL were excluded because they suffered from significant cardiorespiratory dis-

TABLE 1. Demographic Features of Participants in Occupational Health Survey, Texas, 1989–1990

	Glass Workers	Steel Workers
Total number of workers examined	334	898
Percentage of men	80	98
Age ($\bar{X}$ and range)	49 (25–83)	58 (28–91)
Percentage of Smokers	67	70
Years exposed ($\bar{X}$ and range)	17 (6 months–36 yr)	23 (6 months–41 yr)
Years from first exposure ($\bar{X}$ and range)	32 ([illegible]–53)	29 (1–49)

TABLE 2. Asbestos-Related Disease in Survey of 334 Glass Plant Workers, 1989–1990

	Number	Percentage of Abnormal
Pleural disease	38	42
Fibrosis (≥ ILO grade 1/0)	22	24
Cancer (lung, larynx, gastrointestinal tract)	12	13
Restrictive pulmonary function	19	21
Total number of workers seen	334	
Total number with abnormalities	[illegible]	

TABLE 3. Results of Bronchoalveolar Lavage Performed in 30[illegible] Glass Plant Workers, [illegible]–1990

	Number	Percent
[illegible] findings	[illegible]	[illegible]
[illegible] fibers	[illegible]	[illegible]
[illegible] polymorphonuclear leukocytes	[illegible]	[illegible]
[illegible] bodies	[illegible]	[illegible]

TABLE 4. [illegible] Related Disease in 898 Steel Plant Workers, 1989–1990

	Number	Percentage of Abnormal
[illegible] function	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible] gastrointestinal tract)	[illegible]	[illegible]
[illegible] grade 1/0)	[illegible]	13
[illegible]	[illegible]	
Total number of workers seen	[illegible]	
Total number with abnormalities	[illegible]	[illegible]

ease. Five workers either refused the procedure or did not have it for technical reasons. The majority of the lavages failed to yield findings suggestive of asbestos exposure or disease. Positive findings on BAL included the presence of asbestos fibers, ferruginous bodies, or alveolitis defined by more than 10% polymorphonuclear leukocytes (PMNs) in the BAL fluid. All of the asbestos fibers seen were either chrysotile or amosite asbestos, with the great majority being chrysotile.

The study of asbestos-related disease in the steel plant workers constitutes work in progress in that this report summarizes the assessment of that portion of the workers screened as of April 1990 (TABLE 4). Of these 898 workers, 157 or 17.5% had one of the four categories of asbestos-related disease. The majority of these 157 workers had restrictive pulmonary function seen on spirometry followed by pleural disease, cancer of the lung, larynx, or gastrointestinal tract, and asbestosis. The majority of the cases of cancer seen in this group occurred in the

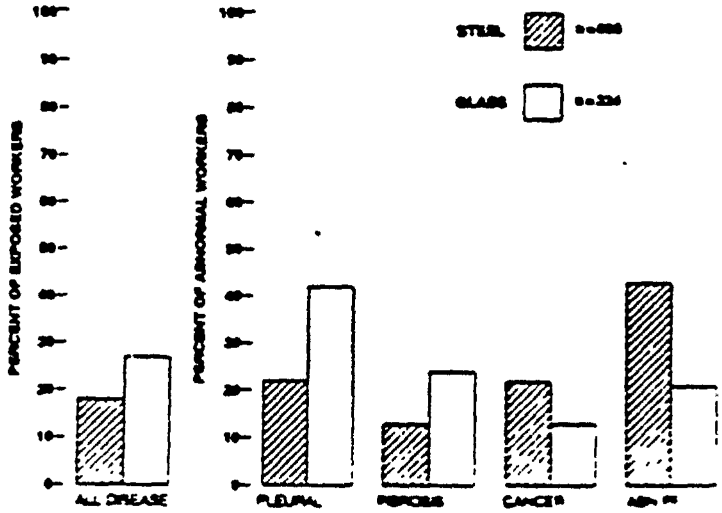

FIGURE 1. A comparison of asbestos-related disease in steel mill and glass bottling plant workers.

gastrointestinal tract (17 cases) followed by the lung (10 cases) and larynx (7 cases). There was one case of pleural mesothelioma in the steel workers.

The types of asbestos-related disease in the two groups of workers are compared in FIGURE 1. The overall prevalence of disease was similar in the two groups, being just under 20% in the steel workers and just under 30% in the glass workers. Pleural disease was the most common manifestation of asbestos-related disease in the glass workers, whereas restrictive pulmonary function was the most common entity in the steel workers.

DISCUSSION

The principal finding of this study is the presence of significant numbers of workers with asbsetos-related disease in two industrial sites, a steel mill and a glass bottle-manufacturing plant, not generally associated with a high risk of asbestos-induced disease. Although the prevalence of disease in these two plants is somewhat lower than that reported in workers in the general construction trades, it is still significant, with an overall prevalence of greater than 20%. The industrial processes occurring at these two plants were diverse, but were not specifically reported to include asbestos or asbestos-containing materials. The workers tended to move around the plant and were exposed to several areas where thermal insulation was present. They were not, however, in trades known to work with asbestos (i.e., they were not insulators, plumbers, or pipe fitters). Although the exact source of asbestos exposure in these workers is not known, the one industrial process common to both plants is the use of intense heat necessary to produce molten glass and steel. In both plants, asbestos was used extensively as an insulator and fire retardant around the furnaces and on the assembly line carrying the molten material. Workers reported they would occasionally repair, cut, and shape this material, which was in various states of deterioration. The repair and maintenance of this asbestos material did not, however, constitute their primary job task or even a significant portion of their job at the plant or mill. It is also likely, given the age of these two plants, that they contained considerable amounts of asbestos insulation and fireproofing as part of their general construction.[14] It seems probable that workers at industrial sites of comparable age which use intense heat in their manufacturing process should be considered at risk for asbestos-related disease. This might include automobile manufacturing plants, aluminum smelters, forges and foundries.

This is not a true cross-sectional study in that no attempt was made to conduct a comprehensive survey of all the workers at these two sites. Therefore the true prevalence of asbestos-associated disease at these two plants cannot be determined by this study. It is possible that the data presented underestimate the incidence of disease at these two plants. Since fewer than half of the total number of workers employed presented themselves for study, selection bias suggests that the [illegible] workers would not have come forward for screening and the remaining un[illegible] workers may have a higher incidence of disease. Another uncertainty in determining the true prevalence of asbestos-related disease at these two plants [illegible] the necessity of basing most of the diagnoses on clinical evidence rather than [illegible] tissue. The BAL data in the glass plant workers do, however, [illegible] tissue burden of asbestos fibers and ferruginous bodies. [illegible] have demonstrated a good correlation between the presence of [illegible] in the BAL fluid and tissue burden of asbestos.[11]

[illegible] presented in this report represent preliminary observations and raise [illegible] for further study. It will be necessary to conduct true cross-se[illegible] as prospective studies at similar industrial sites in order to as[illegible] risk of asbestos-associated disease in these workers. The role [illegible] diagnostic tool deserves further evaluation, particularly in terms of [illegible] other markers of asbestos-induced disease and consequent [illegible] detection and intervention. Which workers should be [illegible] what tools is another important question to be answered. This [illegible] however, that asbestos in place at industrial sites constitutes a [illegible] asbestos induced disease.

ACKNOWLEDGEMENT

[illegible] acknowledge the invaluable assistance of Barbara Pruitt in coordi[illegible] the study and in data collection.

REFERENCES

1. Becklake, M. R. 1976. Asbestos-related diseases of the lung and other organs. Their epidemiology and implications for clinical practice. Am. Rev. Resp. Dis. 114: 187–227.
2. Selikoff, I. J., E. C. Hammond & H. Seidman. 1979. Mortality experience of insulation workers in the United States and Canada, 1943–1976. Ann. N. Y. Acad. Sci. 330: 91–116.
3. Doll, R. 1955. Mortality from lung cancer in asbestos workers. Br. J. Ind. Med. 12: 81.
4. Oliver, L. C., N. L. Sprince & R. E. Greene. 1989. Asbestos-related disease in public school custodians. Am. Rev. Resp. Dis. 139: A211.
5. Rudd, R. M. 1989. Pleural mesothelioma resulting from exposure to amosite in a building. Resp. Med. 83: 237–239.
6. International Labour Office. 1980. Guidelines for the Use of ILO International Classification of Radiographs of Pneumoconioses (revised edition). Occupational Safety and Health Series No. 22. International Labour Office. Geneva.
7. Ogilvie, C. M., R. E. Forster, W. S. Blakemore & J. W. Morton. 1957. A standardized breath holding technique for the clinical measurement of the diffusing capacity of the lung for carbon monoxide. J. Clin. Invest. 36: 1–17.
8. Miller, A., J. Thornton, R. Warshaw, H. Anderson, A. Teirstein & I. J. Selikoff. 1983. Single breath diffusing capacity in a representative sample of the population of Michigan, a large industrial state. Am. Rev. Resp. Dis. 127: 270–277.
9. Boren, H., R. Kory & J. Syner. 1966. The Veterans Administration–Army cooperative study of pulmonary function. II. The lung volume and its subdivisions in normal men. Am. J. Med. 41: 96–114.
10. Goldman, H. I., & M. R. Becklake. 1959. Respiratory function tests, normal values at median altitudes and prediction of normal results. Am. Rev. Tuberc. Pulm. Dis. 79: 457–467.
11. Crapo, R., A. Morris & R. Gardner. 1981. Reference values using techniques and equipment that meet ATS recommendations. Am. Rev. Resp. Dis. 123: 659–664.
12. Garcia, J. G. N., H. L. James, S. Zinkgraf, M. B. Perlman & B. A. Keogh. 1987. Lower respiratory tract abnormalities in rheumatoid interstitial lung disease. Potential role of neutrophils in lung injury. Am. Rev. Resp. Dis. 136: 811–817.
13. Dodson, R. F., M. G. Williams, J. W. McLarty & G. A. Hurst. 1983. Asbestos bodies and particulate matter in sputum from former asbestos workers. Acta Cytol. 27: 635–640.
14. 1988. Study of Asbestos-containing Materials in Public Buildings. A Report to Congress. United States Environmental Protection Agency. Washington, DC.
15. Sebastien, P., B. Armstrong, G. Monchaux & J. Bignon. 1988. Asbestos bodies in bronchoalveolar lavage fluid and in lung parenchyma. Am. Rev. Resp. Dis. 137: 75–78.

