ASBESTOS CONTROL - AN INDUSTRIAL EXPERIENCE

Joseph D. Wendlick

Weyerhaeuser Company
Longview, Washington

ABSTRACT

Reductions in airborne asbestos fiber concentrations by factors of 20-100 were accomplished by instituting an asbestos control program in a plant manufacturing an asbestos-containing calcium silicate. Ventilation techniques, changes in handling methods and improvements in work practices will be discussed as they relate to these reductions. Support programs including protective respiratory equipment, protective clothing, laundering, change rooms, separate lockers, area posting, employee education and orientation and medical surveillance will also be discussed.

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In the past 10-15 years, there has been an ever-increasing demand for fire-rated products for wall construction, ceilings, flooring and floor coverings, interior finish (paneling) and doors. One of the more difficult of the fire ratings to achieve, at least for wood products, was that for fire doors, since traditionally all-wood stave (laminated 1" wood blocks) core or particle core doors showed only a 20-40 minute resistance to burn-through (as tested in accordance with ASTM E-152. Metal doors enjoyed an exclusive set of fire ratings from 3 to 8 hours, their only drawback being the high radiant heats emitted from the unexposed face during a fire. There was an obvious need for fire doors with 3/4 hour (C-label), 1 and 1-1/2 hour (B-label) ratings to 1) prevent the spread of fire better than all-wood doors and 2) supply fire-rated doors for structures not required by fire codes to have 3 hours or greater rated metal doors. Because high radiant heats from metal doors have hindered escape from burning buildings in certain instances, a need also existed for a door construction with an intrinsically low thermal conductivity to permit emergency egress past the door in case of fire.

Born of this need was an all mineral core, wood-faced and wood-railed door which possessed not only the esthetics of wood but the capability of withstanding the thermal stress and shock of the ASTM E-152 fire and hose stream test. Oxychloride and oxysulfate cements, gypsum board, asbestos-cement board, and magnesia-type block insulation were all tried unsuccessfully before arriving at the mineral core suitable for this purpose: an asbestos reinforced calcium silicate.

Development of a successful door construction was measured carefully by the door's ability to be fabricated, pass critical performance tests such as high-temperature-low temperature cycling without delaminating or warping appreciably and slam testing; but above all, pass the ASTM E-152 fire and hose stream test at Underwriters' Laboratories in Chicago for a 3/4, 1 or 1-1/2 hour rating. Initially and for several years following the successful development and testing of this construction, all of the mineral core block used in this operation was purchased from outside suppliers. However, soon after architects began to indicate a need for 4'x8' to 4'x10' doors with both C-labels and B-labels and tests at Underwriters' Laboratories on fire doors fabricated with purchased mineral core failed with these larger dimensions, the decision was made to initiate intra-company research into developing an asbestos-reinforced calcium silicate which would meet these more stringent criteria. This intensive research culminated penultimately after 15 months with the successful fabrication and subsequent testing of 4'x8' and 4'x10' doors at the Company's fire test facilities in Longview, Washington. Successful testing of similar doors at Underwriters' Laboratories approximately 6 months later represented attainment of the final step in development of this product for market.

Albeit success in product development was achieved considerably beyond expectations, a major new area of challenge emerged which demanded immediate attention. Approximately 100 employees at this location involved in either 1) the production of asbestos-reinforced calcium silicate and 2) the fabrication of mineral core fire doors from this calcium silicate material are occupationally exposed to airborne asbestos fibers throughout their 8-hour work shifts. The distinction between employees involved in the production of the calcium silicate and the fabrication of fire doors from this material was made because these two operations are physically separated by several hundred yards on the complex and were, at the time the asbestos control program was instituted, characterized by two markedly different (and efficient) ventilation systems. For the calcium silicate core production plant, employees (numbers in parentheses) are exposed to asbestos fibers at the following locations:

a. Weighing room and mixers. (1)
b. "Wet" end handling operations. (5)
c. "Dry" end unloading stations. (2)
d. Trim saws (Trims along length of cores).
e. Timesaver sander.
f. Sorting and grading area.(2).
g. Salvage saws.
h. Lift truck driver.(1).
i. Factotum. (1)
j. Quality control. (1)
k. Foremen. (1)
l. Lead man. (1)
m. Maintenance. (1)

Since three crews per day are now engaged in the production of asbestos-reinforced calcium silicate block, the total number of employees involved in this part of the operation should total 48. However, because only the day crew is as large as indicated above,the actual number is closer to 44. The process involves weighing and mixing ingredients (including both chrysotile and amosite asbestos), indurating the slurry to effect formation of the calcium silicate product, drying the indurated blocks to achieve a light-weight substance of density similar to pumice, edge trimming of the core blocks out of the dryer, sanding top and bottom surfaces of the dry cores, sorting and grading out the good cores from those which are fractured, broken or crushed, and reclaiming portions of reject core blocks through the use of the salvage saws.

