<comment> 84-0262-1734, Friction Division Products, Trenton, NJ </comment>

HETA 84--262-1734
September 1986
FRICTION DIVISION PRODUCTS
TRENTON, NEW JERSEY

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SUMMARY

4fOn March 28, 1984, the National Institute of occupational Safety and Health (NIOSH) received a request from the International Chemical Workers Union, representing employees at Friction Division Products. The request was assigned to the New Jersey Department of Health for investigation. After delays caused by plant access problems and a strike, the study was conducted in February and March 1986. The request stated concern about asbestos exposure in the plant and the potential for contamination of the home environment. The plant employs about 120 production workers in the manufacture of auto and truck brake shoes. About 90% of the shoes produced include asbestos as a major raw material.

Chest X-rays of employees working for more than 10 years were reviewed by a NIOSH certified B-reader. Personal air sampling for asbestos was conducted in the plant on three days. Bulk samples were obtained from the clothing of workers leaving the plant to assess potential home contamination. Analysis was done by phase contrast microscopy)PCM) and on a few samples, transmission electron microscopy (TEM).

Seven of twenty individuals with greater than 10 years at the plant had X-ray findings consistent with asbestos exposure. Two had asbestosis, two had pleural thickening and one had a pleural plaque. Two had lung cancer.

Personal air sample results indicated asbestos TWA exposures in the range of 0.06 to 1.56 f/cc (fibers per cubic centimeter) and indicating significant contamination throughout the plant and on all operations. On the basis of sampling and analysis results it is suggested that the results are underestimates of the actual exposures present. The'levels documented are above the OSHA Permissible Exposure Limit (PEL) of 0.2 f/ce, and the exposure limit recommended by NIOSH of 0.1 f/cc.

Samples obtained from work clothing as workers left the plant indicated the presence of asbestos.

Results of the air sampling and X-ray review indicate a significant risk of asbestos disease in the plant and a potential risk to families of employees. Review of the employer's occupational health program shows it to be out of compliance with most provisions of the new OSHA Asbestos Standard. Recommendations are given to improve plant conditions, lower the asbestos level, prevent home contamination, and improve the medical monitoring system.

on the basis of air sampling and X-ray review, it is concluded that a substantial health hazard exists for workers and potentially for their families from asbestos exposure at Friction Division. Increased attention to dust control at the plant is required to prevent the occurrence of additional asbestos related disease.

KEYWORDS: SIC 3292, friction products, asbestos, transmission electron

microscopy, NIOSH Method 7400

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INTRODUCTION

On March 28, 1984 the International Chemical Workers Union submitted a request to NIOSH for a Health Hazard Evaluation on behalf of their members working at the Friction Division plant in Trenton, NJ. The Evaluation was assigned to the New Jersey Department of Health for investigation on June 20, 1984 under a cooperative agreement between the two agencies. The request cited concern about the nature and extent of asbestos exposure, the adequacy of current protective measures, and especially the potential health risk to family members from asbestos being carried home on work clothes.

On October 16, 1984 the State Health Department informed Friction Division of our intent to conduct a Health Hazard Evaluation. Meetings were held in the subsequent weeks and a walkthrough was conducted in January 1985. A series of written and oral communications followed during which permission to commence the study was requested. Since the requests 508fwere not answered, a warrant for access to the plant for the study was obtained and served on April 31, 1985. On that day, the local union at the plant went on strike. Since the plant was operating under abnormal conditions, the study was postponed, and the warrant was returned to the court on May 21, 1985.

In January 1986 the New Jersey Department of Health was notified by .Local 155 that the plant's operations had returned to near normal. On February 27 the plant was approached unannounced to complete the investigation. After some delay, we were admitted to conduct sampling on the second shift. Additional air sampling, bulk sampling and review of engineering controls and work practices were conducted on March 10 and March 21.

BACKGROUND

Friction Division began producing brakeshoes in 1969 under the management of Morton Thiokol. Before that time, no asbestos had been used in the plant. In 1973, all other operations were discontinued and many of the employees were laid off with the high seniority workers being retained. In 1983, the plant was bought by the current owners and has continued to produce friction products since that time.

Approximately 120 production workers currently work in the plant. Until the strike in 1985, all production employees were members of ICWU Local 155. During the strike, many non-union employees were hired. Union members have been slowly called back to work so that during our inspection approximately half the workforce were experienced union members and half had been working for only a short period.

Both drum-type and disc-type brake shoes are produced in separate manufacturing lines. Drum brake production begins in drum mixing where the raw materials are charged to a mixer. Depending on the particular mix being made, dry materials including carbon black, cement, hexamethyltetramine, zinc, barytes (barium sulfate), asbestos or polyamide fibers, phenolic resins and recycled grinding dust are added by pneumatic conveyor (vacuum tubes) directly to the mixer. Cashew shell resin is

pumped in from drums. About forty percent of the mix is asbestos which is added through a debagger fitted with a conveyor at each end. After all

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raw materials are added, the mixer is activated. The premix is then unloaded from the bottom of the mixer into bins.