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PLAINTIFF'S EXHIBIT 57

Ann. Occup. Hyg. Vol. 13, pp. 77–80. Pergamon Press 1970. Printed in Great Britain

LETTERS TO THE EDITOR

Asbestos hazard from protective clothing

Sir,

Investigations (being reported elsewhere) have been carried out at the Springfields Works of the United Kingdom Atomic Energy Authority to examine the redispersion of radioactive dust from contaminated coveralls into the atmosphere. A significant relationship was found to exist between the degree of contamination of the coveralls and the concentration of radioactive dust in the breathing zones of the wearers.

It was considered that the wearing of protective clothing made from fibrous asbestos materials might give rise to an airborne asbestos hazard in a similar mode and this hypothesis is supported by the investigations we now describe.

The tests were carried out by an experimentalist wearing a normal industrial type asbestos apron and asbestos gauntlets whilst undertaking a standard pattern of work. During this work period the concentration of asbestos fibres near the wearer's breathing zone and in his vicinity was determined. The tests were carried out under laboratory conditions and no asbestos in any form was present in the laboratory during the experiments other than the protective clothing under test. The laboratory itself had a volume of about 70 m^3 and was air-extracted at ceiling level at a rate of about 13 m^3/min.

The work pattern was designed to combine movements typical of those found in industrial plant environments, and basically consisted of carrying objects about the laboratory, walking, and bench work. During each standard work routine, dust samples were collected on Casella personal air samplers (PAS), originally developed by SHERWOOD and GREENHALGH (1960). The experimentalist carried a PAS on a helmet and another on his chest, whilst a third PAS was set up in a fixed position in the centre of the laboratory at an average distance of about 6 ft from the working zone of the experimentalist. All three samplers were operated simultaneously during each test run.

During each test the floor area was covered by Polythene sheets and after completion of a test run a settling time of at least 24 hr was allowed, after which the sheets were changed and the laboratory area cleaned to minimise accumulation of asbestos fibres. Before commencement of the next test, a 2 hr duration PAS sample was obtained from the centre of the laboratory for control purposes. As a precaution, the experimentalist wore a dust respirator during each test.

All samples were obtained on Millipore HA filter-papers at a sampling rate of 400 cm^3/min and these were counted by a method similar to that described by HOLMES (1965). Briefly, this consists of fixing the sample by drawing a chloroform solution of 'Perspex' through the filter and then clearing by means of glycerol triacetate. The transparent sample was examined microscopically, and all fibres within the range of lengths 5 μm to 100 μm, and with a length to breadth ratio of at least 3, were counted using a Porton graticule and projection microscope at a magnification of × 1000. Fifty randomly chosen graticule areas of apparent size 88 μm by 44 μm were examined on each sample.

None of the control samples showed any measurable asbestos fibres, but all other samples gave positive counts possibly underestimated by about 10 per cent since bright field rather than phase contrast techniques were employed in the estimations. The results (expressed as fibres/cm³) were as follows:

Test No.	Fibre concentration on sample: Chest (worn)	Head (worn)	Laboratory (static)
1	4·17	3·86	0·75
2	3·88	3·61	2·09
3	4·60	2·37	3·41
4	4·45	4·15	1·78
5	3·27	3·60	2·53
6	4·01	3·71	2·11
Mean	4·06	3·55	2·11
95% Conf. limits	±0·47	±0·61	±0·87
99% Conf. limits	±0·72	±0·93	±1·32

These values clearly demonstrate the significant enhancement of detection and the greater reproducibility of results obtainable with a personal air sampler than with a static air sampler.

The Draft Asbestos Regulations seek to prevent exposure of workers to dust containing asbestos to such an extent as to endanger health, and H.M. Factory Inspectorate have given general advice that for Chrysotile, Amosite or Anthophyllite the provisional Threshold Limit Value (TLV) will be 2 fibres/cm³. Where the concentration is between 2 fibres/cm³ and 12 fibres/cm³ the duration of exposure and the level of concentration will be taken into account when deciding what measures are necessary to comply with the Regulations and, where the level is above 4 fibres/cm³, control measures will be required. Concentrations exceeding 12 fibres/cm³ will not be permitted except where respiratory protection is provided.

On the results of these tests it appears that a worker wearing asbestos protective clothing could be exposed to airborne concentrations in his breathing zone well above the tentative TLV. Even at a distance of 6 ft from the worker, the concentration could exceed the TLV. The actual airborne concentration will depend on the type of clothing worn, on local environmental conditions and the nature of the work: other investigations which we have carried out indicate that if vigorous work is undertaken, such as might occur in common operations in heavy industry such as furnacework, the TLV could conceivably be exceeded by a factor of 6 or more. Since the same garments were worn throughout the tests, it is apparent that fibres are released from the material over a considerable time, and the wearer is continuously exposed to airborne asbestos and carries his own dust cloud with him.

Thus it appears that under conditions of arduous work the wearing of asbestos garments of a type commonly worn in industry could give rise to local environmental levels requiring the use of a respirator. For less arduous conditions of work it might be possible for an asbestos apron and asbestos gauntlets to be worn for about one-half a working day without significant hazard (the time weighted concentration then being nominally 2 fibres/cm³). However it would be prudent to confirm the levels obtained for any particular type of work by test measurement. When these conditions cannot be satisfied it is suggested that cotton-backed, aluminised asbestos garments should be worn or otherwise that approved respiratory protection be provided.

Further, by analogy with our findings on resuspension of radioactive dust from contaminated coveralls, it seems reasonable to suppose that a similar situation could arise with ordinary protective clothing contaminated with asbestos. Since such contamination would normally arise from operations requiring the wearing of a respirator, it is recommended that such clothing be removed immediately on completion of the work and before removing the respirator.

It would be of interest to know the experience of other workers in this field in view of the recently heightened interest in asbestos aerosols.

H. A. Bamber
R. Butterworth

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Springfields Works
Salwick
Preston, PR4 0XJ
Lancs.

REFERENCES

Holmes, S. (1965) *Ann. N.Y. Acad. Sci.* 132, 132.
Sherwood, R. J. and Greenhalgh, D. M. S. (1960) *Ann. occup. Hyg.* 2, 127.

Asbestos release from battery boxes

Sir,

Asbestos is incorporated into a number of materials, and when the end-product is friable and liable to release fibres on mechanical abrasion, there is likely to be an inhalation hazard. It has been considered, however, that when asbestos is bound into a plastic base, any subsequent disintegration might release only coated fibres of low toxicity

Annually, many hundreds of thousands of battery boxes are manufactured, for which crocidolite is mixed with bitumen or pitch and moulded. The superfluous pieces (flashings) are removed by filing and may subsequently be trampled underfoot. Examination of crushed material from the floor by polarised light microscopy has revealed free fibres of asbestos, as demonstrated by the Fig. 1.

Exhibit #58

From USX

Medical Dept. Files

CC: M. Bundy

United States Steel Corporation

Interorganization Correspondence

PLAINTIFF'S EXHIBIT 56

85

Date: May 17, 1971

To: Mr. D. W. Brown
Director of Safety

From: Kenneth M. Morse, Director
Environmental Health

Subject: Asbestos Protective Apparel

The article which appeared in the Duluth newspaper, which has been of concern to Bill Slaughter, has been reviewed. Dr. Irving J. Selikoff who was mentioned in the article, found lung cancers in construction workers who were spraying and cutting asbestos insulation and in the processing of certain types of asbestos. Subsequently he has become an alarmist and a most controversial figure as he has expanded his work at New York's Mt. Sinai School of Medicine through government grants. Once one has built up an organization on such grants, his continuation of the program can result only by creating more and more concern among industry and the general public.

I believe that the facts are that in the case of insulation workers, in the processing of asbestos and among the cutters and others engaged in the manufacture of asbestos coats, the problem is real. However, I believe that in the wearing of asbestos coats and asbestos protective apparel, a problem has not been shown. I do not know of any factual report of asbestos being a problem in industry from the use of asbestos protective apparel, and I would not recommend that we dispense with the use of such apparel at this time.

It is difficult to estimate how much further inroads the alarmists in the environmental health field will be able to prevail. It is within the realm of possibility that should a man who has been wearing asbestos protective clothing, at various times throughout his worklife, develop lung cancer, he may endeavor to attribute it to the asbestos. Therefore, should the alarmist type of publicity continue, it may be desirable to investigate the future possibility of the use of other types of materials affording protection against molten metal splashes or a more tightly woven asbestos cloth. I do not know whether NOMEX would be adequate for this purpose, and I am aware that its cost is considerably greater than asbestos. In any event, I do not believe that there is a need to dispense with the use of asbestos protective apparel which is now being used in the Corporation nor do I believe that we should discontinue its purchase at this time.

mt

Copies to:
Plant Medical Directors

USX0000865

51

[redacted]

PLAINTIFF'S EXHIBIT 58

United States Steel Corporation

Interorganization Correspondence

To: Plant Managers
Division Superintendents
and Staff Heads

Date: August 24, 1983

From: E. M. Gorden, Superintendent
Safety and Environmental Health
Mon Valley Works

Subject: Mon Valley Works Guidelines for the Removal and Disposal of Asbestos Containing Materials.

The attached guideline needs to be followed to protect employees against the hazards of exposure to asbestos. This supersedes all existing plant guidelines.