Fabrication of fire doors from the calcium silicate cores in the other half of the process exposes the following work stations (numbers of employees affected in parentheses) to airborne asbestos fibers:

a. Double-end tenoners. (4)
b. Electronics. (5)
c. Abrasive planer. (2) (Timesaver sander)
d. Sizing station and drying tunnel. (1)
e. Inspection. (12)
f. Foremen. (3)
g. Routing out of lite openings. (2)
h. Mortising stations. (2)
i. Quality control. (1)

Although the night crew in the fabrication plant makes railed mineral core, generally no sanding of railed calcium silicate block is performed on the abrasive planer. Detailing, such as routing and mortising of mineral core doors, is only done on the day shift. Therefore, the approximate number of employees exposed in this plant totals 54. Other employees intermittently exposed are mainly maintenance personnel. A walk-through of the fabrication operation reveals the first operation to process calcium silicate cores from the production plant to be the double-end tenoners, where the tongue and groove configuration is cut along the length and width of the core blocks to match up with wood rails and stiles. From there the core blocks and wood rails and stiles are placed on roller conveyors and directed to set-up position on the "electronics." The core blocks are then railed, cured in an "electronic" press with RF and taken to the feeder position on the abrasive planer (Timesaver sander). Once sanded top and bottom, each railed calcium silicate core is sized with a dilute phenolic adhesive and passed through a drying tunnel. A rigorous inspection of each railed mineral core block follows the drying tunnel in preparation for application of crossbands and face veneers. Detailing of the completed doors such as routing out lite openings and mortising out lock set openings represents the last significant asbestos exposures within the plant.

Fiber concentrations from the initial airborne asbestos samplings of June 1972-February 1973 to determine the relative levels associated with each major work station and machine center in both the production and fabrication plants are given in the table below:

TABLE I

TYPICAL ASBESTOS FIBER CONCENTRATIONS IN PRODUCTION (P) AND FABRICATION (F) PLANTS

Work Station	Fiber concentration, fibers/cc greater than 5μ in length
Weighing room* (P)	6.6 - 34.0
"Wet" end dryer loader (P)	1.5
Dryer unloader (P)	5.2 - 9.0
Trim saw operator (P)	3.2 - 6.6
Sorting and grading (P)	3.9 - 17.1
Salvage saws (P)	4.1 - 14.9
Factotum (P)	3.7
Quality Control (P)	2.2
Double-end tenoner feeder (F)	2.5 -(82.0)*
Double-end tenoner offbearer (F)	2.6 - 25.5
Electronic set-up (F)	6.2
Abrasive planer feeder (F)	6.3 - 19.4
Abrasive planer offbearer (F)	4.6 - 29.2
Inspection (includes dry hand sanding)(F)	4.7 - 24.3
Routing* (F)	3.9 - 24.8
Mortising (F)	7.7
Clean-up* (compressed air blowing off of equipment) (F)	37.8

* Peak exposures only.

Asbestos samples were collected in conformance with OSHA and NIOSH guidelines using a Mine Safety Appliances Model G Personnel Gravimetric Sampling pump in conjunction with open-face casettes containing Millipore type AA filters. Each sample was collected at 2.0 liters/minute, a flow rate established with a wet test meter. To avoid contributions from contaminated uniforms, a copper wire/baby food can casette holder was used to position the casette in the breathing zones of employees participating in this survey. Collection times varied from 1 minute to 22 minutes, depending upon how rapidly visible dust became in evidence on the filter face. From previous experience in sampling asbestos-containing calcium silicate dusts, any more build-up than barely visible on the filter face made subsequent microscopic counting very difficult. Asbestos counts were made using Leitz microscope with phase contrast illumination at 400-450X magnification in the Company's Longview analytical laboratory.