Bins of premix are then transferred by fork truck to the adjacent roll forming machine. A continuous strip of preformed material is cut into lengths and stacked by hand into trucks. The preformed strips are then moved to the tables where they are hand loaded into steel trays and oven baked for several hours. After baking, the trays are unloaded and the shoes are ground on cam grinders and drilled to specifications.

Disc-type shoes are similarly formed. The disc preform area of the plant include two mixers and eight preform machines. The dry ingredients are loaded by vacuum into one of the mixers. The asbestos is again charged by a debagging machine. After mixing, the material is dropped from the mixer into a screw conveyor which conveys the premix overhead to hoppers which feed the preform machines-.- The preform machines press the premix into biscuits which are then hand loaded onto trucks for additional processing.

The biscuits are taken to the press area and pressed into their final form under heat (supplied by steam) and hydraulic pressure. The biscuits are then loaded into trays and oven baked for several hours to cure the resin system. When the trays are unloaded, the shoes are first brought to the tumbler to remove flash from the edge, a-ad then sent for grinding and drilling to final specifications. The final product is then branded (marked with ink) and packed.

The plant has gradually been increasing its production of semimetallic (non-asbestos) disc brake shoes which are made in the same production area as the disc brakes. Although different ingredients are used, the process is very similar. A polyamide fiber is used as an asbestos substitute.

The company had conducted regular air monitoring for asbestos exposure until the time of the strike. Monitoring'was conducted with only short term samples (approximately I hour) which were analyzed by the quality control lab at the plant. Their results indicate exposures in all parts of the plant at levels up to 0.3 f/cc (fibers per cubic centimeter) with occasional higher excursions.

A formal OSHA complaint was made by the ICWU in 1983 resulting in a health inspection of the plant completed on August 10, 1983. OSHA conducted limited air sampling (short term samples from 10-55 minutes duration) using NIOSH Method P&CAR 239 and found potential exposures up to 0.44 fibers/cc. No citations were issued.

A follow-up complaint was made to OSHA by the union to address areas not fully evaluated in the first inspection. During the second inspection, asbestos exposure in the preform area was between 1.27 and 2.11 f/cc (fibers per cubic centimeter) with a TWA of 1.33 f/cc. Coal tar

pitch volatiles (from coke) and antimony exposures were measured on the semi-metallic mixer. Coal tar pitch volatiles were found at 0.036 mg/m3 (milligrams per cubic meter), and antimony was found at 0.19 mg/m3. The OSHA PELs are 0.2 mg/m3 for coal tar pitch volatiles and 0.5 mg/m3 for

2

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antimony. The inspection was interrupted by the strike and no citations were issued.

In 1981 the Local Union requested two occupational health professionals from Montefiore Medical Center to conduct a walkthrough of the plant, review the health and safety provisions and make specific 0 Crecommendations. The recommendations made at that time included improvements in the ventilation system, personal protective equipment and dust handling procedures.

In 1983, the New Jersey State Department of Health conducted a walkthrough of the plant and reviewed company sampling data. A report was issued at that time that recommended improvements in the air sampling program, ventilation system, housekeeping and personal protective equipment. Provision of work clothes and separate locker facilities to prevent home contamination were strongly recommended.

METHODS AND MATERIALS

A. Medical

In order to ascertain whether past asbestos exposure at the plant has been sufficient to cause chest x-ray changes characteristic of asbestos exposure, current and recently retired (within a few months) workers with more than ten consecutive years of employment at the plant were identified. Of the 23 employees listed on the plant-wide seniority list as fulfilling these criteria, twenty were located and agreed to release their chest x-rays for examination.

Annual chest x-rays had been performed as part of the plant's medical surveillance program since 1975, and these films were obtained for the 20 employees. If more recent films were available from a hospital or a private physician, these films were also obtained. The most recent film of good quality was selected for interpretation by a NIOSH certified "B" x-ray reader, who is specially trained to examine chest x-rays for the effects of dust exposure.

B. Environmental

During the walkthrough and the three sampling periods, workers were observed performing their jobs and potential sources of exposure during these procedures were noted. The ventilation system was qualitatively evaluated by observation and the use of smoke tubes.

Individuals from each area of the plant, with the exception of

maintenance, were chosen for personal air monitoring. Personal sampling was conducted according to NIOSH Method 7400 on February 27 and March 10, 1986. All NIOSH recommendations for this method were followed including the use of graphite impregnated extension cowls (plastic tubes) wrapped with aluminum foil. Pumps were pre-and post-calibrated at 1.5 to C2 liters per minute. Filters were examined by phase contrast microscopy according to the set "A" counting rules in the New Jersey State Department of Health Laboratory which is proficient for asbestos analysis in the NIOSH PAT Program.