JRD/gdc

Attachment

cc: S. A. Bennett, Jr.
E. E. Harris
T. F. Weir, M.D.
J. R. Dierdorf
Industrial Hygiene Staff

MON VALLEY WORKS GUIDELINES FOR THE REMOVAL AND DISPO' OF ASBESTOS CONTAINING MATERIA'

OSHA has established a Permissible Exposure Limit of two (2) asbestos fibers, longer than five (5) microns, per cubic centimeter of air averaged over an 8-hour period. In addition, a maximum concentration of ten (10) fibers per cubic centimeter, longer than 5 microns, which is not to be exceeded at any time during the workday has also been established.

In recent times, asbestos exposure has been shown to have a causal relationship with a variety of pulmonary abnormalities when continuing exposures are in excess of Permissible Exposure Limits. The risk resulting from asbestos exposure is also greatly compounded by the effects of cigarette smoking.

The teardown and removal of asbestos insulation materials from walls, ceilings, steam pipes, furnaces, etc., has the potential to generate atmospheric concentration of asbestos fibers in excess of OSHA Permissible Exposure Limits. In the event that any such material is to be removed, the following procedures must be followed to minimize employee asbestos exposure.

A. Initial Determination

When feasible the Industrial Hygiene Organization shall be notified prior to any major insulation removal job of two or more days duration, and/or prior to any insulation removal job for which the asbestos content or lack thereof cannot be confirmed. Where uncertainty of asbestos content exists, a bulk sample will be collected and analyzed by the Industrial Hygiene Organization. In all cases where asbestos content has not been determined prior to work beginning, and in all cases where asbestos-bearing material is present, precautions must be taken. Should the absence of asbestos be confirmed, no precautions are required.

B. Work Practices - To Minimize Dust Generation

1. Prior to handling, the insulation should be thoroughly wetted when conditions permit such application. Additionally, the water spray should be controlled to prevent breakdown of the material.

2. The insulation should be removed in as large of sections as possible. That is, the amount of fracturing should be minimized.

3. Where the asbestos material must be cut, hand tools, such as chisels on knives, are preferable to hand saws or power tools. Use of power tools is prohibited without approval of the Superintendent of Safety and Industrial Hygiene.

4. All asbestos debris must be collected and placed in sealed, labeled, impermeable bags.

   The bags shall then be placed in a sealed drum which is labeled as follows:

CAUTION

CONTAINS ASBESTOS FIBERS

AVOID CREATING DUST

BREATHING ASBESTOS DUST MAY CAUSE BODILY HARM

C. Personal Protective Equipment

1. All employees involved in asbestos handling operations shall be required to wear NIOSH-approved respirators. The use of a particular type respirator shall be determined by the exposure level as outlined below. It should be noted that single use, disposable respirators are not permitted within the Corporation for protection against asbestos.

Respirator Type	Exposure Level
Air Purifying Dust Respirator (Must have specific NIOSH approval for protection against asbestos-containing dusts)	Not more than 10 times the 8-hour time-weighted average exposure level.
Powered Air Purifying Respirator	Not more than 100 times the time-weighted average expsosure level.
Type "C" Supplied Air Respirator	Not more than 1000 times the time-weighted average exposure level.

If the asbestos material is thoroughly wetted, hand tools are used and the operation is in an area of good ventilation, air purifying respirators should be adequate to reduce employee exposures to below the permissible levels. Respirator wearers shall be given proper fitting instructions. Due to the extremely hazardous nature of asbestos, it is important to comply with the OSHA regulations governing the use of respiratory protection as stated in 29 CFR 1910.134 and our plant respirator programs.

2. Disposable protective garments should be worn by employees during asbestos removal. [redacted], [redacted]s, [redacted] coveralls without pockets or cuffs made of Dupont's Tyvek material is the preferred clothing. A vacuum cleaner should be used to remove loose fibers adhering to contaminated work clothing. The use of compressed air to dislodge asbestos fibers from contaminated clothing or tools is strictly forbidden.

   Respirators should continue to be worn until contaminated work clothing is removed. Upon completion of the shift, the disposable clothing and respirator filters should be placed in bags for disposal with the waste insulation.

D. Monitoring

Whenever an extensive (two days or greater duration) asbestos removal project is undertaken, personnel monitoring shall be conducted until worker exposure levels have been established for the particular removal operation. If possible, the Industrial Hygiene Staff should be notified several days prior to starting an insulation removal job so the necessary arrangements can be made for monitoring.

E. Personal Hygiene

The employees should be instructed to wash hands, face and forearms prior to drinking, eating, or smoking.

F. Housekeeping

Dry sweeping of insulation is prohibited. Vacuum cleaning methods should be utilized on floors and other surfaces contaminated with asbestos. Where vacuuming is not feasible, wet shovelling or wet-sweeping may be used. The use of compressed air for clean-up is strictly forbidden.

G. Restricted Area

All employees whose work does not require occupancy in the area of insulation removal are prohibited. Areas should be roped off as a minimum. In some applications, such as indoors removal, the work area may need to be sealed to prevent exposure of nearby employees and areas. Industrial Hygiene should be contacted for consultation in these instances.

H. Training

The employees should be instructed on the hazards of asbestos and the precautionary measures that are being taken to control their exposures.

I. Disposal

Asbestos waste must be accumulated separately from other refuse. All asbestos containing materials, after they are properly packaged and labeled, must be taken to a licensed land fill. Contact A. Eross, Senior Environmental Engineer (H 3111), for information regarding approved waste haulers and licensed land fills.

J. Medical Surveillance

The OSHA Standard requires that all employees exposed to airborne asbestos fibers, regardless of concentration, must be given annual medical examinations, including chest x-rays and pulmonary function tests. Arrangements should be made with plant medical directors to insure proper scheduling is provided.

To: Plant Managers
Area Managers of Operations
Staff Heads

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United States Steel Corporation

PLAINTIFF'S EXHIBIT 59

Interorganization Correspondence

Date: April 9, 1984

From: S. A. Bennett, Jr.
General Manager
Mon Valley Works

Subject: Revised Mon Valley Works Guideline for the Handling and Removal of Asbestos Bearing Materials.

The attached revised guideline must be implemented to insure continued compliance with existing asbestos regulations and to protect employees against the hazards of exposure to asbestos. This supersedes the Mon Valley Guideline dated August 24, 1983. Questions regarding the Guideline should be addressed to J. R. Dierdorf, General Supervisor-Industrial Hygiene (Homestead-Ext. 2945).

S A Bennett

egb

Attachment

cc: E. E. Harris
E. M. Gorden
K. F. Kuhns, M.D.
J. R. Dierdorf
Safety & Environmental Health Staff

GUIDELINES FOR THE REMOVAL AND HANDLING OF

ASBESTOS CONTAINING MATERIALS

MON VALLEY WORKS

Guidelines for the Handling and Removal of Asbestos Containing Materials

In November 1983, an OSHA Emergency Temporary Standard was promulgated reducing the eight (8) hour exposure limit from 2.0 fibers/cc to 0.5 fibers/cc. As policy in the Mon Valley a permissible exposure limit of 0.5 fibers/cc will be enforced.

Asbestos exposure has been associated with a variety of pulmonary abnormalities and diseases including pleural thickening, asbestosis, lung cancer, mesothelioma and gastrointestinal cancer. The effects of cigarette smoking compound the risk.

Teardown and removal of asbestos bearing products has the potential to generate levels of asbestos in excess of permissible exposure limits. Handling of asbestos bearing products such as gaskets, rope, brake shoes, etc. may also cause asbestos exposure.

The following guideline must be followed in all handling applications.

A. NOTIFICATION FOR EXPOSURE MONITORING

The Plant Industrial Hygiene Representative should be notified prior to all asbestos removal and handling jobs in order to arrange for monitoring of employee exposures. Notification must be made in a timely manner before each job begins. Once exposure levels have been determined for a job or occupation and protection procedures have been established, further routine monitoring will not be required and management will be so notified.

Subsequent to initial monitoring, only those jobs which present new or different circumstances and hazards will require monitoring. The Plant Industrial Hygienist should be notified to arrange for monitoring.

B NOTIFICATION FOR REPORTING TO CORPORATE INDUSTRIAL HYGIENE SERVICES

All major jobs (i.e., those requiring more than 2 man-days to complete) which involve the handling or removal of asbestos materials, and all shipments of asbestos materials to dump sites must be reported to the Corporate Office. Initial reporting of the above information should be to the Superintendent - Safety and Environmental Health - Mon-Valley Works. The information will then be transmitted to the Corporate Industrial Hygiene Services Organization.

C INITIAL DETERMINATION

Before beginning any job where handling a material suspected to contain asbestos is involved, a member of Management must either confirm that the material is asbestos free or if uncertain, contact the Plant Industrial Hygienist to have a bulk sample analyzed.

If the material is determined to contain asbestos, or a determination cannot be made, the precautions outlined below must be followed:

D. SAFE WORK PRACTICES

The work practices established for handling asbestos are designed to minimize dust generation and exposure to airborne fibers. The Mon-Valley Works Safe Work Practices for handling asbestos are as follows:

1. Prior to handling asbestos material, it should be thoroughly wetted when conditions permit such application. The water spray should be controlled to prevent the breakdown of the material, when existing materials are being removed. When installing new material, the product shall be thoroughly soaked when feasible, prior to application.

2. Drop cloths or other suitable means should be used to contain both the asbestos material as it is removed, as well as fibers that may be released during handling and cutting of asbestos bearing products. This will prevent spreading of the material and also facilitate clean up operations.

3. The existing asbestos bearing material should be removed in as large of sections as possible. That is the amount of fracturing should be minimized.

4. Where asbestos bearing materials must be cut, hand tools such as chisels or knives are preferable to hand saws or power tools. Use of power tools is strictly prohibited without approval of the Superintendent of Safety and Environmental Health.