Once the magnitude of the exposures had been ascertained, the next step was to implement a multi-faceted control program, comprising: 1) the immediate initiation of a respirator program 2) initiation of a protective uniform program, together with change rooms, separate lockers, shower facilities, lunch room separate from contaminated areas, and launderomg facilities, 3) improvement or modification of existing ventilation systems including new pickup heads at the point of asbestos fiber generation, new ducting, new fans and a new baghouse, 4) instituting a complete medical program to include pre-employment physicals, annual physicals thereafter, pulmonary function testing and chest X-rays, 5) an employee educational program to explain the hazard, the need for protective equipment and the need for changes in some operating procedures and methods of handling and 6) engineering controls other than ventilation methods. Mr. C. A. Mangold, et. al.'s report on "Asbestos Exposure and Control at Puget Sound Naval Shipyard" (March, 1970) provided the guidelines for the control program described in this report.

Respirator Program

A respirator program was the first control applied to these operations in view of the hazard from asbestos fiber inhalations. For both the production and the fabrication plants, the 3M-8710 disposal dust mask was used, mainly because of its light weight, wearing comfort and low breathing resistance. An overlap with the educational program was necessary to convince employees of the need for wearing these masks and to demonstrate the proper way to wear them. Other discussions were held with employees to teach them to close the lids on boxes of protective masks to avoid contamination and not to hang these masks around their necks or on a nail at the end of their work shift such that airborne dust collects inside the mask, to be inhaled on re-application of the mask. For certain individuals whose noses became abraded from improper wearing of the 3M masks, a rubber-sealed MSA Dustfoe 66 respirator was temporarily substituted.

Protective Clothing

Since many areas within both the production and fabrication plants involved direct handling of the calcium silicate core and were, at the time of the initial testing, in excess of the OSHA asbestos standard ceiling limits, protective clothing was issued to the employees. Separate lockers for street clothes and contaminated clothing were made available to all employees, as well as shower facilities at the end of the work shift. Contaminated uniforms are laundered every 3-4 days, or more frequently, if necessary, in washers and dryers situated within the plants. A lunchroom is available separate from the contaminated areas.

Ventilation Systems

While the production plant had been built with a good ventilation system included, the fabrication plant had a system which was constantly overloaded and grossly inadequate for handling mineral core dusts efficiently. The system that was being used in the fabrication plant had originally been designed to handle wood dusts from a few machine centers. As the need to ventilate additional equipment developed, more and more tie-ins to the old ventilation system were made until it became overloaded. A new system of ducting, fans and a larger baghouse with more capacity changed the airborne asbestos concentration in this area considerably. This system was also extended into the detailing department to capture the dusts generated during routing out of lite openings and mortising out lockset openings. Many of the pickup heads on machines were modified to present a high velocity, low volume situation to the point of asbestos fiber generation. A new vacuum system was installed throughout the production plant. Shortly after it became functional, all brooms and compressed air hoses were ceremoniously retired. A portable vacuum is available in the fabrication plant, since the presence of fugitive asbestos fibers is not nearly as ubiquitous. A short canvas skirt was installed on the asbestos weighing hopper in the production plant to increase the capture velocity of the negative air system.

Medical Program

A complete medical program has now been in effect for about 1-1/2 years. This program includes: a) pre-employment testing of individuals who may be hired for either the production or fabrication plants to establish a reference X-ray, reference pulmonary function (FEV_1 and FVC) tests and medical information on pre-existing conditions (viz. - cardio-vascular, respiratory, gastro-intestinal,etc.)

which may disqualify that individual from work with asbestos-reinforced calcium silicate, and b) annual testing to provide a check on changes which might occur as a result of an employee's exposure to asbestos. A doctor from a local clinic has directed this portion of the program, and additionally, has provided the essential interpretations of the X-rays and pulmonary function testing.