3

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Because some problems with the method were experienced, a third day of sampling on March 21 was conducted using NIOSH Method P&CAM 239. Analysis was conducted the same way.

It was observed that samples collected according to Method 7400 had collected some of the airborne dust on the inside of the cowl instead of688` the filter face. In order to estimate the loss of asbestos to the cowl, an additional analysis of the cowls was conducted. After separating the cowl from the filter cassette, each cowl was placed in a beaker and the inside surface carefully washed with a directed stream of water. The wash water was then filtered through a 0.8 micron pore size mixed cellulose ester filter, dried and counted according to the set "A" counting rules. Thus an estimate of the total concentration in the air being measured was made.

On the first two sampling days, samples were run for 6 hours or more and the time weighted average (TWA) is based on the individual sampling time. As the dust loading observed was quite considerable, on the third day of sampling both a morning and afternoon sample was collected and a time weighted average calculated based on the total sampling time.

In order to identify in more detail the nature of the exposure at this plant, four samples were chosen for analysis by transmission electron microscopy (TEM). Counting was conducted by the New Jersey State Department of Health Laboratory.

In order to assess the potential for workers contaminating their homes by carrying asbestos home on clothing, samples were obtained from five individuals as they left the plant at the end of the day. Each sample was collected with the use of a personal sampling pump connected to a 37 mm filter with a short length of tygon tubing attached upstream of the filter cassette (closed face). Worker's shirts and pants were thus "vacuumed" for a one minute period. The dust sample was qualitatively analyzed by polarized light microscopy and x-ray diffraction for the presence of asbestos fibers in the collected dust sample.

EVALUATION CRITERIA

1. General

As a guide to the evaluation of the hazards posed by workplace exposures, NIOSH field staff employ environmental evaluation criteria 'for

assessment of a number of chemical and physical agents. These criteria are intended to suggest levels of exposure to which most workers may be exposed up to 10 hours per day, 40 hours per week for a working lifetime without experiencing adverse health effects. It is, however, important to note that not all workers will be protected from adverse health effects if their exposures are maintained below these levels.

In addition, some hazardous substances may act in combination with other workplace exposures, the general environment, or with medications or personal habits of the worker to produce health effects even if the occupational exposures are controlled at the level set by the evaluation criterion. These combined effects are often not considered in the

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evaluation criteria. Finally, evaluation criteria may change over the years as new information on the toxic effects of an agent becomes available.

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

A time-weighted average (TWA) exposure refers to the average airborne concentration of a substance during a normal 8 to 10 hour workday. Some substances have recommended short-term exposure limits or ceiling values which are intended to supplement the TWA where there are recognized toxic effects from high short-term exposure.

2. Asbestos Health effects:

Although the precise risk associated with particular levels of 36;1520fexposure to asbestos remains controversial, the fact that exposure to asbestos causes severe and often fatal disease is widely recognized by the scientific community and the general public.

Numerous studies of workers exposed to asbestos show significant risks of developing diseases including asbestosis (scarring of the lung tissue), lung cancer, gastrointestinal (stomach and bowel) cancer and mesothel rare cancer of the lining of the chest or abdominal cavity) One of the key aspects of asbestos-related disease is

that it develops many years after an individual is first exposed to asbestos.

Lung cancer in asbestos workers may develop as soon as 10 years after first exposure but usually develops more than 20 years after first exposure. The disease is usually fatal. There is a strong dose-response effect between asbestos exposure and lung cancer. The higher the level of exposure, and the longer the exposure continues, the more likely it is that lung cancer will develop. Also, the more asbestos exposure an individual has, the sooner the cancer is likely to develop.

The occurrence of lung cancer in asbestos-exposed individuals is also strongly related to smoking. Although the exact disease rates are debated, a smoker who is not exposed to asbestos has about a 10-fold increased risk of developing lung cancer. A non-smoker who is exposed to

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asbestos has about a 5-fold increased risk. However, a smoker who is exposed to asbestos has about a 50-fold increased risk of lung cancer. In addition to reducing or stopping the exposure, the best thing an individual exposed to asbestos can do to reduce the risk of lung cancer is to stop smoking.

;1952fMesothelioma is a rapidly fatal cancer of the lining of the chest or abdominal cavity which is found almost exclusively in asbestos workers. it occurs at least 25 years and usually more than 40 years after exposure. There is no relationship between cigarette smoking and mesothelioma. This disease may develop in people with-very brief periods of exposure,8016` sometimes as little as 6 months, and in people.with very little exposure, such as family members of asbestos workers.

Asbestosis (scarring of the lung tissue) is a non-cancerous lung disease caused by asbestos exposure. It may develop after about 5 years in very heavily exposed workers but generally is not seen until after 15 years of exposure. In general, asbestosis is seen in individuals exposed for a long period of time to relatively high concentrations. Severe cases of asbestosis will lead to severe shortness of breath and may result in death.