5. Cleanup of asbestos material from the ground, equipment or clothing must be in such a way as to minimize dust generation and material breakdown. Dry sweeping and blowing with compressed air are strictly prohibited. Vacuum cleaning methods should be used where a high efficiency vacuum cleaner is available. Where a high efficiency vacuum cleaner is not available, wet methods of sweeping, wiping or shoveling may be used. The Safety and Environmental Health Organization should be consulted to determine if vacuum cleaners meet high efficiency requirements.

6. All asbestos debris, contaminated disposable clothing, respirator cartridges and drop cloths should be collected and placed in sealed, labeled, impermeable bags. The bags shall then be placed in a sealable drum which must be labeled with the warning:

CAUTION
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
BREATHING DUST MAY CAUSE BODILY HARM

7. Safe Job Procedures should be developed for all existing applications where asbestos bearing materials are handled. Employees shall be contacted annually on the requirements specified. The Safety and Environmental Health Organization is available to assist in insuring all required safe handling procedures are addressed in the Safe Job Procedures.

E. DISPOSAL

When the drums are sealed and ready for disposal, the Mon-Valley Environmental Engineering Organization (Homestead Extension: 3111) must be notified. They will secure the appropriate agency permits and will insure that the drums are disposed of in a properly licensed landfill.

F. PERSONAL PROTECTIVE EQUIPMENT

1. Respirators

All employees involved in asbestos removal or dismanteling operations, regardless of duration, shall be required to wear NOISH-approved respirators. The type of respirator to be used shall be determined by the exposure level as outlined below. All handling of asbestos bearing products other than removal or dismantling shall require the use of respiratory protection only when job exposures have been documented in excess of the OSHA PEL.

Required Respirator	Exposure Level
Air Purifying Dust Respirator (with specific approval for asbestos)	Not exceeding 10 times the PEL
Powered Air Purifying Respirator	Not exceeding 100 times the PEL
Type "C" Supplied Air Respirator	Not exceeding 1000 times the PEL

If the asbestos material is thoroughly wetted, hand tools are used and the operation is in an area of good ventilation, air purifying respirators should be adequate to reduce employee exposures to below the permissible levels.

Before using any respiratory protection, training and fit testing must be provided to insure proper use, fitting, handling and cleaning of the respirator. Due to the hazardous nature of asbestos, it is important to comply with the Mon-Valley Respiratory Protection Program and Facial Hair Policy.

2. Protective Clothing

Disposable protective coveralls shall be worn by employees involved in all asbestos removal or dismanteling jobs greater than one hour in duration, or upon employee request regardless of exposure duration. Coveralls without pockets or cuffs, made of impermiable material are preferred. Clothing, including boot covers and hoods, shall be mandatory at all times (regardless of the type of handling performed) when OSHA ceiling limits are exceeded as determined by Industrial Hygiene surveys. Respirators must be worn until contaminated disposable clothing is removed after completion of the job. Compressed air should not be used to blow the dust from clothing or tools.

Suggested ordering information for respiratory protection equipment and protective clothing is attached.

G. PERSONAL HYGIENE

Personal hygiene is important in protection against gastrointestinal exposure to asbestos. Hands, face and forearms must be washed prior to drinking, eating, smoking, etc., in order to prevent transfer of fibers and accidental ingestion.

H. RESTRICTED AREA

All employees whose work does not require occupancy in the area of the asbestos job are prohibited from entering such areas. Areas should be roped off as a minimum. In some applications, such as indoor removals, the work area may need to be sealed to prevent exposure of nearby employees and areas. The Plant Industrial Hygienist should be contacted for consultation in these instances.

I. EMPLOYEE TRAINING

All employees potentially exposed to airborne asbestos fibers shall receive initial instruction in the hazards and precautions required when handling asbestos bearing products. Initial training is to be arranged with the Safety and Environmental Health Organization, and is to be recorded on the employee's blue safety record card.

Periodic retraining for those employees frequently handling asbestos bearing product is to be conducted every six (6) months by the employees' supervisor and is to include the information in sections D, E, F, G and H of this document. Retraining shall be conducted prior to each job for those employees handling asbestos on an infrequent basis (i.e., less than twice a year). All training shall be recorded on the employee's blue safety record card.

Occupations handling asbestos bearing products, which have been demonstrated through Industrial Hygiene monitoring to have negligible asbestos exposure, will be exempted from the training requirements by the Mon Valley Safety and Environmental Health Organization.

J. PHYSICAL EXAMS

OSHA requires that all employees exposed to airborne asbestos fibers, in excess of 0.1 fibers per cc of air, must be given annual medical examinations, including chest x-rays and pulmonary function tests. Arrangements should be made with the Plant Medical Department to insure proper scheduling is provided.

April 9, 1984

ATTACHMENT I

RESPIRATORY PROTECTION
FOR ASBESTOS

Mine Safety Appliance Company - Vendor Stocking Contract No. 89060

A. Respirator body without filter or cartridge:

Size	Commodity Code	Cost
Small	896-151-1873	$ 11.50
Medium	896-151-1857	11.50
Large	896-155-1085	11.50

The following filters and filter covers must be ordered separately from item A:

1) Type "F" filters - 100 per box, $29.50 per box, commodity Code: 896-172-2967

2) Type "F" filter covers - $0.80 each, commodity code: 896-172-1704, two required per respirator.

B. Respirator with 10 type "F" filters and two covers - medium size only, $13.60, commodity code: 896-155-1077

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PLAINTIFF'S EXHIBIT 60

MEMORANDUM TO FILE

Analysis of Insulation Material - Main Steam Line for Homestead 48" Mill Engine

In February, 1984, two bulk samples were collected from the Main Steam Line of the Homestead 48" Mill Engine. Fiber identification was performed by the Environmental Health Lab. The sample from the top layer of the insulation was found to contain approximately 30-40% amosite asbestos and 5-10% chrysotile asbestos. The sample from the backing layers was found to contain approximately 40-50% amosite asbestos and 5-10% chrysotile asbestos.

PLAINTIFF'S EXHIBIT

United States Steel Corporation

Interorganization Correspondence

To: Holders of USS Health Services Approved Protective Apparel and Equipment Manual

Date: June 16, 1983

From: Walter D. Holloway
Manager-Safety

Subject: <u>Stop Order on Purchasing Asbestos Protective Garments</u>

Effective this date, <u>no USS location</u> shall order any protective garment (coats, jackets, pants, aprons, spats, leggings, gloves, hoods, etc.) containing asbestos.

The approved alternates are:

(1) Aluminized 19 oz. Kevlar (Thermobest, Norfab 400, Korspun).

(2) Aluminized Rayon, USS Specification 405-1275 (Exhibit I).

(3) Aluminized FR Cotton with attached FR Cotton Liner, USS Specification 403-174 (Exhibit II).

W.D. Holloway (F.P.m.)

FILING INSTRUCTIONS

1. Place this letter, Exhibit D, after Exhibit C, Section 5, Aluminized Clothing/Apparel.

2. Place the revised page I-5-1 behind the tab marked 5, Aluminized Clothing/Apparel. Remove old page I-5-1.

3. Remove Exhibit III, pages I-5-13 thru I-5-16.

4. Remove page I-2-3 from Section 2, Index, and insert revised page I-2-3.

USX0000571

WDH/nlk

To — All Division and Staff Heads

United States Steel Corporation

DILLARD
DEPOSITION EXHIBIT
#68

Interorganization Correspondence

Date: December 28, 1979

From: A. S. Patterson
General Supervisor of Safety

Subject: Guidelines for Removal and Disposal of Asbestos Materials

In order to comply with accepted practices when removing and disposing of asbestos materials and products (including asbestos insulating materials), following is a set of guidelines.

1. Work Practices
A wet process (wetting with water) should be used where asbestos material is being removed from piping tanks, boilers, etc. Dust generation should be minimized by removing it in as large sections as possible. Breaking or fracturing of asbestos should be minimized.

2. Personal Protective Equipment
If the asbestos is thoroughly wetted and the operation is in an area of good ventilation, air purifying respirators (such as MSA - Dust Foe Types, 3M and Wilson disposable type with TC approval for asbestos) should be adequate in reducing exposure to below permissible time weighted or ceiling levels.

In confined areas where the asbestos cannot be adequately wetted, air monitoring should be conducted to determine exposure levels. If such air sampling shows asbestos exposures to be well in excess of permissible limits powered air purifying respirators or Type "C" supplied air respirators should be used.

3. Personal Hygiene
Employees involved in the removal and disposal of asbestos materials should be instructed to wash hands, face and forearms prior to drinking, eating or smoking.

Contaminated work clothing should be thoroughly vacuum cleaned prior to removal. Coveralls or similar whole clothing is recommended.

4. Housekeeping
Dry sweeping of the asbestos debris should be prohibited. Vacuum cleaning methods should be used on floors and other exposed surfaces contaminated with asbestos. The asbestos material (debris and sweep up) must be placed in an impermeable bag (plastic refuse bags are acceptable) and then wired or taped closed. The bag must be labelled with a sign which states, "Caution -- Contains Asbestos. Avoid Opening Or Breaking Container. Breathing Asbestos Is Hazardous To Your Health."

4. Housekeeping (Continued)
The bag must then be placed in cardboard or metal drums and the drums must also be labelled as were the bags. The drums should then be taken to a licensed landfill.

Contact R. V. McCarthy, Engineering Department, Extension 2600, or the Safety Department, Extension 2255, for information regarding the licensed landfill.

A. S. Patterson

ASP:kmj

DILLARD
DEPOSITION
EXHIBIT
#69

United States Steel Corporation

Interorganization Correspondence

To: Division Superintendents
and Staff Heads

Date: May 8, 1981

From: T. R. McCune
General Supervisor Safety
Homestead Works

Subject: CORPORATION ASBESTOS GUIDELINES

Attached for your information and use is a copy of Corporation recommendations recently developed by Headquarters' Environmental Health for the protection of our employees against the hazards associated with exposure to asbestos.

