U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
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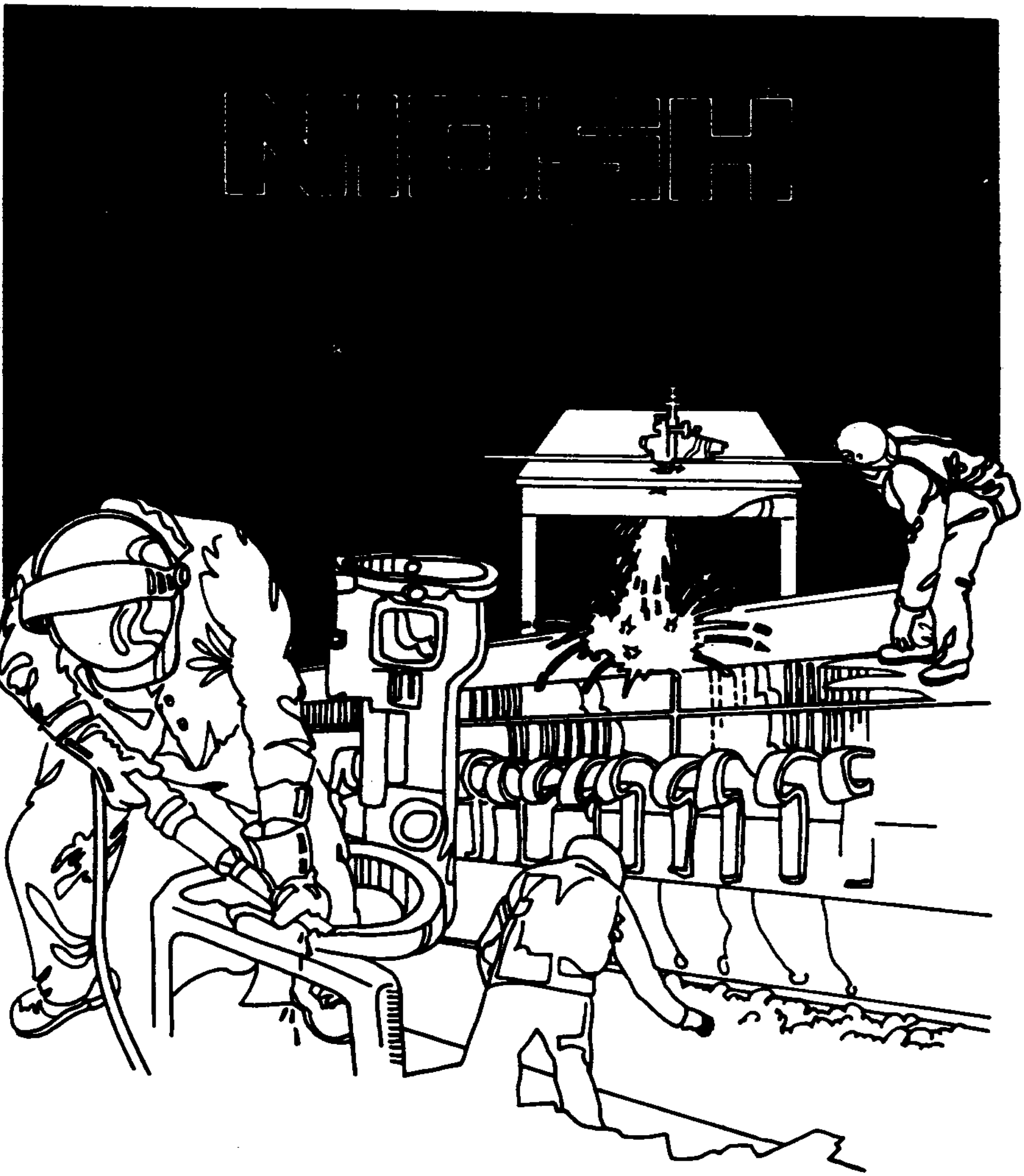

Health Hazard Evaluation Report

HETA 87-126-2019
CHRYSLER CHEMICAL DIVISION
TRENTON, MICHIGAN

PREFACE

The Hazard Evaluations and Technical Assistance Branch of NIOSH conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from any employer or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

The Hazard Evaluations and Technical Assistance Branch also provides, upon request, medical, nursing, and industrial hygiene technical and consultative assistance (TA) to Federal, state, and local agencies; labor; industry and other groups or individuals to control occupational health hazards and to prevent related trauma and disease.

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I. SUMMARY

On January 26, 1987, the National Institute for Occupational Safety and Health (NIOSH) received a confidential request from employees at the Chrysler Friction Products and Chemical Plant in Trenton, Michigan to evaluate employee exposures to asbestos, solvents, and lead.