Some individuals with asbestos exposure will develop other non-malignant (non-cancerous) changes in their chest such as pleural (outer lining of lung) calcifications or thickening. This thickening of the lung lining found among asbestos exposed workers does not cause either lung symptoms or disability.

3. Level of Exposure and Risk

On June 20, 1986 OSHA published new General Industry and Construction Standardg (Appendix A) and a Preamble for occupational exposure to asbestos . The old standard of 2 fibers per cc over an 8 hour day was lowered to 0.2 fibers per cc. This new permissible exposure limit (PEL) was effective on July 21, 1986 for General Industry which includes the plant which is the subject of this report.

6
In the preamble to the new asbestos standard, OSHA has estimated mortality from exposures to varying concentrations of asbestos for different time periods (Appendix B). Exposure of 100,000 individuals to an asbestos fiber concentration of 0.2 f/cc for a 20 year exposure is estimated to yield 278 lung cancers, 146 mesotheliomas and 27.8 gastrointestinal cancers for a total of 451.8 excess deaths per 100,000 exposed individuals, (4.5 per 1,000; .45 per 100).

I NIOSH recommends controlling exposure to asbestos to 0.1 fiber per cc . 10784;2040fThis recommendation is based on NIOSH's belief that carcinogens should be regulated to the "lowest feasible level' and that 0.1 f/cc was, at the time, the lowest level at which asbestos could be easily measured.

6

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4. Home contamination

Family members of asbestos workers and residents of neighborhood with asbestos plants have
been shown to be at increased risk of asbestos
related diseases , . It is postulated that much of the family 4;1520fmember risk is a result of workers bringing contaminated clothing home for washing.

RESULTS

1. Medical

Sixteen of the twenty individuals who had their chest x-ray reviewed had worked at the plant for more than 40 years. The remaining four had worked at the plant between 20 and 30 years. Thus, all of the twenty had been potentially exposed to asbestos since it was introduced into the plant in 1969 (i.e., for 16 years).

Of the 20 x-ray films examined, seven showed changes consistent with the effects of asbestos exposure. Two individuals had x-ray evidence of asbestosis (1/0 or greater on the ILO classification); one of these also had a unilateral pleural thickening also characteristic of asbestos exposure. Three individuals showed no evidence of asbestos-related disease in the lung tissue but did have x-ray changes indicative of asbestos exposure; two of these had pleural thickening of the chest wall, one bilateral and one unilateral; one had a calcified plaque on the diaphragm.

In addition, two individuals had lung cancer evident on their x-rays. Both of these individuals had been previously diagnosed and were under medical treatment for their cancer at the time of the study. Since medical histories were not obtained, we cannot determine the likelihood that these cancers are related to asbestos exposure. However, given the strong association between asbestos and lung cancer, it is certainly possible that these cancers are work-related.

2. Environmental

General Plant Conditions

8;2028fDust is found everywhere in the plant, and in certain areas such as Preform and Drum Lining, raw materials collect in piles on the floor and on machinery.

The ventilation system, although large and potentially effective is not well maintained and is, therefore, functioning significantly below its design potential. The ventilation system was partially disconnected from the preform machine enclosures. Operators use the flexible exhaust hoses for clean-up and often fail to reconnect them to the machine enclosures. Some duct connection points had been left unsealed providing additional leakage from the system. Enclosures around the preform machines are not sealed at key points, thus allowing asbestos premix to constantly stream

7

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out into the workroom air. Seals on both the Disc and Drum mixers are deteriorated so that a constant cloud of dust emanates from the machines during operation.

The debagging machine in the disc premix area does not function properly. The bag routinely jams in the machine and the operator is ;1472frequired to open the side door, lean into the machine to shake the bag loose, remove it and deposit it into the waste bag.

On the final day of our visit, the debagger had broken down and was not running. However, enough premix had been made on the previous shift to last through about half of the day shift while we were present. (Mix #608001, 6080003, 6080004 for a total of 1600 lbs of asbestos). According to plant personnel, charging of the raw asbestos had been done directly by hand from a step ladder into the mixer hatch with no hopper or ventilated charge port present. Excessive asbestos exposure would be expected in such an operation.

During mixing, dust clouds were visibly emanating from both the mixer seals and from the debagger. No exhaust ventilation was placed on the system during operation. Similar problems were seen on the Drum Line Mixer from which visible dust escaped during mixing.

Enclosures on grinding and drilling machines have numerous leaks and dust clouds are visible from these points. On the double disk grinders, compressed air is blown into the vented enclosure to remove grinding dust from the shoe as it passes through. Dust emanates from these enclosures through leaks and the port through which the shoe is ejected. Capture hoods on the Canadian drills were seen filled with heavy particles blocking all air flow. Other drill hoods were disconnected from the exhaust ducts, rendering them useless.