Educational Program

Demonstrably one of the most important aspects of an asbestos control program, the educational programs presented to the employees resulted in some remarkedly reductions in air-borne asbestos levels throughout the operations. Key points discussed at these sessions included: a) a review of the health hazards of asbestos inhalations, b) the OSHA standards, both now and after July 1, 1976, c) the need to wear protective dust masks and uniforms, d) the relationship of the medical program, e) the ventilation system modifications and other engineering controls being put into effect by the Company and finally, f) how they can help as individual employees in this effort by more careful handling of the cores, better operating procedures, etc. In this latter category, such hazardous dust-producing practices as sweeping, compressed air blowing, throwing of broken core blocks into trash carts or bins, rough handling when stacking or unstacking loads, unventilated skil sawing, hand sawing or drilling of mineral core blocks, failure to report system plug-ups or missing bolts in fan housings and dropping core blocks onto electronic set-up tables were either minimized or eliminated. All scrap clean-up with squeegees in the production plant must now be done wet to reduce the airborne asbestos fiber contribution from this source.

Other Engineering Controls

For certain areas such as the sorting and grading area and salvage saw area in the production plant and the double-end tenoners, electronics and inspection in the fabrication plant which defied most of the control methods attempted, a simple but novel approach was devised by plant personnel. Since glue sizing of the core blocks is necessary to effect an acceptable core to crossband bond in the finished product, several employees decided to try sizing each core which passes out of the Timesaver sander in the production plant and the abrasive planer in the fabrication plant. The net result was to bring several areas, heretofore thought to be next to impossible to control by "feasible" engineering means, into compliance with the 1976 OSHA asbestos standard.

Table II describes airborne asbestos concentrations at key work stations throughout the operation both from May-June, 1973 and, for reference, those values reported in

Table I earlier. It is difficult to single out any one control which was the most salient in effecting the reductions reported below since all controls have had a contributory effect on reducing the airborne asbestos dust levels.

TABLE II

TYPICAL BEFORE AND AFTER ASBESTOS FIBER CONCENTRATIONS IN PRODUCTION (P) AND FABRICATION (F) PLANTS

Work Station	Fiber concentration, fibers/cc June, 1972-Feb., 1973	May-June, 1973
Weighing room* (P)	6.6 - 34.0	3.0 - 7.3
"Wet" end dryer loader (P)	1.5	1.2
Dryer unloader (P)	5.2 - 9.0	3.6 - 5.9
Trim saw operator (P)	3.2 - 6.6	0.50- 2.0
Sorting and grading (P)	3.9 - 17.1	3.2 - 9.6
Salvage saws (P)	4.1 - 14.9	0.50 - 0.90
Factotum (P)	3.7	1.5
Quality control (P)	2.2	1.3
Double-end tenoner feeder (F)	2.5 -(82.0)*	1.7 - 3.3
Double-end tenoner offbearer (F)	2.6 - 25.5	0.11--1.1
Electronic set-up (F)	6.2	0.17 – 0.60
Electronic offbearer (F)	8.4	0.08 – 0.17
Abrasive planer feeder (F)	6.3 - 19.4	5.4 – 7.6
Abrasive planer offbearer (F)	4.6 - 29.2	0.30 – 1.1
Inspection	4.7 - 24.3	0.21 – 1.9 (one peak at 4.6)
Routing* (F)	3.9 - 24.8	6.5
Mortising (F)	7.7	-
Clean-up*	37.8	1.50

* Peak exposures only.

Approximate Costs for Controls

Control of asbestos in the production and fabrication plants has been expensive, as shown by the cost breakdown appearing below:

Equipment or Operation	Approximate Cost
Production plant; including exhaust and collection system (rated CFM = 50,000)	$125,000
Glue Spreader - Production Plant	10,000
Fabrication plant; new ductwork, baghouse (rated CFM = 30,000)	90,000
Glue Spreader - Fabrication plant	10,000
New back sander - Fabrication plant	20,000
Total Estimated Capital Costs (to date)	$255,000
Total estimated Maintenance Cost/year	$ 60,000
(Includes $8,000 annually for baghouse maintenance)	

* * * * *

As evidenced by the data in Table II, the controls - although costly - have brought both plants nearby into compliance with the OSHA 1976 asbestos standard of 2 fibers/cc greater than 5 microns in length for an 8-hour time-weighted average. With the additional controls due for implementation by February 1974, total compliance with the 1976 standard is very probable.

References:

1. Criteria for a recommended standard - "Occupational Exposure to Asbestos" - U.S. Dept. of Health, Education and Welfare. National Institute for Occupational Safety and Health Criteria Document.