On April 23-24, 1987, an initial site visit was conducted at the Chrysler Chemical plant; however, due to a turnover in NIOSH staff, this investigation was reassigned and a second walkthrough site visit was conducted on October 14, 1987. As a result of the conditions observed, work practices employed, and exposure records supplied by Chrysler, Chrysler was informed (letter dated 10-22-87 to Chrysler Corporate Medical Director) that conditions within their plant were a threat to the health of the employees and immediate steps should be taken to bring this plant into compliance with the OSHA asbestos exposure standard.

During the week of November 16-19, 1987, NIOSH conducted employee exposure monitoring and a medical evaluation consisting of chest X-rays, pulmonary function tests, blood lead testing, and a questionnaire. Results of personal breathing zone exposure monitoring showed the following 8-hour time-weighted average asbestos concentrations: Mixer operators, 0.06-0.45; Press Operators, 0.06-0.77; Grinder operators, 0.02-0.07; Saw operators 0.09-0.19; and Millwrights, 0.05-0.18 fibers-per-cubic centimeter (fibers/cc).

A second exposure monitoring survey was conducted in March, 1988, to determine exposure potential during a full and more typical production operation. Additional job operations were identified which had considerably higher exposure levels during the full production operation: 2.6 BiPell Press Operators, 0.54-0.88; 2.6 M-body Press Operators, 0.74-1.11; 2.6 Press Operators, 0.53-1.10; and 2.6 Barker Operators, 0.17-0.20 fibers/cc. Many of these exposure levels were above the OSHA Permissible Exposure Limit of 0.2 fibers/cc and the NIOSH Recommended Exposure Level to limit asbestos exposure to the lowest possible concentration. The medical evaluation identified three persons with radiological signs consistent with pneumoconioses. Six participants had a restrictive pulmonary function pattern and 22 persons had an obstructive pattern (7 of whom may have had restrictive effects). The highest blood lead level was 43 ug/dl; the other 27 were less than 40 ug/dl, the level at which more intensive monitoring is required by the OSHA lead standard.

On the basis of conditions observed and environmental sampling results, NIOSH investigators concluded that a health hazard did exist and continued to exist until the plant closed in July, 1988. Recommendations made to improve conditions at this plant included the use of supplied-air respirators, use of company supplied coveralls, establishment of a decontamination area, improved industrial hygiene monitoring, and the use of engineering controls.

Keywords: SIC 3714 (Motor Vehicle Parts and Accessories) Asbestos, Chrysotile, Friction Products, Brake Lining.

II. INTRODUCTION

On January 27, 1987, NIOSH received a confidential request from employees at the Chrysler Trenton Chemical Plant, Trenton, Michigan, to evaluate the health effects of long term exposures to asbestos, lead, and solvents.

On April 23-24, 1987, an initial walkthrough site visit was conducted at the Chrysler Chemical plant; however, due to a turnover in NIOSH staff, this investigation was reassigned and a second site visit was conducted on October 14, 1987. As a result of the conditions observed, the work practices employed, and exposure records supplied by Chrysler, Chrysler was informed (letter dated 10-22-87 to Chrysler Corporate Medical Director) that conditions within their plant were a threat to the health of the employees and immediate steps should be taken to bring this plant into compliance with the OSHA asbestos exposure standard.

Follow-up exposure monitoring and medical evaluations were conducted during the week of November 16-19, 1987. A second exposure monitoring evaluation was conducted March 29-30, 1988, to characterize asbestos exposures for jobs on production processes not operating during the November, 1987, survey. Interim industrial hygiene exposure results and medical evaluation reports were sent to the company on March 10, 1988, and March 23, 1988, respectively. All workers who participated in the environmental and medical screening evaluation received individual letters providing the results of their tests.

III. BACKGROUND

Production of adhesives, sealers, and paints began at Chrysler's Trenton Plant in 1947, under the brand name, Cycleweld. Brake linings were first produced in the chemical building as a pilot program in 1958. Because of the success of this pilot program, and an increased demand for friction products, the brake lining division was expanded and occupied a new Friction Products building in 1964. This operation was further expanded in 1968.

The Chrysler friction products plant produced both asbestos and nonasbestos brake linings for Chrysler automobiles. Asbestos and other components (e.g., zinc powder, lead powder, cellulose filler, steel fibers, graphite, and phenolic resin), which varied depending upon the specific product formulation, were weighed into dumpsters, which were used to transport the ingredients to the mixing area. The ingredients were mixed in ribbon blender mixers. From the mixer, the formulation was gravity-fed into dumpsters, which were used to temporarily store and transport the dry mix formulation.

Depending on the type of friction product, the formulation may have been extruded or pressed into the shape of the brake component. The formed brake pads or linings were transferred to curing ovens and/or additional presses. The cured brake products underwent a variety of processing operations, including sawing, grinding, and drilling.

At the time of this evaluation, 70% of the brake shoes and discs were made with asbestos, and 30% were made of metalic composites. Chrysotile asbestos has been used exclusively at this site since brakes were first produced here (1958), until the friction products plant closed in July, 1988.