Three times daily during breaks, an operator clears the bag house by shutting down the ventilation system, shaking down the bags and removing

the collected dust in drums. Local exhaust hoods on the bag house blast gates are inoperable when the system is shut off. A large cloud of fine dust is released during this procedure in the vicinity of the operator. Air sampling during this time indicated an exposure of 1.73 fibers/cc over the 77 minutes sampling time.

The plant undergoes vacuuming and sweeping throughout the shift with the use of brooms, squeegees, vacuum cleaners and a sweeper cart. Although the employees have been told not to use the brooms, they are still available and thus used. The vacuums and sweeper are very old. Holes were seen in the filter bags and clouds of dust were observed emanating from the equipment. There were no HEPA filters on the vacuum exhaust. It is probable that the use of this outdated equipment is increasing the airborne dust level through re-entrainment of the asbestos.

The lunch room is adjacent to the plant with no physical or ventilation isolation, and it is thus contaminated with asbestos. A wall 276;1472fexhaust fan was present in the lunch room area. If this fan were to exhaust air from the room, it would draw further contamination from the plant into this area. our one area sample in the lunch room found airborne asbestos at 0.07 f/cc.

8

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One janitor is responsible for cleaning the rest rooms and the lunch room. Employees complained of conditions in the bathrooms so unsanitary that they are unwilling to use them. Dust was visible on piping and toilet facilities, indicating contamination and lax cleaning service. Adequate shower facilities exist for male employees but no facilities are provided for female employees.

The quality control laboratory is located in the production area and has no local exhaust ventilation equipment. Employees working in the lab were observed using compressed air to clean the dust build up on the room's air conditioner, thus creating a cloud of dust in the room. They were also observed knocking brake shoes together to remove dust from them before making test measurements.

Numerous other problems were noted in the plant but are not directly addressed in this report because they were not the subject of the HHE request and because of the immediacy of the asbestos problem. Other potential hazards noted include:

a. antimony and other exposures from semi-metallic mixing;

b. a severe eye and respiratory tract irritant was noted which may have been formaldehyde emanating from the curing ovens; 2fventilation of ovens should be further investigated;

C. fire extinguishers were all expired;

d. employees were working with the steel racks soon after they were removed from the ovens potentially causing burns and other safety hazards;

e. full racks were lifted up and down from floor level by one person; a job that was previously done by two. This procedure may present a significant lifting hazard.

Personal Protective Equipment

At the outset of this investigation, work uniforms were supplied for maintenance and preform area workers but for no other plant employees. The policy was recently altered so that work uniforms are now available for any employee, if they choose to contribute money toward the maintenance of the uniform. Cleaning is conducted by a uniform supply service, which picks up soiled clothes each Friday and returns clean 72funiforms to a set of clean lockers during the following week. Each participating employee receives five shirts and three pairs of pants. Each employee is assigned one locker in the lunch room in which the clean uniforms are left and one locker in the wash room. The wash room locker is used for storage of both used uniforms and street clothes.

A few individuals wore tyvec lab coats and two employees had tyvec coveralls. The lab coats have been supplied by the company for employees who request them.

At the time of our initial plant walkthrough, a respiratory protection program had been established and was conducted by the plant fnurse. 3M 8710 respirators (TC-21C-132, approved for respiratory protection against dusts and mists having an exposure limit measured as a

9

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time weighted average not less than 0.5 mg/m3 and asbestos) were supplied to employees and they were instructed in their proper use. A booklet was produced explaining correct use of the respirators and specifying jobs requiring the use of respiratory protection. Since the nurse resigned, the respirator program has not been pursued and new employees have not been properly instructed on respirator use.

During our investigation, most but not all employees were seen wearing the disposable masks. There was no super-vision of proper use, and many employees were seen wearing masks improperly, i.e., with one strap, hanging around chin or neck, with wide gaps around nose, etc.

Routine Air Monitoring

Air monitoring for asbestos exposure has been conducted regularly by the company since 1975. The program consisted of periodic personal sampling on selected jobs in the plant. Samples were short-term, generally under-one-hour. Sampling was conducted by the nurse and analyzed by PCM by the quality control manager at the plant who has not been trained in asbestos fiber counting by NIOSH. The laboratory does not participate in NIOSH's PAT program. Since the beginning of our investigation, no sampling has been conducted.

Bulk Samples

Two bulk samples of premixed material, two floor dust samples and one sample of the insulation in the tumbler area quonset hut were obtained for analysis on 1/8/85. The two premix materials were found to be 30% and 32% chrysotile. Floor dust from the tumbler area was 24% chrysotile and from the preform area was 63% chrysotile. The quonset insulation material was identified as cellulose, containing no asbestos.