2. Federal Register Volume 37, No. 110 (June 7, 1972), Part 1900 - Occupational Safety and Health Standards, "Standard for Exposure to Asbestos Dust."

3. General Electric "Environmental Health Management Manual" Section 9 on Dust and Dust Diseases, Subsection 9.1 Asbestos, pp. 7-9.

4. "Industrial Ventilation," a manual by the Committee on Industrial Ventilation - American Conference for Governmental Industrial Hygienists.

5. Mangold, C.A., Beckett, R.R. and Bessmer, D.J. "Asbestos Exposure and Control at Puget Sound Naval Shipyard," Puget Sound Naval Shipyard at Bremerton, Washington (Marsh, 1970).

REPORT OF CALL

CC for
Leon Persson-H&c
W. C. Thurber
J. E. Walsh
NF Files
KC Files ✓

UNION CARBIDE CORPORATION

P.O. Box 579 Niagara Falls, N.Y. 14302

R. E. Byrne
By L. Persson, T. P. Morris

Date 1-14-74

Full Name	WEYERHAEUSER CO.	Interviewed
Address	3400 13th. Ave. S. W. Seattle, Wash 98134 also Longview, Wash 98632	Dr. R. E. Kreibich, Mgr. M. Frank Gillern, Polymer Research Joseph D. Wendlick, Corp. Ind. Hyg.
Mfrs. of		

OBJECTIVE

Attempt to overcome this company's reluctance to continue evaluation of RG 244.

DISCUSSION

Dr. Kreibich had done promising R&D evaluations with RG-244 in a phenolic adhesive that had great market potential in laminating plywood veneers, and laying up trusses for the construction industry. Weyerhaeuser plants in Longview, Wa., Cottage Grove, Ore., and Albert Lea, Minn., were known to be potential users.

The OSHA regulations alarmed the various plant managers which inturn caused Dr. Kreibich to discontinue his work and the entire project ground to a halt. After visiting with Dr.Kreibich & Frank Gillern who both gave glowing reports on the use of RG-244 in the above applications plus other unnamed product areas, we left them with the promise we would track down the problem in the Longview plant and try to resolve it.

Joe Wendlick was most cordial and confused as to why no one had bothered to ask his opinion on this matter. He went on to say that there was not an asbestos ban at Weyerhaeuser, and that he advised whoever in the organization ask, that asbestos can be used and used safely but you must be sure to follow the OSHA regulations. The Longview plant currently uses a combination Chrysotile & Amosite in an asbestos-reinforced calcium silicate block fire door. At first the plant had a serious asbestos problem as many production areas exceeded the ceiling limit, but with controls and the necessary equipment installed these were bought into line. A copy of his paper Asbestos Control-An Industrial Experience is enclosed.

REPORT OF CALL

CC for

UNION CARBIDE CORPORATION

P.O. Box 579 Niagara Falls, N.Y. 14302

By ______________________

PAGE 2

Date ______________________

Full Name WEYERHAEUSER CO. Address Mfrs. of	Interviewed

The results of the meeting were that Wendlick called Kreibich, the same day, advised him of the present status, and Kreibich ordered a 10# bag to continue evaluations. Kreibich actually seemed grateful we took the time to correct this problem as he earlier in the day informed us that 244 was the only product that would give the desired results in his applications.

LOAN THIS ONE.

ASBESTOS CONTROL - AN INDUSTRIAL EXPERIENCE

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ABSTRACT

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c. "Dry" end unloading stations. (2)

d. Trim saws (Trims along length of cores).

e. Timesaver sander.

f. Sorting and grading area.(2).

g. Salvage saws.

h. Lift truck driver.(1).

i. Factotum. (1)

j. Quality control. (1)

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Once the magnitude of the exposures had been ascertained, the next step was to implement a multi-faceted control program, comprising: 1) the immediate initiation of a respirator program 2) initiation of a protective uniform program, together with change rooms, separate lockers, shower facilities, lunch room separate from contaminated areas, and launderomg facilities, 3) improvement or modification of existing ventilation systems including new pickup heads at the point of asbestos fiber generation, new ducting, new fans and a new baghouse, 4) instituting a complete medical program to include pre-employment physicals, annual physicals thereafter, pulmonary function testing and chest X-rays, 5) an employee educational program to explain the hazard, the need for protective equipment and the need for changes in some operating procedures and methods of handling and 6) engineering controls other than ventilation methods. Mr. C. A. Mangold, et.al.'s report on "Asbestos Exposure and Control at Puget Sound Naval Shipyard" (March, 1970) provided the guidelines for the control program described in this report.