At the time of this NIOSH evaluation, the Chrysler Friction Products and Chemical divisions employed approximately 138 hourly workers who were represented by the United Auto Workers Union, Local 372. The working population at the plant was predominately male (98%) and white (84%).

Medical care for employees was provided by the Chrysler Corporation at an ambulatory clinic, located approximately one-mile from the plant at Chrysler's Trenton Engine Plant.

IV. METHODS OF ASSESSMENT

A. Environmental

Bulk samples of settled dust were collected at several locations throughout the production area. The dust samples were submitted for qualitative identification of asbestos utilizing polarized light microscopy with subsequent quantitation of the type of asbestos present.[1] A portion of each sample was also prepared for transmission electron microscopy analysis (TEM) via an ethyl alcohol-ultrasonic method. Aliquots of the resulting suspensions were evaporated onto 200-mesh carbon-coated copper grids and examined on a Philips 420 TEM at 1750X and 5000X magnification. Elemental spectra and diffraction patterns were obtained to confirm the existence of asbestos, identify the type of asbestos, and determine the relative percentage of asbestos content per sample.

Full-shift personal exposure sampling was conducted over four different shifts during the November, 1987 survey to determine representative asbestos fiber exposure levels for various jobs in the plant. Asbestos fiber exposure was characterized in 34 different jobs and for 50% of the workforce in the friction products plant.

Because three specific operations were not functioning due to equipment failure, it was believed the November exposure sampling may not have accurately represented the worst case exposure situation expected during a full production operation. Therefore, exposure sampling for jobs on these three operations, and other jobs felt to be influenced by these operations, was performed in March, 1988.

Personal exposure sampling was conducted according to NIOSH Method 7400 using 25-millimeter (mm)-diameter cellulose ester filters with a 0.8 micrometer (um) pore size.[1] The filters were contained in a cassette with a non-conductive cowl and attached via flexible tubing to portable battery-operated sampling pumps operated at calibrated flow rates of 1.0 to 3.0 liters per minute (lpm). The filters were analyzed utilizing phase contrast microscopy (PCM) with the A counting rules in accordance with NIOSH Method 7400.[1] The limit of detection (LOD) for this analysis was determined to be 0.03 fibers/field or 1500 fibers/filter for the 25-mm-diameter filters. This LOD is lower than that cited within the previously quoted NIOSH methods. Confirmation of asbestos was performed on selected filters using TEM according to NIOSH Method 7402.[1]

The potential for home contamination with asbestos dust from work clothes worn home by the employees was addressed by collecting samples from the clothing and car seats of the workers as they left work at the end of their shift. Each sample was collected with the use of a personal sampling pump connected to a 25-mm filter. Worker's shirts and pants, or their car seats, were "vacuumed" for a three minute period. The filter samples were qualitatively analyzed for the presence of asbestos by PCM and TEM.

B. Medical

Currently employed hourly workers with five or more years of employment at the chemical and friction product plant were invited to participate in this evaluation. Letters were sent to all retirees in Michigan and surrounding areas, informing hourly and salaried retirees of the hazard evaluation, and inviting the participation of any retired worker who could be available during the scheduled week of evaluation. In addition, a memo was circulated to all salaried personnel informing them that the medical evaluation was also open to any manager with five or more years of employment at the plant.

The medical survey included the use of breathing-zone exposure samples, chest x-rays, pulmonary function tests, a respiratory/neurobehavioral questionnaire, and for chemical products employees, a determination of blood lead concentration.

Chest x-rays were taken with a General Electric power unit modified for use in a mobile (trailer) setting. An upright chest stand allowed use of a dual format (17x14 or 14x17) orientation. X-rays were taken using standard technique, i.e., 110 kvp (kilovolt-pressure) with a back-up time of 32 MAS (milli-amp-second). Posterior anterior (PA) films were processed on location using a Kodak M-7 film processor. Chest x-rays were then sent to two radiologists certified as "B-readers". Each radiologist recorded his findings on forms supplied by NIOSH, using the International Labour Office system for recording signs of pneumoconiosis.[2] In the event these two radiologists disagreed about the presence, extent, or location of radiological signs of pneumoconiosis, a third B-reader interpreted the film and results were reported based on the majority opinion or median value.

Pulmonary function tests were administered using an Ohio Medical Model 822 spirometers equipped with the Spiro-tech 200 Screening Spirometry System. Equipment was calibrated at the beginning and end of each shift using a Pul-Mark II electronic 3.0 liter calibration syringe.

The respiratory portion of the questionnaire was derived from the ATS standardized questions for assessing respiratory health [3]. Workers responded to questions about past work histories, length of employment at the company, smoking history, and specific self-reported medical conditions.

The effects of solvent exposure were assessed with a neurobehavioral questionnaire in which employees were asked to respond to symptoms associated with chronic solvent exposure. For the purposes of analysis, respondents were grouped according to exposure potential, which was based upon the assumption that chemical plant workers are most exposed, friction product workers less exposed, and managerial staff least exposed to solvents.