Air Sampling Methods

As described in the Methods Section, dust was noted on the inside of the extension cowls used during sampling by NIOSH Method 7400 after sampling on the first two days. The results of the wash procedure on six samples are given in Table I. An average of 38.7 percent (range 23.1 - 49.7) of the total fiber count was found on the cowl and not on the filter. Thus, samples collected with the cowls are probably underestimates of the true exposures by approximately 40%. In addition, the filters were heavily loaded with particulates which masks the asbestos Cfibers and results in further underestimates of fiber concentration.

Personal Air Sampling Results

Sample results by Department from 2/27/86 second shift, and 3/10/86, first shift are given in Table II. Since all of these samples were taken using extension cowls and the filters were also overloaded with

10

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particulate, they are probably underestimates of the true exposure level.

Exposures documented ranged from 0.06 f/cc in branding/packing and disc tables to 0.66 f/cc on drills. All monitored job titles had exposure over the NIOSH recommended limit of 0.1 f/cc except for the disc table loading and unloading and all but this sample and brand/packing exceeded the OSHA PEL of 0.2 f/cc.

Exposure results from 3/21/86 are presented in Table III. These samples were collected on 37 mm cassettes with no extension cowl (method P&CAM 239). Results on 3/21/86 ranged from 0.09 to 1.56 f/cc. The highest exposure jobs were on the tumbler, preform machines, the disc area tables, and in the drum shoe area (including mixer, roll mill operator and drum tables). All jobs measured were over the NIOSH recommended limit of 0.1 f/cc, as well as the OSHA PEL of 0.2 f/ce.

For results of the electron microscopy analysis of fiber size distribution, see Appendix C.

1488fPotential Home Contamination

The potential for home contamination and exposure of household contacts was addressed by vacuuming clothing of five workers as they left the plant after the work shift. All five samples were positive for chrysotile indicating the potential for contamination of the home. The risk potential cannot be quantified from this assessment. However, since the asbestos was released during the vacuuming procedure it may also be released during normal wear, or washing procedures at home, and thus present a real hazard to workers' families.

DISCUSSION AND CONCLUSIONS

Conditions at the plant are poor and asbestos exposure is excessive in all areas, posing a significant health risk to employees. Lack of maintenance of the ventilation system, inadequate procedures for preventing asbestos becoming airborne, the use of outdated equipment and the continued production during periods when protective systems such as the debagger are not working, all contribute significantly to the high asbestos exposures.

The presence of asbestosis in two of the 20 workers whose x-rays were examined strongly suggests that hazardous levels of asbestos exposure have occurred at the plant. These two workers had been employed at the facility for over 40 years and exposed to asbestos at the plant since 1969; thus, although their occupational histories before that time were not obtained, there is little likelihood of their both having sufficient exposure from previous jobs to have caused these lung changes.

The presence of pleural thickening and pleural plaques in one of the workers with asbestosis and three additional workers provides further evidence that these workers have had significant asbestos exposure in the past. Once again, all these employees have worked at the facility for

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more than 40 years, thus it is most likely that the asbestos exposure causing these x-ray changes occurred at Friction Division.

The current study was not designed to determine whether there is an excess of asbestos-related cancer among current and former employees. Thus we have not determined whether the occurrence of two cancers among these 20 employees represents more than would be expected on the basis of age, sex, and smoking status. Nevertheless, the levels documented at the plant and the finding of asbestos-related lung changes strongly indicates sufficient exposure to constitute a cancer hazard.

The exposure levels documented in the plant were greater than the current OSHA standard. Work on the equipment should begin immediately to bring the levels down, within compliance with the new asbestos standard, and with the NIOSH recommended standard of 0.1 fibers/cc over 8 hours.

Our air sampling results indicate that there is no single source of asbestos contamination in the plant. High levels were found in all areas including drum mix, preform, grinding, tables and presses. Although the heaviest concentration of visible airborne dust and some of the highest measured levels were in the preform area, all areas require additional dust suppression.

Evidence from contamination on our sampling cowl, and the comparison of the heavily loaded filters from 2/27 and 3/10 with the lighter dust loads collected on 3/21 suggest that our results may be underestimates of the levels actually present at the plant.

The employer's occupational health program fails to meet most provisions of the new OSHA Asbestos Standard. Exposure monitoring, regulated areas, compliance program, personal protective equipment, hygiene facilities and practices, hazard communication, housekeeping and medical surveillance must all be greatly improved.

A potential for home contamination with asbestos dust from work clothes was documented. Asbestos fibers were present on work clothes after the shift, and they were easily removed from the cloth with a mild vacuum. Since previous studies have identified disease in family members of asbestos workers, we conclude that the presence of asbestos on clothes poses a hazard to workers' families.

RECOMMENDATIONS

A. Medical

1. Since the risk of lung cancer in smokers exposed to asbestos is far greater than that associated with smoking or asbestos exposure alone, all employees should be encouraged to stop smoking.

2. The current medical surveillance program should be modified. Chest x-rays should be interpreted by a certified B-reader. All individual medical information should be confidential, known

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only to the employee and medical personnel, unless the findings are felt to be caused by work or might affect an employee's ability to perform his/her work. Only aggregate data without personal identifiers should be distributed to management and other workers.