These guidelines deal with the OSHA requirements on environmental monitoring, medical surveillance, controlling worker exposure to asbestos fibers and employee training. Each division should review their involvement with asbestos containing materials and advise this office of their status with regards to compliance required by OSHA.

In the near future, memos will be issued by the Safety Office providing the divisions with revised guidelines for the removal and disposal of asbestos containing materials and a list of products that can be substituted for asbestos.

T. R. McCune

TRM/ch

Attachment

USX0002868

GUIDELINES FOR THE PROTECTION OF EMPLOYEES AGAINST THE HAZARDS OF ASBESTOS DUST EXPOSURE

UNITED STATES STEEL CORPORATION

USX0002869

TABLE OF CONTENTS

USX0002870

I. Introduction

Asbestos is a generic term used to describe a variety of naturally-occurring, fibrous, hydrated mineral silicates. There are two main types: serpentine and amphibole. The serpentine variety is called chrysotile and accounts for more than 90% of the asbestos used in the United States. Amphibole asbestos includes the fibrous forms of the minerals amosite, crocidolite, tremolite, actinolite and anthophyllite. Asbestos fibers are generally characterized by high tensile strength, flexibility, heat and chemical resistance, and favorable frictional properties. Certain grades can be carded, spun and woven, while others can be laid and pressed to form sheets or used for structural reinforcement of materials such as cement, plastic and asphalt.

There are over 3,000 known asbestos products used in industry, commerce and the home. Examples of these include building and pipe insulation materials; products such as millboard, roofing felt and beverage filters; rope and braid; asbestos-cement pipe and sheets; vinyl-asbestos floor tiles; automotive brake linings and clutch plates; paints, coatings and sealants; gaskets and packings; and reinforced plastics. For all practical purposes, asbestos is a ubiquitous substance, i.e., almost everyone is exposed to it in some form and to some degree, everyday.

II. The Health Hazard of Asbestos

Knowledge of diseases associated with the use of asbestos apparently dates back 2,000 years. However, the association of asbest-- with chronic respiratory disease had to be rediscovered in the mode era. In very recent times, asbestos exposure has been shown to have a causal relationship with a variety of disease entities and pulmonary abnormalities including:

A. Pleural Effusion, Pleural Thickening, Calcification & Plaques -

Asbestos exposure should be considered whenever there is benign effusion in the pleural cavity. The effusion may be accompanied by pleural thickening. Pleural thickening, usually bilateral in distribution, may occur, however, without previous evidence of effusion. A pleural plaque is a localized fibrous thickening of a parietal pleural surface. Microscopically, plaques consist primarily of connective tissue, often containing deposits of calcium. They do not interfere with pulmonary function to any significant extent, nor do they necessarily indicate the presence of pulmonary fibrosis. An association between pleural abnormalities and exposure to asbestos has been clearly demonstrated in several studies. Although pleural plaques do not, themselves, appear to be precursors of malignant disease, a recent study showed that bronchial carcinoma was 2-1/2 times more frequent in men with pleural plaques.

B. Asbestosis - a diffuse, interstitial, non-malignant scarring of the lung. This is the most common disease produced by exposure to asbestos. It is a sometimes fatal condition that results from significant, but not necessarily heavy exposure. Lung infections, such as pneumonia or bronchitis, are extremely threatening to people with asbestosis.

C. Bronchogenic Carcinoma - a malignancy of the interior of the lung. A high proportion of asbestos patients may develop lung cancer. The cancer risk is much higher for cigarette smokers suggesting some synergistic relationship between asbestos fibers and tobacco smoke. It has been estimated that asbestos workers who smoke have almost 90 times greater risk of lung cancer than the non-smoking general public.

D. Mesothelioma - a diffuse malignancy of the lining of the chest cavity or of the lining of the abdomen. This condition is extremely rare in the general public; however, the incidence of these cancers has been increasing and their peculiar relationship to asbestos fibers has received considerable attention. Mesotheliomas can occur even after a limited exposure to asbestos dust and may affect people who were not directly involved in handling the material, such as relatives of asbestos workers who may be exposed to dust carried home on work clothing.

E. Cancer of the Digestive System - asbestos may also produce disease when it is ingested. A number of studies now indica\ that the increase in incidence of cancer of the stomach and colon among asbestos workers is two or three times the number of expected tumors.

III. An Integrated Control Program to Protect Employees Against the Hazardous Effects of Asbestos Exposure

Four key elements are necessary to insure the success of a program designed to control the adverse health effects of asbestos fibers in man's environment. These basic components include:

---Air monitoring and analysis to determine the level of exposure to asbestos fibers.

---Medical surveillance to assure that no physiological changes are occurring as a result of the asbestos exposures.

---Physical control of human exposure to asbestos fibers, i.e., to reduce the contact between the worker and the fibers.

---An educational program to inform employees of the potential hazards of asbestos and to train them in the proper implementation of procedures designed to minimize exposures.

A. Environmental Monitoring

The first determination that must be made is whether or not there is an actual exposure to asbestos. It is meaningless and often costly to arrive at a solution where no problem exists. There are numerous fibrous insulation materials used throughout the Corporation which may or may not contain asbestos. Where there is uncertainty, a bulk sample of the material is sent to Headquarters Environmental Health to ascertain the possible presence of asbestos. Fiber morphology is examined under phase contrast microscopy and the crystal properties of the fibers are studied under the polarizing light microscope. A wet chemical screening test, specific for magnesium and iron complexes, may also be conducted. In most cases, these tests will confirm the presence of asbestos or eliminate the possibility of it being a component of the bulk material. If there is any doubt, the sample is forwarded to USS Research for positive identification of the fiber using electron microscope techniques.

When employees work with materials known to contain asbestos, their exposures are evaluated with personal monitoring equipment which can detect and measure the concentrations of asbestos fibers which may be released into the worker's breathing zone. With such equipment, the exposures can be monitored over short, peak periods or averaged over the entire workshift.

The OSHA asbestos standard requires that periodic monitoring be conducted, at intervals no greater than six months, on those employees whose asbestos exposures may reasonably be foreseen to exceed permissible exposure limits. However, any initial determination of such elevated exposures would be an immediate cause for concern, and corrective action would be promptly taken by U. S. Steel management to implement control measures to reduce asbestos exposures to the lowest possible levels.

B. Medical Surveillance

The OSHA standard further dictates that all employees exposed to airborne asbestos fibers, regardless of concentration, must be given annual medical examinations, including chest X-rays and pulmonary function tests. However, as pointed out earlier, asbestos is such a widespread substance that virtually everyone has some measurable exposure. OSHA has apparently come to understand this premise and under Program Directive 300-16 (October, 1978) has defined, for medical purposes, exposure to airborne asbestos fibers as a minimum of 0.1 asbestos fibers, longer than 5 micrometers, per cubic centimeter of air (i.e., 1 fiber per 10 cc). At U. S. Steel, we use this 0.1 fiber/cc exposure level to identify those employees to be included in the medical surveillance program. Separate guidelines detailing the medical surveillance procedures were previously sent to plant physicians by the Director of Industrial Medicine. A copy of these guidelines is attached.

C. Controlling Employee Exposures to Asbestos Fibers

1) Substitution of Alternative Materials

Using "non-asbestos" materials on applications which previously used asbestos products is the first choice of controlling exposures since it eliminates the source of the hazard. Some of the alternative materials that have found common usage as substitutes for asbestos include fiberglass, kaolin wool, ceramics, mineral wool and various plastic fibers. In certain individual applications, each of these has exhibited adequate tensile strength, heat resistance, flexibility and durability to satisfactorily perform functions previously served only by asbestos products. Some examples of "asbestos-free" materials being used at operations at U. S. Steel facilities include:

--the widespread use of ceramic fiber and kaolin wool as pipe insulation materials.

--non-asbestos mortar compounds for heat resistant cement applications.

--fiberglas and aramid fiber textile products such as welding curtains and heat resistant clothing.

--various hot-top products at ingot teeming operations.

Although the use of asbestos is well entrenched in many important applications, it is likely that substitution will play an increasingly significant future role in reducing health hazards from asbestos.

2) Encapsulation

The mere presence of asbestos insulation materials does not constitute a health hazard. In this regard it is not U. S. Steel's philosophy or intention that all asbestos insulation materials be torn out and replaced with alternative materials. However, once it is determined that such insulation has deteriorated to the point that fibers may be emitted into occupied areas, steps should be taken to control the hazard.

A feasible alternative to complete removal of asbestos insulation is encapsulation, i.e., treating the material with an acrylic or elastomeric polymer protective coating to seal the fibers in place and prevent further deterioration. Although each case must be considered on an individual basis, encapsulation can often be a preferable solution because it generally costs much less, does not cause long-term disruption of operations, and does not require the intensive decontamination efforts necessitated by complete removal. Examples of these asbestos containment treatments are Hydro-ban by KRC Corporation and Asbestos Guard Fiber Fix (719) by U. S. Coatings Collaborative, Inc.

Raybestos Manhattan has developed a product called Novatex which is an asbestos textile encapsulated with an acrylic resin. A neoprene coating may give additional protection. Novatex cloth can be used for welding curtains, insulation applications, and for aluminized and non-aluminized protective bodywear.

3) Exhaust Ventilation

Any operation which may conceivably generate airborne asbestos dust concentrations in excess of permissible exposure limits should be provided with local exhaust ventilation. Where such ventilation is used the exhaust hood should be located as close as possible to the point of dust generation to achieve maximum capture of the released fibers. Examples of operations where local ventilation may be employed include the mixing of asbestos mortar compounds and the use of saws, drills and grinders on asbestos materials.

4) Isolation

Operations which have the potential to generate high concentrations of airborne fibers should be isolated to the extent feasible to minimize human exposure to the fibers. The removal or teardown of asbestos pipe insulation is an example of this type of operation. U. S. Steel guidelines outlining procedures to be followed during this task stipulate that the vicinity of the operation be designated a restricted area, thus denying access to employees whose presence is not required.