Blood lead was analysed using the anodic striping volametry method. Zinc protoporphyrin levels were determined using a hematofluorometer. Both of these laboratory methods were employed at a laboratory approved by OSHA in accordance with its blood lead standard (29 CFR 1910.1025).

V. EVALUATION CRITERIA

A. 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. A small percentage may experience adverse health effects because of individual susceptibility, a preexisting medical condition, and/or a hypersensitivity (allergy).

In addition, hazardous substances may act in combination with other workplace exposures, the general environment, or with medications or personal habits of the worker to produce health effects even if the occupational exposures are controlled at the level set by the evaluation criterion. These combined effects are often not considered in the evaluation criteria. 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 Government Industrial Hygienists (ACGIH), Threshold Limit Values (TLVs), and 3) the US Department of Labor, OSHA PELs (Permissible Exposure Limits). NIOSH recommendations and ACGIH TLVs are often lower than the corresponding OSHA standards which take into account the feasibility of controlling exposures in various industries where the agents are used. Both NIOSH recommendations and ACGIH TLVs are based on more recent information than are the OSHA standards and are based primarily on concerns relating to the prevention of occupational disease. In evaluating the exposure levels and 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 (STEL) or ceiling values which are intended to supplement the TWA where there are recognized toxic effects from high short-term exposure.

B. Asbestos

1. Health Effects

Although the precise risk associated with particular levels of exposure to asbestos remains controversial, the fact that exposure to asbestos causes severe and often fatal disease is widely recognized by the scientific community. [4]

Numerous studies of workers exposed to asbestos show significant risks of developing asbestosis (a diffuse interstitial pulmonary fibrosis), lung cancer, gastrointestinal cancer (stomach and bowel), and mesothelioma (a rare cancer of the pleura).[5-7]

Asbestosis 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 asbestos concentrations.[8] Severe cases of asbestosis will lead to severe shortness of breath and may result in death.

Lung cancer in asbestos workers can develop as soon as 10 years after first exposure but usually develops more than 20 years later.[9] The disease is usually fatal. There is a strong dose-response effect between asbestos exposure and lung cancer .[10] This is to say the higher the level of exposure, and the longer 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 an asbestos-exposed individual is also strongly related to smoking.[11-13] Although the exact disease rates are debated, estimates suggest that a smoker who is not exposed to asbestos has a 10-fold increased risk; a non-smoker who is exposed to asbestos has a 5-fold increased risk, and a smoker who is exposed to asbestos has a 50-fold increased risk of lung cancer [11]. In addition to reducing or stopping the exposure to asbestos, a smoker can further reduce the risk of lung cancer by eliminating his or her smoking habit.

Mesothelioma can occur 15 to 47 years after exposure to asbestos and is always fatal.[14] No relationship has been shown between malignant mesothelioma and cigarette smoking or the dose of asbestos exposure. This disease may develop in people with very brief periods of exposure, such as family members of asbestos workers.[15-20]

Some individuals with asbestos exposure will develop other non-cancerous changes in their chest such as thickening and calcification of the pleura (outer membranous lining of the lungs). This thickening of the lung lining found among asbestos exposed workers causes neither lung symptoms nor disability. But, since it is indicative of asbestos exposure, the person with this finding is presumably at risk of more serious asbestos-related diseases.

2. Exposure Criteria

On June 20, 1986, OSHA published new General Industry and Construction Standards Regulating Asbestos Exposure.[21] The previous standard of 2 fibers/cc over an 8-hour day was lowered to 0.2 fibers/cc. This new Permissible Exposure Limit (PEL) became effective on July 21, 1986, for General Industry, which includes Chrysler's friction products plant.

In the preamble to the new asbestos standard, OSHA has estimated mortality from exposures to varying concentrations of asbestos for different time periods.[21] Exposure of 100,000 individuals to a fiber concentrations of 0.2 fibers/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 persons.

NIOSH recommends as a goal the elimination of asbestos exposure in the workplace; where it cannot be eliminated, the occupational exposure to asbestos should be limited to the lowest possible concentration.[22] This recommendation is based on the proven carcinogenicity of asbestos in humans and on the absence of a known safe threshold concentration.

NIOSH contends that there is no safe concentration for asbestos exposure. Virtually all studies of workers exposed to asbestos have demonstrated an excess of asbestos-related disease. NIOSH investigators therefore believe that any detectable concentration of asbestos in the workplace warrants further evaluation and, if necessary, the implementation of measures to reduce exposures.

The ACGIH TLV for chrysotile asbestos is 2 fibers/cc, with a classification of a "confirmed human carcinogen". ACGIH further advises that "exposure (to a confirmed carcinogen) by all routes of exposure should be carefully controlled to levels as low as reasonably achievable (ALARA) below the TLV.[23]

3. Off-Site Contamination

Family members of asbestos workers and residents of neighborhoods with asbestos plants have also been shown to be at increased risk of asbestos-related diseases.[15-20] It is postulated that much of the family member risk is a result of workers bringing contaminated clothing home for washing.