A revised medical monitoring program should be established consistent with the OSHA requirements described in 1910.1001 (1) (page 22737 of Appendix A).

B. Environmental

1. Current and past employees should be educated on the health Crisks of asbestos exposure. A hazard communication program should be established following the OSHA requirements in 1910.1001 (j) (page 22736 of Appendix A).

2. Asbestos exposure should be reduced to ensure that exposures are consistently under the OSHA PEL of 0.2 f/cc and the NIOSH recommended limit of 0.1 f/cc. Numerous strategies must be employed to contain the dust since there is no one primary source of exposure. All operations in the plant appear to contribute to the high dust levels. The following recommendations should be implemented and their effectiveness evaluated by additional air sampling. Re-engineering of the operation and all dust control equipment may ultimately be required to reduce asbestos exposure at this facility to acceptable levels. A compliance program should be written which meets the OSHA requirements of 1910.1001 (f)(2)(page 22735 of

Appendix A).

a. Establish, demarcate and restrict access to regulated areas where exposure to asbestos exceeds the OSHA PEL in accordance with 1910.1001 (e) (page 22734 of Appendix A).

b. Set up an active preventive maintenance program for all key pieces of asbestos handling equipment. Seal all potential sources of dust leakage and inspect equipment periodically to ensure that leaks do not reappear.

C. Apply exhaust ventilation to to the mixers and improve the exhaust system applied to the debagging machines.

d. Clear ducts and ventilation hoods of collected debris after every shift. Ensure that all ventilation equipment present is properly set up.

e. Prohibit operation of the mixers without the debagger in properly functioning condition, unless properly constructed vented charge ports are constructed. Overhaul or replace the debagger to prevent jamming which requires employees to enter the machine.

f. Unless the enclosures around the DD grinders can be entirely sealed, the use of compressed air for dust clearing should be discontinued. Brushes may be set

13

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up with strong, directed exhaust ports close to the surface of the shoe to remove dust as it moves through the machine.

g. Set up an independent dust collection system to operate local exhaust vents on the bag houses during cleaning procedures.

h. Remove all brooms from the plant to prevent their use. Discontinue use and remove the vacuum cleaners currently in the plant and replace with units with HEPA (high efficiency particulate air) filtered exhausts. Expand dust collection procedures to include all surfaces of plant.

i. Isolate the lunch room from the plant by physical barriers such as walls and an independent ventilation 3548fsystem. Conduct a thorough cleaning of all surfaces in the rest areas. Apply a sealant to walls and floor surfaces to promote continued thorough cleaning. Provide additional janitorial services to maintain adequate sanitary facilities.

968;3032fj. Set up down draft vented tables for the tray breaking jobs.

k. Implement a housekeeping program meeting the requirements of 1910.1001 (k) (page 22737 of Appendix A).

3. Personal Protective Equipment and Policies

a. Provide clean uniforms or disposable coveralls and gloves, head

coverings and foot coverings daily to all employees. As these are necessary to prevent home contamination, wearing of such protective clothing should be required by management. In order to ensure full compliance with this policy, options such as fully paying for the laundry service should be considered. Street clothes should not be stored with'soiled work clothes. Each individual should be provided with a clean locker in which to store personal belongings. Soiled work clothes should either be kept in a separate locker or deposited in a closed, impermeable container at the end of each work shift. If clothes are used for only one shift, two weeks worth of uniforms will need to be provided, with laundering once per week.

As required by 1910.1001 (h)(3)(iv) (page 22736 of Appendix A) the employer must inform the laundry service of the hazards of asbestos and the precautions needed to prevent exposure to laundry employees.

b. Shower facilities should be supplied for female employees in accordance with 1910.1001 (i)(2) (page 22736 of Appendix A). Showering after work should be encouraged by providing clean facilities with separate stalls for privacy.

14

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C. The respiratory protection program should be reinstituted to provide adequate training on the proper use of respiratory protection to all employees and to fulfill all requirements of the OSHA Respiratory Protection Standard (1910.134).

d. The use of disposable respirators such as the 3M 8710 now in use is not adequate protection for asbestos and is not permitted under the new OSHA Standard, 1910.1001 (g) (page 22735 of Appendix A). If the provisions of this section are followed, a half-mask air-purifying respirator equipped with high-efficiency filters is the minimum type of respirator which could be selected. However, powered air purifying respirators with high-efficiency filters would offer more protection and greater employee comfort. Such respirators are required by OSHA when an employee chooses to use this type of respirator.

4. Air Monitoring

A program of periodic monitoring of asbestos exposure should be established to provide information to employees and management on the adequacy of control systems. Samples should be taken in each area of the plant using the methods and schedule required by OSHA in 1901.1001 (d) (page 22733 of Appendix A). All monitoring should be observed by employees as required by 1910.1001 (n) (page 22738 of Appendix A).