Respirator Program

A respirator program was the first control applied to these operations in view of the hazard from asbestos fiber inhalations. For both the production and the fabrication plants, the 3M-8710 disposal dust mask was used,mainly because of its light weight, wearing comfort and low breathing resistance. An overlap with the educational program was necessary to convince employees of the need for wearing these masks and to demonstrate the proper way to wear them. Other discussions were held with employees to teach them to close the lids on boxes of protective masks to avoid contamination and not to hang these masks around their necks or on a nail at the end of their work shift such that airborne dust collects inside the mask, to be inhaled on re-application of the mask. For certain individuals whose noses became abraded from improper wearing of the 3M masks, a rubber-sealed MSA Dustfoe 66 respirator was temporarily substituted.

Protective Clothing

Since many areas within both the production and fabrication plants involved direct handling of the calcium silicate core and were, at the time of the initial testing, in excess of the OSHA asbestos standard ceiling limits, protective clothing was issued to the employees. Separate lockers for street clothes and contaminated clothing were made available to all employees, as well as shower facilities at the end of the work shift. Contaminated uniforms are laundered every 3-4 days, or more frequently, if necessary, in washers and dryers situated within the plants. A lunchroom is available separate from the contaminated areas.

Ventilation Systems

While the production plant had been built with a good ventilation system included, the fabrication plant had a system which was constantly overloaded and grossly inadequate for handling mineral core dusts efficiently. The system that was being used in the fabrication plant had originally been designed to handle wood dusts from a few machine centers. As the need to ventilate additional equipment developed, more and more tie-ins to the old ventilation system were made until it became overloaded. A new system of ducting, fans and a larger baghouse with more capacity changed the airborne asbestos concentration in this area considerably. This system was also extended into the detailing department to capture the dusts generated during routing out of lite openings and mortising out lockset openings. Many of the pickup heads on machines were modified to present a high velocity, low volume situation to the point of asbestos fiber generation. A new vacuum system was installed throughout the production plant. Shortly after it became functional, all brooms and compressed air hoses were ceremoniously retired. A portable vacuum is available in the fabrication plant, since the presence of fugitive asbestos fibers is not nearly as ubiquitous. A short canvas skirt was installed on the asbestos weighing hopper in the production plant to increase the capture velocity of the negative air system.

Medical Program

A complete medical program has now been in effect for about 1-1/2 years. This program includes: a) pre-employment testing of individuals who may be hired for either the production or fabrication plants to establish a reference X-ray, reference pulmonary function (FEV_1 and FVC) tests and medical information on pre-existing conditions (viz. - cardio-vascular, respiratory, gastro-intestinal, etc.)

which may disqualify that individual from work with asbestos-reinforced calcium silicate, and b) annual testing to provide a check on changes which might occur as a result of an employee's exposure to asbestos. A doctor from a local clinic has directed this portion of the program, and additionally, has provided the essential interpretations of the X-rays and pulmonary function testing.

Educational Program

Demonstrably one of the most important aspects of an asbestos control program, the educational programs presented to the employees resulted in some remarkedly reductions in airborne asbestos levels throughout the operations. Key points discussed at these sessions included: a) a review of the health hazards of asbestos inhalations, b) the OSHA standards, both now and after July 1, 1976, c) the need to wear protective dust masks and uniforms, d) the relationship of the medical program, e) the ventilation system modifications and other engineering controls being put into effect by the Company and finally, f) how they can help as individual employees in this effort by more careful handling of the cores, better operating procedures, etc. In this latter category, such hazardous dust-producing practices as sweeping, compressed air blowing, throwing of broken core blocks into trash carts or bins, rough handling when stacking or unstacking loads, unventilated skil sawing, hand sawing or drilling of mineral core blocks, failure to report system plug-ups or missing bolts in fan housings and dropping core blocks onto electronic set-up tables were either minimized or eliminated. All scrap clean-up with squeegees in the production plant must now be done wet to reduce the airborne asbestos fiber contribution from this source.