VI. RESULTS

A. Exposure Monitoring Results

Table I presents personal breathing zone fiber exposure levels documented during the November, 1987, survey. These results, which were provided to Chrysler management and representatives of the United Automobile Workers Union by letter dated March 10, 1988, are grouped according to job operation and indicate 8-hour time-weighted average (TWA) exposures as well as partial shift exposures, (i.e., individual filter results). These exposure results represent 53 jobs sampled, over three days, covering three shifts per day. The OSHA PEL was exceeded in 8 of the 53 (15%) jobs sampled with two other jobs at the PEL of 0.2 fibers/cc; the NIOSH REL of 0.1 fibers/cc was exceeded in 26 (49%) of the jobs sampled. Personal breathing-zone, full-shift TWA exposure levels in the jobs sampled during the November, 1987, survey ranged from 0.02 to 0.77 fibers/cc, with a press operator having the highest exposure. Partial shift (short-term) exposures ranged from 0.01 to 0.96 fibers/cc. Confirmation of asbestos fibers was accomplished via TEM analysis on selected samples representing the various jobs sampled. All samples submitted for this confirmation were found to contain chrysotile asbestos and are so indicated in Table I.

Table II presents the personal breathing-zone TWA fiber exposure levels as determined during the March, 1988, environmental monitoring survey. These exposure levels were obtained because of the concern that the November, 1987, monitoring may not have accurately reflected the full exposure potential during a typical production operation (three specific operations were shut down in November due to equipment failure). These results also are grouped according to job operation and indicate 8-hour TWA exposures, as well as partial shift exposures. These exposure results represent 34 jobs sampled over two days on first shift (the only shift when the processes of interest were functioning). The OSHA PEL was exceeded in 14 of the 34 (41%) jobs sampled, with two other jobs at the PEL of 0.2 fibers/cc; the NIOSH REL of 0.1 fibers/cc was exceeded in 26 (76%) of the jobs sampled. Personal breathing-zone full-shift TWA exposure levels of the jobs sampled ranged from 0.02 to 1.11 fibers/cc as compared to the range of 0.02 to 0.77 fibers/cc found during the November survey. A 2.6 M-body press operator and a 2.6 press operator had the highest exposures. Partial shift (short-term) exposures identified during the March survey ranged from 0.13 to 3.66 fibers/cc as compared to 0.01 to 0.96 fibers/cc found during the November survey.

Table III provides the results of the area air monitoring for fibers in selected locations inside and outside the Friction Products plant. These results indicate 'fibers in air' contamination in the cafeteria of the Friction Products plant and the Union room of building 20, adjacent to the plant. 'Fibers in air' contamination was not identified in any other area locations sampled.

Table IV provides results of samples for asbestos contamination carried outside the Chrysler Friction Products plant by workers from the plant. Asbestos contamination of personal clothing and automobiles was confirmed in 11 of 13 (85%) of the samples. Asbestos contamination of personal clothing was found for each individual job title sampled. The two negative samples were from automobile seats; in one case the car was less than a year old and not generally driven to work by the worker. Information concerning the age or usage of the other automobile was not available.

Table V presents the percentage of asbestos content for the bulk settled dust samples collected inside and outside the Friction Products plant. Chrysotile asbestos was found in the settled dust collected at selected locations. Asbestos content of the dust sampled ranged from 1% to 50%. The most contaminated dust was found on the superstructure of the building, on the floor below the mixer, and on the floor below the screw conveyor for the dust collector. In all cases, these were settled dust samples and not samples from a "leakage" point in the process.

B. Ventilation

A limited qualitative evaluation of the existing local exhaust ventilation equipment using smoke tubes revealed that it ranged from nonoperational to adequate. A comprehensive evaluation of the existing exhaust ventilation system was not conducted since this was beyond the scope of the hazard evaluation. Where possible, smoke tubes were used to qualitatively assess the exhaust ventilation systems on selected processes.

The sawing and grinding operations appeared to be equipped with adequate ventilation to maintain airborne asbestos levels below the OSHA PEL. However, duct work on several of these operations was in a poor state of repair which probably influenced the asbestos exposure potential of the operator.

The BiPell presses, and other presses, had inadequate ventilation, which included several poorly engineered down draft tables. The BiPell hoppers and collection bins had no ventilation. In addition and perhaps more importantly, large radial fans (for comfort cooling) in operation at each press, probably interfered with any level of efficiency the existing exhaust ventilation system provided.

Both bag dump/weigh-up stations of the weigh-up area had local exhaust ventilation which was poorly engineered.

The ventilation of the hammermill and mezzanine area appeared inadequate; local exhaust ventilation was not present at points where dust emissions were visible on the mixing mezzanine area.. Local exhaust ventilation was not provided should the unit exhaust ventilation system malfunction or the hammermill hoppers bridge-over, which would require manual handling of asbestos in the mezzanine area.