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15

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16

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DISTRIBUTION AND AVAILABILITY OF REPORT

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4. NIOSH, Region II
5. OSHA, Region II

For the purpose of informing affected employees, copies of this report 9 Cshall be posted by the employer in a prominent place accessible to the employees for a period of 30 calendar days.

17

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TABLE I
ASBESTOS CONTAMINATION ON EXTENSION COWLS
USING NIOSH METHOD 7400

Sample (Min.)	Sample Time (f/cc)	Filter (f/cc)	Cowl (f/cc)___	Total	% on Cowl
1	184	0.18	0.18	0.36	49.7
2	193	0.51	0.31	0.82	37.8
3	379	0.24	0.22	0.46	47.0
4	371	0.37	0.29	0.66	44.3
88;1576f5	346	0.57	0.17	0.74	23.1

6	389	0.49	0.21	0.70	30.1
Mean		0.39	0.23	0.62	38.7

18

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TABLE II
EXPOSURE RESULTS BY JOB TITLE
(fibers/cc)
2/27/86 - 3/10/86

Job Title	N*	Range	TWA**
Branding/Packing	2	0.06 - 0.27	0.17
Drill Operator	3	0.34 - 0.66	0.53
Grinder Operator	8f2	0.14 - 0.27	0.20
Preformer	4	0.16 - 0.49	0.28
Pre-mix Mixer (Disc)	2	0.26 10 C- 0.37	0.32
Press Operator	2	0.39 - 0.54	0.46
Tables (Disc/Oven-Rack Loading and Unloading)	2	0.06 - 0.07	10 C0.07
Tumbler	1	0.57 - 0.57	0.57

Number of samples in Job Title.

** Time Weighted Average based on total sampling time which was greater than 6 hours. Six of eight samples are greater than the OSHA PEL of 0.2 f/cc.

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TABLE III
EXPOSURE RESULTS BY JOB TITLE
(fibers/cc)
3/21/86

Job Title	N*	Range	2440;7564fTWA**
Drills	2	0.09 - 0.76	0.43
Drum Area	3	0.45 - 0.93	0.67
Tables (disc)	2	0.17 - 1.56	0.87
Grinder	1	0.52 - 0.52	0.52
Preformer	2	1.22 - 1.37	1.30
Mixer (disc)	1	0.61 - 0.61	0.61
Preform (Maint)	1	0.65 - 0.65	0.65
Tumbler	1	1.10 - 1.10	1.10

Number of samples in Job Title.

Time Weighted Average based on total sampling time which was greater than 6 hours. All are greater than the OSHA PEL of 0.2 f/cc.

20

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APPENDIX A

29 CFR 1910.1001
Asbestos, tremolite, anthophyllite,
and actinolite

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Federal Register Vol. 51, No. 119 Friday, June 20, 1986 /-Rules and Regulations
22733

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percent of 0.3 micmmeter diameter

shall be the time of issuance of this issued under 29 U.S.C. 653.
mono-disperse particles.

document as provided by 29 CM Section 1910.1025 also issued under 29
'Regulated area" means an area

J 1911.1& The time of issuance is the 1924;3940fU.S.C. 653 and 5 U.S.C. 55&
5 established by the employer to

earliest moment that petitions for review Section 1910AD43 also issued under
demarcate areas where airborne

may be filed with United States Courts U.S.C. 551 et seq.
concentrations of asbestos, tremolite,

Sections 1910.1045 and IM.1047 also anth

Of Appeals, issued under 29 U.S.C. 653.
ophyllite, actinolite, or a

Signed at Washington, DC. this 12th day of . Sections 1910.1499 and 1910.15W also
combination of these minerals exceed,

June, 1986. issued under 5 U.S.C. 50.
or can reasonably be expected to

John A, Pendergrass. 4. Section 1910.IW1 is hereby revised
exceed, the permissible exposure limit.

Assistan t Secretaryfor Occupolknol Safety to read as follows:

"Tremolite, anthophyllite, or
undHealth. .
actinolite" means the non-asbestos form
11910.1001 Asbestostrwnollte, of these minerals, and any of these
XIIL Amended Standards anthophynits, and actinolite.
minerals that have been chemically
ted and/or altered.
PART 191D--IAMENDED] (a) Scope and application. (1) This
trea
section applies to all occupational (c) Permissible exposure limit (PEL).
Part 1910 of Title 29 of the Code of exposures to asbestos, tremolite,
The employer shall ensure that no
Federal Regulations is hereby amended anthophyllite, and actinolite, in all
employee is exposed to an airborne
as follows- industries covered by the Occupational
concentration of asbestos, tremolite,
L The authority citation for Subpart B Safety and Health Act, except as
anthophyllite, actinolite, or a
of Part 1910 continues to read as provided in paragraph (a)(2) of this
combination of these minerals in excess

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