5) Work Practices

Changes in work practices may often be the most cost-effective way of reducing occupational exposure to asbestos. When conducting an operation which involves the handling of asbestos materials, consideration should be given to performing the task in such a manner that the emission of asbestos fibers into the air will be minimized. Some of the ways in which work practices may be modified include:

--the use of a slow band saw or hand saw in lieu of a high-speed circular table saw to cut Transite asbestos board.

--thoroughly wetting asbestos materials prior to use - such as immersing a coil of asbestos rope in water prior to applying it as a sealant around furnace or oven doors.

--the purchase of pre-cut and pre-drilled materials such as brake shoe lining containing asbestos.

--using a vacuum cleaner instead of a compressed air hose to remove dust residue from mobile equipment brakes during inspection and repair operations.

--removing asbestos insulation in as large of sections as possible to minimize the amount of fracturing.

--using hand tools such as chisels or knives, rather than power tools or saws, to cut and remove asbestos insulation.

6) Housekeeping

Good housekeeping practices are essential to maintain low levels of airborne asbestos fibers. Dust on floors, ledges, equipment and workbenches may become airborne when disturbed by work activity, air movement, or vehicular traffic. Dry sweeping should be prohibited in areas where asbestos is used because it merely redisperses the fine fibers into the workroom air. Instead, vacuum cleaning is the preferred method of removing dust accumulations.

Waste materials such as rejects, scrap, shavings or other debris should be collected and placed in plastic bags or some other impermeable container. The containers should be sealed shut, labeled as to the contents and hazard, and disposed of in accordance with applicable Federal and State regulations.

7) Personal Protection

The control measures previously discussed under this section should always be the primary means of minimizing employee exposure to asbestos fibers. If, however, these measures are not sufficient, or if some specific operations are not amenable to such control, the use of personal protective equipment will be necessary. While respirators and protective clothing should always be available, it must be understood they serve only as a complement to, not as a replacement for, engineering and work practice control measures.

a. Respirators

Respirators may be necessary to control asbestos exposures in some instances, such as the removal of thermal pipe insulation. Since these devices place a burden on the respiration of the worker, it must first be determined whether the wearer can use the equipment and still perform the assigned task. In such a determination, consideration should be given to: the physical condition of the worker, such as possible pulmonary or cardiovascular impairment; the physiological demands of the task, such as required oxygen uptake; and the presence of facial hair which may negate an effective respirator seal.

The type of respirator needed will be dictated by the preceding factors as well as the concentration of airborne asbestos fibers. With fiber concentrations less than 10 times the permissible exposure levels a properly fitted air purifying dust respirator will provide sufficient protection. The type of respirator selected should be specifically approved by NIOSH for protection against dusts containing asbestos. It should be noted, however, that single use, disposable respirators are not permitted within U. S. Steel for protection against asbestos.

When the fiber contamination level is between 10 and 100 times the permissible exposure level, powered air-purifying respirators should be worn. If exposures exceed 100 times the acceptable limits, a type "C" supplied air respirator or pressure-demand self-contained breathing unit should be worn.

Respirator wearers should be instructed to wash the masks, and change filters, where applicable, daily. Proper fitting instructions should also be given. When respirators are issued, it is important to comply with the appropriate regulations governing the use of respiratory protection. For those facilities under OSHA jurisdiction, these regulations are stated in 29 CFR 1910.134. MSHA requires a respirator program consistent with the provisions of ANSI Z88.2-1980.

b. Protective Clothing

In regard to asbestos, it is important to consider protective clothing in two ways. First, it may be necessary to provide special clothing to employees who are required to handle asbestos to prevent work clothing from becoming contaminated with the fibers. In this instance protective clothing is a control measure to protect not only the worker but also family members who may be exposed to dust carried home on his work clothing. Second, some protective clothing articles, intended to provide thermal protection for those in close proximity to high radiant heat sources, are made from asbestos materials. Reports in the literature indicate that this type of clothing, through gradual deterioration with use, is actually a source of asbestos exposure to workers. We will consider each type of protective clothing separately.

i) Protective Clothing as a Control Measure

When employee asbestos exposures exceed a "ceiling limit" of 10 fibers/cc the OSHA asbestos standard requires employers to provide "special clothing" (coveralls, head coverings, gloves and foot coverings), change rooms with two lockers (one for the employee's street clothes and one for his contaminated work clothes), transportation of contaminated clothing in sealed impermeable bags or containers, and laundering facilities. The necessity of complying with some of these provisions can be eliminated by issuing employees disposable protective garments. Disposables may include hard hat liners, coveralls and shoe liners. The coverall garment should be without pockets or cuffs. A good example is DuPont's Tyvek protective garments. Tyvek is a durable spunbonded olefin with high tensile/tear strength, chemically resistant and due to a relatively slick surface, it does not tend to entrap particles. A vacuum cleaner should be used to remove loose fibers adhering to contaminated work clothing. Employees should not attempt to dislodge these fibers by brushing them off nor by using compressed air. In addition respirators should continue to be worn until contaminated work clothing is removed.

ii) Protective Clothing Made of Asbestos Material

Occasionally, employees working in areas of high radiant heat, those who are exposed to molten metal or weld spatter or those who have to handle hot objects or tools are required to wear heat-resistant asbestos clothing. Eventually there may be sufficient wear and movement of the fabric to cause the release of appreciable airborne fibers into the employee's breathing zone. As previously discussed, the primary method of controlling asbestos exposures is to substitute a non-asbestos material. In this regard, there have been several recent advances by protective garment manufacturers in developing incombustible, thermal resistant fabrics. Some examples of these are aramid fibers (a high temperature nylon) such as DuPont's Nomex and Southern Textile's Goldengard; polyacrylonitrile fabrics like Gentex's Preox, which also comes with an aluminized facing where heat reflectivity is crucial, as in teeming operations; and glass fiber products, including Zetek by Newtex Industries and Pyroglas by Raybestos Industrial Products.

8) Removal of Insulation Materials

At U. S. Steel, the greatest potential for high exposures to asbestos is the removal of deteriorating insulation materials such as pipe coverings. Specific guidelines to protect the employees during this operation were developed by Headquarters Environmental Health and distributed to all Corporate facilities. These procedures included provisions on work practices to minimize dust generation, personal protective equipment, exposure monitoring, personal hygiene, housekeeping, restriction of area, employee training and waste disposal.

D. Education

Employees will be more apt to cooperate with management's attempts to control their exposures to toxic substances if they are made aware of the nature of the hazard and its consequences. It is mutually beneficial to the workers and the Corporation to develop and implement an education and training policy regarding exposure to asbestos. The goals of the program should be to increase the employees' knowledge of:

--the nature of the asbestos hazard

--work processes involving asbestos and the potential for fiber emissions

--diseases that may result from exposure to asbestos fibers and how these diseases are manifested

--the concept of "risk"

--environmental monitoring procedures and objectives

--the purpose and nature of engineering and work practice controls

--the purpose, proper use, and limitations of respiratory protection equipment

--the application of decontamination and waste disposal practices

--the elements of the medical surveillance program and the reasons for it

--the role of related factors in disease production such as smoking

It is strongly recommended that supervisory personnel be included in any education program. A well-informed supervisor may personify management's concern and insistence that operations involving the use and handling of asbestos products be conducted in a safe and healthful manner.

GUIDELINES FOR MEDICAL SURVEILLANCE

ASBESTOS EXPOSURE

The following guidelines for medical surveillance shall be followed in all United States Steel Corporation operations whenever exposure to asbestos occurs.

1. All employees exposed to asbestos shall be provided (or made available) a comprehensive medical examination prior to first employment in an occupation exposed to airborne concentration of asbestos fibers. These medical examinations will be required for any 7- to 8-hour time-weighted average concentration of 0.1 fibers/cc, or for a greater concentration. (The OSHA Asbestos Standard permits this examination to occur within 30 calendar days of the first exposure.)

   Annually thereafter and within 30 calendar days before or after termination of employment in an occupation exposed to airborne concentration of asbestos fibers requiring a medical examination as designated above, a physical examination shall be provided or made available to these employees.

   Whenever pleural thickening is found on any routine chest x-ray on an individual who has had any airborne asbestos exposure, this individual shall be kept under yearly medical surveillance.

   The minimum components of the examination shall be:

   (a). A medical history, including a respiratory questionnaire to elicit symptomatology of respiratory disease.

   (b). A 14" x 17" chest x-ray - posterior-anterior view. Whenever there is evidence of pleural response, right and left oblique views and expiratory posterior-anterior view should be taken to confirm or rule out pleural findings.

   (c). Pulmonary Function testing to include forced vital capacity (FVC) and forced expiratory volume at 1 second (FEV_1).

2. A complete work history shall be taken on initial assignment to an occupation where exposure to airborne concentration of asbestos fibers will occur. This is particularly important if changes in the chest x-ray begin to occur. The work history will include all work experiences in United States Steel and other non-United States Steel work experiences to determine extent of exposure to asbestos. In order to be complete, military exposures, i.e. ship and shipyard exposures; hobbies; exposures of family members (father, brothers, grandfathers, mother, sisters, etc.) who might have brought asbestos fibers home on their clothing; living (home) location (geographic) for proximity to asbestos mining or manufacturing plant; and play areas

in relation to discarded wastes from asbestos factories. The Environmental Health unit (corporate headquarters or plants) will be helpful in evaluating the extent of work exposures.

3. The chest x-ray should be read by at least two United States Steel physicians or physicians selected by the plant physicians. Any positive chest x-ray shall be read by a "B" reader for confirmation of the findings. It is permissible to contract with a "B" reader to read all x-rays in this program. (A "B" reader is certified following successful completion of qualifying examination of 125 chest x-rays by NIOSH and the American College of Radiology.)

4. A clinical evaluation leading to a diagnosis and recommendations will be made.

   (a). Correlate all medical findings - history, physical findings, chest x-ray interpretation, pulmonary function results, and any other medical information -- with the environmental exposure data.