Considerable quantities of visible aerosolized dust were observed during each NIOSH survey. Visible dust emissions were observed during the weighing of ingredients, charging of the mixer with ingredients, mixing of ingredients, dumping from the mixer, and filling the BiPell hoppers.

Visible dust emissions were also observed during the dumping of the mobile vacuum-sweeper and cleaning of the vacuum-sweeper filters.

C. Work Practices

Observation of employee work practices revealed manual material handling techniques which could be improved to reduce airborne fiber exposures.

Employees at the weigh stations were breaking up bails of asbestos with gloved hands and then continuing work throughout other portions of the facility wearing the same contaminated gloves. The plastic wrapping of the asbestos bales were "stuffed" into a fiber drum, away from any exhaust ventilation, with no control of fiber emissions.

The workers moved the asbestos-containing mix-filled bins (with non-sealed lids) to the mixers. The bins were jarred as they hit bumps on the floor, producing visible dust emissions.

Operators were required to shovel the loose or friable brake pad mix from an open bin into the BiPell hopper. This created a high potential for asbestos fiber exposures, depending on individual work habits.

The BiPell/Press operators were required to weigh brake pads which were then grouped on a metal plate on top of the down-draft table, significantly blocking the air flow of the table. The non-cured pads were manually moved from the down draft table to another table and then into the press. Ventilation was provided only during the weighing process. Overall, the cured and non-cured pads were not carefully handled.

The sawing operation, as with the presses, required the handling or moving of brake linings from exhaust ventilated equipment to non-ventilated areas (over racks). The potential for operator exposure was increased in the nonventilated areas.

D. Personal Protective Equipment

Prior to August, 1987, the use of personal protective equipment was not required for any job in the Chrysler Friction Products plant. In August, 1987, two process areas within the plant were designated as regulated asbestos areas per the OSHA requirements. For these areas, the company required the use of half-face negative-pressure cartridge respirators or powered air-purifying respirators (TC#21C-172, TC-21C-244, TC-21C-135, TC-21C-152, TC-21C-212, TC-21C-265, or TC-21C-316).

The use of disposable dust masks (3M-3710) were provided for optional use by workers outside of the regulated areas. The company had not developed a written respirator program, provided training on the use and maintenance of respirators to all workers involved, or provided adequate facilities for the cleaning and storage of respirators.

The use of company-supplied coveralls was required in the regulated areas and was optional to workers in other areas.

The regulated areas were not contained by structural barriers; a painted line on the floor was used to segregate a regulated process area from a non-regulated area. Therefore, it was common to observe an individual required to use a respirator working as close as 15 feet from an unprotected worker. Also, the use of comfort fans inside the regulated areas compromised the intent of these areas.

E. Medical

One-hundred-seventy-one persons (77% of the workforce) participated in the medical evaluation. The participants included 19 out of 51 management representatives (37%), and 17 out of 108 living retirees (16%). Fifty two percent of those participating were employed in friction products, 32% were employed in the chemical division, and 16% had jobs such as maintenance and repairmen which required that they work in both the chemical and friction products divisions.

Three persons had radiological signs consistent with fibrogenic dust exposure. One x-ray showed bilateral small rounded opacities in the middle and upper lung fields. (Asbestosis is typically manifest as irregular opacities beginning in the lower lung fields.) Two x-rays showed pleural thickening. One of these x-rays showed pleural thickening along the diaphragm with circumscribed plaques along the chest wall; the second showed pleural thickening involving the right costophrenic angle and circumscribed plaques along the chest wall.

Abnormal pulmonary function tests were recorded for 28 persons. Six workers showed a restrictive pattern (a Forced Vital Capacity less than 80% of the predicted value and an FEV1/FVC greater than or equal to 70%). Twenty two persons (13%) had an obstructive pattern (FEV1/FVC ratio less than 70%), and seven of these 22 persons may also have had a restrictive effect.

Spirometry results were further analyzed to determine if exclusive work in friction products, or ever having worked in friction products, would affect two parameters of the lung function test, the forced vital capacity (FVC) and the ratio of forced expiratory volume to the forced vital capacity (FEV1/FVC). The test differences between those who had ever worked in friction products versus those who had never worked in friction products showed the decline in percent predicted FVC among friction product workers to be indistinguishable from chance (p=0.12). The same analysis for employees who were exposed exclusively to chemical products (testing the independent effect of chemical exposure) showed no difference in percent predicted FVC or FEV1/FVC between chemical plant and non-chemical plant workers. Furthermore, neither parameter was associated with increasing years at Chrysler, years in friction products, or years in chemical products (surrogate measures of dose), after adjustment for age and smoking.