Other Engineering Controls

For certain areas such as the sorting and grading area and salvage saw area in the production plant and the double-end tenoners, electronics and inspection in the fabrication plant which defied most of the control methods attempted, a simple but novel approach was devised by plant personnel. Since glue sizing of the core blocks is necessary to effect an acceptable core to crossband bond in the finished product, several employees decided to try sizing each core which passes out of the Timesaver sander in the production plant and the abrasive planer in the fabrication plant. The net result was to bring several areas, heretofore thought to be next to impossible to control by "feasible" engineering means, into compliance with the 1976 OSHA asbestos standard.

Table II describes airborne asbestos concentrations at key work stations throughout the operation both from May-June, 1973 and, for reference, those values reported in

Table I earlier. It is difficult to single out any one control which was the most salient in effecting the reductions reported below since all controls have had a contributory effect on reducing the airborne asbestos dust levels.

TABLE II

TYPICAL BEFORE AND AFTER ASBESTOS FIBER CONCENTRATIONS IN PRODUCTION (P) AND FABRICATION (F) PLANTS

Work Station	Fiber concentration, fibers/cc June, 1972-Feb., 1973	May-June, 1973
Weighing room* (P)	6.6 - 34.0	3.0 - 7.3
"Wet" end dryer loader (P)	1.5	1.2
Dryer unloader (P)	5.2 - 9.0	3.6 - 5.9
Trim saw operator (P)	3.2 - 6.6	0.50- 2.0
Sorting and grading (P)	3.9 - 17.1	3.2 - 9.6
Salvage saws (P)	4.1 - 14.9	0.50 - 0.90
Factotum (P)	3.7	1.5
Quality control (P)	2.2	1.3
Double-end tenoner feeder (F)	2.5 -(82.0)*	1.7 - 3.3
Double-end tenoner offbearer (F)	2.6 - 25.5	0.11--1.1
Electronic set-up (F)	6.2	0.17 – 0.60
Electronic offbearer (F)	8.4	0.08 – 0.17
Abrasive planer feeder (F)	6.3 - 19.4	5.4 – 7.6
Abrasive planer offbearer (F)	4.6 - 29.2	0.30 – 1.1
Inspection	4.7 - 24.3	0.21 – 1.9 (one peak at 4.6)
Routing* (F)	3.9 - 24.8	6.5
Mortising (F)	7.7	-
Clean-up*	37.8	1.50

* Peak exposures only.

Approximate Costs for Controls

Control of asbestos in the production and fabrication plants has been expensive, as shown by the cost breakdown appearing below:

Equipment or Operation	Approximate Cost
Production plant; including exhaust and collection system (rated CFM = 50,000)	$125,000
Glue Spreader - Production Plant	10,000
Fabrication plant; new ductwork, baghouse (rated CFM = 30,000)	90,000
Glue Spreader - Fabrication plant	10,000
New back sander - Fabrication plant	20,000
Total Estimated Capital Costs (to date)	$255,000
Total estimated Maintenance Cost/year (Includes $8,000 annually for baghouse maintenance)	$ 60,000

* * * * *

As evidenced by the data in Table II, the controls - although costly - have brought both plants nearby into compliance with the OSHA 1976 asbestos standard of 2 fibers/cc greater than 5 microns in length for an 8-hour time-weighted average. With the additional controls due for implementation by February 1974, total compliance with the 1976 standard is very probable.

References:

1. Criteria for a recommended standard - "Occupational Exposure to Asbestos" - U.S. Dept. of Health, Education and Welfare. National Institute for Occupational Safety and Health Criteria Document.

2. Federal Register Volume 37, No. 110 (June 7, 1972), Part 1900 - Occupational Safety and Health Standards, "Standard for Exposure to Asbestos Dust."

3. General Electric "Environmental Health Management Manual" Section 9 on Dust and Dust Diseases, Subsection 9.1 Asbestos, pp. 7-9.

4. "Industrial Ventilation," a manual by the Committee on Industrial Ventilation - American Conference for Governmental Industrial Hygienists.

5. Mangold, C.A., Beckett, R.R. and Bessmer, D.J. "Asbestos Exposure and Control at Puget Sound Naval Shipyard," Puget Sound Naval Shipyard at Bremerton, Washington (Marsh, 1970).