   (b). Referral to a pulmonary specialist to assist in this evaluation may be done at the option of the plant medical director or other examining physician.

   (c). Referral of the chest x-ray to another "B" reader may occasionally be necessary for the proper interpretation of the x-ray.

5. The clinical evaluation will result usually in a diagnosis of one of the following in descending order of importance:

   (a). Asbestosis - pulmonary infiltrate of s, t, u type almost always, with or without pulmonary function decrements, and with or without pleural thickening or plaques (with or without calcification). Record on OSHA-200 Log as "Asbestosis".

   (b). Pleural Thickening due to asbestos exposure - bilateral pleural thickening or plaques (with or without calcification) and with or without pulmonary function decrements. Without pulmonary function decrements, no need to refer unless requested by employee. Record on OSHA-200 Log as "Pleural thickening due to asbestos exposure".

   (c). Pleural Thickening due to asbestos exposure - unilateral pleural thickening or plaques (with or without calcification) and with or without pulmonary function decrements. Without pulmonary function decrement, no need to refer unless requested by employee. Record on OSHA-200 Log as "Pleural thickening due to asbestos exposure". This diagnosis is one of elimination from 5. (d).

The language for OSHA-200 Log recording for (b) and (c) has been agreed upon in a meeting held October 1, 1980 of Personnel, Medical, Labor Relations, Safety & Environmental Health, Law, and Workers' Compensation & Casualty representatives.

(d). Unilateral pleural thickening or plaques with or without adequate history of asbestos exposure (with or without calcification) and with or without pulmonary decrements. The most likely explanation for the pleural thickening in this (d) group is one of the following: infection (pleural effusion) or hemorrhage, callous from rib fracture, radiation fibrosis, scleroderma, chronic mineral oil aspiration, metastatic disease, lymphoma, myeloma or a combination of these. DO NOT RECORD ON OSHA-200 LOG. Normal anatomical shadows -- pectoral shadow area, extra pleural fat deposits, serratus and external oblique muscle shadows can usually be ruled out by the above mentioned (1. (b)) techniques.

(e). Pulmonary Function Decrement only - Emphysema. It is important to establish whether this is result of occupational exposure or is due to non-occupational origin. Differentiation between obstructive and restrictive disease must be made. Do not record on OSHA-200 Log unless occupationally related. Define cause if so recorded.

(f). Normal Chest - further follow-up testing failed to substantiate suspicions in original chest x-ray or pulmonary function tests. The role of smoking in any pulmonary function decrement must be carefully evaluated. Diffusing capacity determinations may be helpful in ruling out pulmonary fibrosis and probably should be done. In coke plants, the possibility of coalworkers pneumoconiosis with or without focal emphysema must always be ruled out.

6. Recommendations to the physician in discussing findings with the affected employees:

(a). All employees must be told of any positive findings found during his/her examination and the United States Steel physician evaluation (also consultant if used) of these findings. Recorded exposure levels should also be given to the employee. Because of proper handling of asbestos today, these environmental levels should ordinarily be helpful in allaying any fears of continued exposure to hazardous levels.

(b). Pulmonary infiltrate due to asbestos exposure with or without pleural reaction. Shall be advised that this response is due probably to exposures of many years past. Depending upon the pulmonary function finding, the risk of continued decrement is probably directly correlated to continued smoking especially if any continued exposure is properly handled by respiratory protection and is of very minimal, if any, monitored value. The corporate headquarters Environmental Health unit shall prescribe the approved manner of handling any continuing exposure. To be followed every year unless pulmonary function is decreased, then at shorter intervals if clinically indicated. Every effort should be made to get the individual to STOP SMOKING if he/she is a smoker. The risk of lung cancer in those with parenchymal infiltrate is up to sixteen (16) times the risk of a non-smoker with the same exposure and ninety (90) times that of a worker who is a non-smoker and not exposed to asbestos.

(c). Bilateral or unilateral pleural thickening or plaques due to asbestos exposure (with or without calcification). Should be advised that this response is the result of many years of low level of exposure. This also should not progress if the exposure has been eliminated or properly controlled by proper handling of asbestos and by respiratory protection if exposure continues. Depending upon the pulmonary function findings, the risk of continued decrement is directly correlated with continued smoking especially if any continued exposure is properly handled by respiratory protection and is of very minimal, if any, monitored value. The corporate headquarters Environmental Health unit shall prescribe the approved manner of handling any continuing exposure. To be followed yearly unless there is a decrement in pulmonary function, then at shorter intervals if clinically indicated. Every effort should be made to get the individual to STOP SMOKING if he/she is a smoker. The risk of lung cancer in those with bilateral pleural thickening or plaques is two and one-half (2-1/2) times those without pleural reaction.

(d). Unilateral pleural thickening or plaques (with or without calcification) not the result of exposure to asbestos. Continue to follow on a yearly basis.

(e). Emphysema - if believed due to occupational exposure - follow yearly unless otherwise indicated or requested by employee.

If believed to be non-occupational, then referral to private physician, if appropriate - follow yearly.

(f). Normal - yearly follow-up.

7. Environmental Monitoring. Will be carried out by the Environmental Health unit (corporate headquarters or plants) according to requirements of the OSHA Asbestos Standard.

To: Safety and Environmental Health Representatives

Ex #73

United States Steel Corporation

Interorganization Corresp

Pekrzywka
DEPOSITION EXHIBIT
#73

Date: November 21, 1983

From: William D. Miller
Director - Safety and Environmental Health

Subject: Asbestos - Emergency Temporary Standard

The Occupational Safety and Health Administration (OSHA), on November 4, 1983, issued an Emergency Temporary Standard (ETS) for asbestos. This Standard is effective immediately and applies to all workplaces where employees may be exposed to asbestos in all industries covered by the Act including General Industry, Construction and Maritime. The major changes to the Standard made by the ETS are:

1. The permissible exposure level has been lowered from 2 fibers/cc to 0.5 fibers/cc.

2. The ETS permits the use of methods other than engineering controls to immediately reduce employee exposure to the 0.5 fibers/cc permissible exposure level; however, engineering controls are still mandated to reduce exposure to 2 fibers/cc.

NOV 28 1983

3. Training programs must be established for all employees exposed above 0.5 fibers/cc without regard to the use of respirators.

Attached is a Summary of Requirements of the Standard.

In order to assure compliance with this Standard, the following steps should be implemented immediately:

- Identify all jobs, processes, areas, etc. which may expose employees to asbestos above the 0.5 fibers/cc ETS limit.

- Conduct Industrial Hygiene monitoring in all areas where asbestos exposures occur to adequately determine if employee exposures exceed the 0.5 fibers/cc ETS limit.

- Establish and implement a training program that addresses all of the items mandated by the ETS for all employees exposed to asbestos above the 0.5 fibers/cc limit.

USX0002893

- Document all of the above steps through accurate records. Provide the Corporate Industrial Hygiene Services organization with an initial report that indicates your timetable for accomplishing the above objectives and a final report showing compliance.

If you require technical Industrial Hygiene assistance in accomplishing compliance with this Standard, contact:

F. M. Toca, Ph.D.
Manager-Industrial Hygiene Services
600 Grant Street - Room 720
Pittsburgh, PA 15230

Steelcom - 8-723-6836

WDM/js
attachment

United States Steel Corporation

Interorganization Correspondence

PLAINTIFF'S EXHIBIT

Date: February 1, 1974

To: Mr. F. R. Smith, Jr.
General Superintendent
Homestead Works

From: W. C. Janes, Manager
Environmental Health

Subject: Asbestos Dust Survey

At the request of Al Patterson, Safety, an environmental health survey was conducted in the No. 3 Machine Shop and No. 2 Forge Heat Treating Shop at Homestead Works on Oct. 24 and 31, 1973. Its purpose was to determine whether workers are exposed to asbestos dust concentrations in excess of the air standard established under the OSHAct of 1970.

The present OSHA standard for exposure to asbestos dust is 5.0 fibers, longer than 5 micrometers, per cubic centimeter of air, based on an 8-hour, time-weighted average exposure. On July 1, 1976, the limit is reduced to 2.0 fibers per cubic centimeter.

While the standard is based on an 8-hour, time-weighted average, no single exposure may exceed a ceiling limit of 10 fibers per cubic centimeter.

Fifteen short-term (15-47 minutes) breathing zone samples were collected during this survey. A sample was worn by each worker, thus giving his integrated exposure for the period of sampling. Results of the samples are listed in the attached tables.

Two samples were collected on the Conset tester at the heat lathe in No. 3 Machine Shop. During the first test (15 minutes), the employee hand sawed semi-circles from two 42" x 48" pieces of fiberboard and installed one of the pieces at the end of the induction hood. His exposure over this sampling period was 0.58 fibers/cc. During the second sampling period (30 minutes), he installed the other piece of fiberboard and applied cement to cracks and crevices for better insulation. During this period, his exposure was 0.23 fibers/cc giving a time-weighted average exposure of 0.35 fibers/cc for the total period of sampling. Since this represents his only exposure to airborne asbestos for the work shift, his 8-hour, time-weighted average exposure calculates to be 0.05 fibers/cc.

According to the manufacturer, the insulating cement used in this operation (Johns-Manville No. 460 Insulating Cement), contains no asbestos fibers.

Results from 7 samples, collected in the breathing zone of the quencher helper in the Sealas furnaces area of No. 2 Forge Heat Treating Dept., ranged from 0.10 to 0.48 fibers/cc with a time-weighted average exposure of 0.21 fibers/cc. The two highest exposures (0.48 and 0.35 fibers/cc), were found while cutting asbestos fiberboard with a hand saw. Cutting 1/16" asbestos sheets showed an asbestos exposure of 0.12 fibers/cc.