The questionnaires indicated that 11 persons (6.5%) met the case definition for chronic bronchitis. For the purposes of this evaluation, chronic bronchitis is defined as having a cough with phlegm, on most days, for 3 or more months of the year, for 2 or more years. All 11 cases were smokers. (Smoking is the most common cause of chronic bronchitis in the general population.)[24]

Employees responded to questions concerning the degree and severity to which they were affected by episodes of shortness of breath. Sixty three persons (36%) indicated that they had trouble with shortness of breath when hurrying on a level surface or walking up a slight hill. Sixteen employees (9.3%) complained of breathlessness severe enough to require them to stop for breath when walking at their own pace on a level surface. Thirteen, (7.6%) needed to stop for breath after walking approximately 100 yards, and 3 persons (2.7%) were too breathless to leave the house, or are breathless upon dressing or undressing. Only 5 workers (2.9%) indicating problems with shortness of breath had exclusive exposure to either solvents or asbestos alone; therefore, the independent effect of either exposure on the severity and prevalence of "shortness of breath" could not be meaningfully evaluated. Fifty nine percent of the 63 workers complaining of shortness of breath were smokers. (relative risk for shortness of breath for smokers = 1.67; 95% CI 1.09, 2.55).

One of 28 blood lead levels in chemical plant operators was in excess of 40 ug/dl, the level at which the OSHA leas standard requires more intensive monitoring. This sample result was below the level (50 ug/dl) requiring removal from exposure. The remaining 27 samples showed blood lead levels from < 5 to 22 ug/dl, with a mean of 7.8 ug/dl. These levels are similar to those observed in the general population.

Employee responses to neurobehavioral symptoms associated with solvent exposure were grouped according to exposure potential. Chemical employees were considered highest exposed, friction products workers were less exposed, and management participants were considered least exposed to solvents. Analysis of the eight neurobehavioral categories (memory symptoms, gastrointestinal symptoms, alcohol related symptoms. neurasthenic symptoms, dermatological symptoms, respiratory symptoms, and peripheral nervous system symptoms) showed no statistical difference in responses between each of the three exposure classifications. Therefore, we were unable to observe an increased risk of neurobehavioral effects due to work in any of the three exposure groups.

VII. DISCUSSION AND CONCLUSIONS

Asbestos exposure in the Chrysler Friction Products plant was excessive in all job operations and areas, posing a considerable health risk to all workers in this plant. Inadequate procedures for preventing aerosolization of asbestos containing dust, a lack of appropriate exhaust ventilation systems, poor design and maintenance of existing exhaust ventilation systems, and the absence of personal protection equipment have contributed to high asbestos exposures in this workforce. A considerable increase in asbestos exposure potential when all plant processes are in operation, was evident when exposure results from the November, 1987, survey were compared to the March, 1988, survey. The additional processes operating during the March survey resulted in the highest full-shift and short term exposures documented in this plant. Although exposures at this plant were at levels widely recognized as dangerous to health, there was little evidence of disease. Why few physical signs of disease were observed may be explained by one or a combination of the following:

A. The Healthy Worker Effect

To complete the demands of everyday employment requires a degree of health and vigor. Workers affected by physical illness may not have the stamina needed to complete the demands of a work day and can be absent from the job due to sick leave, medical disability, or death. Those missing from the workforce (ill, retired, relocated, or deceased) would not be represented in a cross sectional study where volunteers from the active workforce are evaluated. This study at Chrysler was a cross-sectional study and would, by design, not fully characterize the effects of asbestos on health among those absent from the workforce. We did not evaluate all retirees or medically disabled individuals to determine the status of their health or characterize the contribution of asbestos to their disease.

B. An insufficient period has elapsed since exposure for disease to be observed.

The appearance of disease following exposure to asbestos is not immediate. In individuals who meet the combined requirements for development of disease (i.e., exposure and biological susceptibility), asbestos-related disease may follow 5 to 50 years later. Most asbestos-related disease occurs more than 20 years after exposure. Reviewing years of exposure among study participants at this plant (Table VI) we observe that only 17% of the chemical plant workers, and only 9% of the friction product workers had 20 or more years of exposure at their job. This may have been too short of a period following exposure for signs of asbestos-related disease to be prevalent.

VIII. RECOMMENDATIONS

The following recommendations were provided by letter to Chrysler dated December 4, 1987. These recommendations were offered as prudent precautions which should be taken to reduce the risk of asbestos exposure and subsequent adverse health effects. Many of these recommendations deal with requirements of the amended OSHA Asbestos Standard (Part 1910, Subpart Z, 1910.1001 dated June 20, 1986) with which Chrysler had not fully complied.

1. Chrysler should fully demonstrate that full-shift exposure levels are at or below the OSHA permissible exposure limit (PEL) as stated on page 22733, paragraph (d). This section reads: "Determinations of employee exposure shall be made from breathing zone air samples that are representative of the 8-hour TWA of each employee. Representative 8-hour TWA employee exposures shall be determined on the basis of one or more samples representing full shift exposures for each shift for each employee in each job classification in each work area." Chrysler had not conducted full shift monitoring on employees nor adequately documented representative full-shift exposures prior to the NIOSH survey. Based on review of Chrysler exposure monitoring data, it was felt that full-shift exposure levels had not been completely nor accurately determined. The OSHA standard on page 22734, paragraph (7)(i) and (ii) also requires written notification of exposure results be provided to sampled employees within fifteen working days.