Findings from 6 samples collected on the furnace operator in the Sealas furnaces area ranged from 0.03 to 0.61 fibers/cc with a time-weighted average value of 0.15 fibers/cc. The operator worked with the quencher helper in preparing protective discs for sleeve ends. However, he did none of the cutting of asbestos products. The higher exposure (0.61 fibers/cc), resulted when the operator positioned the protective disc into the sleeve end while the quencher helper hammered it into place. This hammering caused asbestos dust to be released from the edge of the disc into the breathing zone of the furnace operator. It would be good practice to wet the edges of the discs before hammering to minimize the generation of asbestos dust.

Asbestos dust exposures of all employees sampled during this survey were found to be well below the present OSHA air standard of 5.0 fibers/cc and also well within the projected permanent standard of 2.0 fibers/cc which goes into effect on July 1, 1976. The employees are not exposed to hazardous levels of airborne asbestos dust.

W. C. James

W. C. James

JFQ/mdd

Attachments

TABLE 1

ASBESTOS EXPOSURES

No. 3 Machine Shop

Homestead Works

October 24, 1973

Occupation	No. of Samples	Total Sampling Time	High	Low	Time-Weighted Average Concentration (fibers/cc) for Period of Sampling
Conset Tester at Heat Lathe - (J. Pifer)	2	45	0.58	0.23	0.35

Federal Standard - Asbestos Dust

As of July 7, 1972: 5.0 fibers/cc

As of July 1, 1976: 2.0 fibers/cc

TABLE 2

ASBESTOS EXPOSURES

No. 2 Forge Heat Treating - Sealas Furnaces Area

Homestead Works

October 31, 1973

Occupation	No. of Samples	Total Sampling Time (Min.)	High	Low	Time-Weighted Average Concentration (fibers/cc for Period of Sampling
Quencher Helper - (E. Turozey)	7	178	0.48	0.10	0.21
Furnace Operator - (D. Lloyd)	6	188	0.61	0.04	0.15

Federal Standard - Asbestos Dust

As of July 7, 1972: 5.0 fibers/cc

As of July 1, 1976: 2.0 fibers/cc

United States Steel Corporation

PLAINTIFF'S EXHIBIT

Interorganization Correspondence

Date: February 5, 1976

To: W. C. Janes, Manager
Environmental Health

From: J. F. Quealy

Subject: OSHA Inspection
Homestead Works

On February 4, 1976, I went to Homestead Works to collect simultaneous samples during an OSHA inspection. The inspection was conducted by OSHA Industrial Hygienists Paul Hitcho, Matt Perry and Dave Berestecky. The OSHA personnel arrived at approximately 9:10 a.m. Messrs. Hitcho and Perry went to the Harvey Shop while Mr. Berestecky proceeded to the No. 2 Forge Shop. I arrived at the plant at approximately 10:20 a.m.

At the Harvey Shop, Mr. Hitcho conducted the inspection. Mr. Perry acted primarily as an observer. They collected sulfur dioxide samples on three employees (craneman, heater and expeditor) and asbestos samples on two heaters. Ron Andes, Homestead Fuel Engineer, had one personal sampler and began collecting a simultaneous sample on the craneman. We began collecting samples on the other 4 individuals when I arrived.

OSHA collected their SO_2 samples in midget impingers containing 10 ml of 0.3 N H_2O_2. A prefilter was used to remove particulates. They collected their samples at 1.7 lpm. The NIOSH Manual of Analytical Methods states that a sample size of not more than 100 liters should be collected using this method. However, OSHA exceeded this limit with each sample. They changed solutions only once for each sample during the day. Their sample times ranged from approximately 2-3 hours. The method also calls for 15 ml of absorbing solution to be used. OSHA used only 10 ml.

Our SO_2 samples were collected using the same method. However, we used 15 ml of absorbing solution and tried to restrict our sample size to 100 liters. We collected a total of 14 samples, ranging from 12-60 minutes, on the same three individuals.

Mr. Hitcho collected asbestos samples on the two heaters in the Harvey Shop because he saw rolls of asbestos sheet on the floor. This sheet is used very infrequently in the Harvey Shop. Mr. Hitcho left the same sample filter on the heaters for the entire sampling period (approximately 5 hours). I changed our filters after about 3.5 hours because it appeared that the total collected particulates could make counting difficult.

Mr. Berestecky conducted the survey in the No. 2 Forge Dept. He arrived at the Sealas furnaces area at about 9:30 a.m. and collected samples for asbestos on two employees, the quencher and his helper. He was accompanied by Chuck Van Horne, Homestead Safety Engineer. Mr. Berestecky collected four samples on each individual, ranging from 39 to 136 minutes. Total sampling time was 314 minutes on the quencher and 274 minutes on his helper. I arrived at this area and collected two samples on each individual. My total sampling time was 3 hours on each individual. After my arrival, these employees had little or no contact with asbestos. Prior to my arrival, Mr. Berestecky said he observed the quencher helper dry sweeping debris containing asbestos products. Housekeeping in the area was awful, with numerous pieces of asbestos products strewn all over the floor.

At 3:05 p.m., the OSHA personnel held a closing conference with Mr. Dean Wilson, General Superintendent. Mr. Hitcho stated that he felt that air samples collected in the Harvey Shop would show low concentrations of SO_2 and asbestos but that a citation would probably be issued because no monitoring had been done to initially determine employees' asbestos exposures. Mr. Berestecky commented on the poor housekeeping in the area of the Sealas furnaces in No. 2 Forge Shop and recommended that wet sweeping be substituted for dry sweeping. He also indicated that a citation would probably be issued for failure to comply with the medical examination requirements of the asbestos standard.

J. F. Quealy

JFQ/mdd

- inform employees of the purpose, proper use, fitting instructions and limitations of respirators;

- review the provisions of the Asbestos Standard 1910.1001.

- Warning Signs

  Legible signs warning of the health hazards of asbestos shall be provided and displayed at each location where airborne concentrations of asbestos fibers may exceed 0.5 fibers/cc.

- Application

  Applies to all workplaces where employees may be exposed to asbestos in all industries covered by the current Asbestos Standard; i.e., General Industry, Construction and Maritime.

Details of compliance with this Standard are covered in Industrial Hygiene Services Guideline Number 12 (Revised December, 1983) entitled, "Guidelines for the Protection of Employees Against the Hazards of Asbestos Dust Exposure."

js
November 21, 1983

OSHA EMERGENCY TEMPORARY STANDARD FOR ASBESTOS

Summary of Requirements

Effective Date: November 4, 1983

Requirements:

- Permissible Exposure Level

  Employees may not be exposed to concentrations of asbestos exceeding 0.5 fibers/cc on an 8-hour time-weighted average basis.

- Methods of Control

  Employers may choose among engineering controls, work practices and respirators to reduce exposures to the new PEL. However, the requirements in 1910.1001(c) to utilize feasible engineering controls and work practices to reduce exposure levels to 2.0 fibers/cc remain in effect.

- Training

  A training program must be initiated no later than December 4, 1983 for those employees potentially exposed to asbestos above the PEL, without regard to the use of respirators. This program must:

  - inform the employee of health effects of asbestos exposure;
  - inform the employee of the relationship between asbestos and smoking in producing lung cancer;
  - identify those operations which may expose employees to asbestos and the steps being taken by the company to minimize exposure (engineering controls, work practices, respirators, housekeeping and protective clothing);
  - inform employees of the necessary protective steps that they should take to minimize exposure;

Homestead — SO_2

USS ENVIRONMENTAL HEALTH
SAMPLES FOR ANALYSIS

Date Submitted 1-9-73

Facility [illegible]

Location: [illegible]

Dept. [illegible] OSHA Insp. ____ Complaint [illegible]

[illegible]

By [illegible] Ext. 2100

Date Reported ____ Lab. # 76-3

By ____

SAMPLE DATA									ANALYTICAL RESULTS		
NO.	[illegible]	[illegible]	DATE	TIME MIN.	RATE LPM	FINAL WEIGHT	INITIAL WEIGHT	ANALYSIS DESIRED	SO_2 (mg)	mg/L	ppm
1	[illegible]	[illegible]	1-9-73	42	2	92		SO_2 Conc	0.10	0.0011	0.42
				47	2	94		SO_2 Conc	0.20	0.0021	0.80
				41	2	82		SO_2 Conc	0.10	0.0012	0.46
				53	2	106		SO_2 Conc	0.10	0.0009	0.35
				24	2	48		SO_2 Conc	0.16	0.0033	1.26
				39	2	78		SO_2 Conc	0.10	0.0013	0.50
				45	2	90		SO_2 Conc	0.10	0.0011	0.42
				48	2	96		SO_2 Conc	0.10	0.0010	0.40

[illegible] Collection [illegible] impinger by [illegible] titration with [illegible]

Note: 1 mg/l = 382 ppm

TWA = 0.53 ppm

Figure 14-4

Distribution: 1. P/F
2. Research
3. Environmental [illegible]

USX0000175

CERTIFICATE OF SERVICE

I hereby certify that the original of the foregoing Documents Produced By USX Corporation Made Exhibits To Depositions Given By USX Corporation (Also Some Documents Identified At USX Depositions Not Produced By USX Corporation*) was filed with the Prothonotary on May 15, 1997, and copies were served, by first class mail, postage prepaid, on May 15, 1997, as follows:

David A. Luptak, Esquire
USX Corporation
Rm 1515, 600 Grant Street
Pittsburgh, PA 15219-4778
(Counsel for USX Corporation)

Nicholas P. Vari, Esquire
Kirkpatrick & Lockhart
1500 Oliver Building
Pittsburgh, PA 15222-2312
(Counsel for Harbison Walker
Refractories Division of Dresser Industries, Inc.
and Indresco, Inc. and as lead counsel for all supplier
defendants)

I further certify that a copy of this Certificate Of Service was served upon the counsel for the remaining defendants by first class mail on May 15, 1997, with advice that counsel may obtain a copy of the attached booklet by requesting it from plaintiff's counsel.

STEPHEN I. RICHMAN