2. Based on Chrysler and NIOSH exposure monitoring results, Chrysler should provide a 3-phase decontamination facility within the plant as required on page 22739 and diagrammed on page 22778 of the OSHA standard. All contaminated clothing should remain on the dirty side of this facility and stored in covered containers for laundry pick-up. Employees should use the decontamination facility to access the lunchroom and exit the plant. Respirators should be properly stored in this facility. Showers should be mandatory to exit the plant. The lunchroom should be under positive air pressure in relation to the decontamination area and the rest of the plant.

3. Access to, as well as egress from, the plant should be strictly limited. Workers from Building 20, deliverymen, and office workers were observed entering and exiting the plant from main and side entrances. Such practices are inconsistent with the concepts of regulated areas, which are adjacent to these entrances, and respirator usage in the plant. Workers from Friction Products should not be allowed to enter the Chemical Products Building or Building 20 without first changing out of their contaminated clothing. The removal and cleaning of sweeper filters should not be conducted in Building 20. Asbestos-contaminated materials and equipment should not be stored, cleaned, or maintained in Building 20. This includes the transport, storage, and sorting of contaminated coveralls in Building 20. The individual who sorts contaminated coveralls should wear proper respiratory protection. These practices should be restricted to, and potential exposure or environmental contamination contained in, the Friction Products Building.

4. The respiratory protection program should be refined and fully developed as required on page 22735 of the OSHA standard and in accordance with 29 CFR 1910.134 (b), (d), (e), and (f). The current program was deficient in several aspects with regard to these requirements. Employees should be informed of their right to request powered air-purifying respirators (PAPR) in lieu of any negative pressure respirator. Chrysler should require their respirator fit testing contractor to supply each individual employee tested with a "respirator fit factor card" as required by the OSHA Standard (see page 22746, section 9, e.). As of the date of the NIOSH survey, the contractor had not supplied these cards.

5. Smoking and tobacco use at all work stations in the plant should be immediately stopped. If smoking is to be allowed in the plant then an area, separate from work stations and regulated areas, should be designated and equipped with ventilation as per the ASHRAE guidelines. Currently these guidelines call for 60 cubic feet of air per minute (CFM) per occupant for smoking lounges which is exhausted directly to the outside.

6. Since Chrysler has defined "Regulated Areas", an Asbestos Standard Program should be developed and written in accordance with the OSHA requirements. Such a program should include and document a Compliance Program, Hazard Training Program, and a Right to Know Program (see pages 22735-22737 of the OSHA Standard). The Compliance Program should outline the plans and procedures intended to reduce exposures to or below the PEL. Chrysler should provide, upon request and at no charge to any employee, a copy of the OSHA Asbestos Standard (see page 22737 section iv, A).

7. Housekeeping should be conducted, and the environmental condition of the plant maintained, in accordance with section k, page 22737 of the OSHA Standard. Dry sweeping with brooms and shoveling of asbestos-containing materials or formulations should be discontinued immediately. Settled dust on all surfaces of the I-beam superstructure of the plant should be appropriately removed. NIOSH analytical results of settled dust from these areas indicate 30 to 50% chrysotile contamination.

8. Waste, scrap, debris, equipment, bulk dust, and all other asbestos contaminated materials should be collected and disposed of in impermeable bags or closed containers. These items should be disposed of in an EPA approved and licensed landfill. Written notification concerning the asbestos contamination of this waste should be provided to the contractor collecting and disposing of the waste. Similar notification should be provided to the laundry which cleans the asbestos-contaminated coveralls.

9. All employees, including supervisors, and visitors entering the Friction Products plant, should be provided with and required to wear appropriate clothing and respiratory protection. These individuals should be informed of the asbestos hazard within the plant. Tours of the plant by civic organizations, service clubs, or youth groups should not be conducted.

10. Chrysler should fully review their medical surveillance program to ensure the program coincides with requirements of the current OSHA Asbestos Standard (see pages 22737 through 22739).

11. Communication of the asbestos hazard via proper signage should be provided. Current warning signs and labels found in the plant do not meet the OSHA requirements outlined on page 22736 of the standard. There is also a lack of warning signs on containers of asbestos and in certain areas. As examples: each tote bin which is used to transport asbestos-containing mixtures should be labeled accordingly, and the entry door to the bag house of the dust collector should bear the appropriate warning sign.

12. NIOSH agrees with and fully supports Chrysler's efforts to implement effective engineering controls to reduce exposure potential and eliminate the need to use respirators. Effective engineering controls currently exist which are suitable for use in the production of brake shoes and pads. Such controls include:

    a. Screw or pneumatic conveyors to eliminate the need to shovel dry asbestos mixtures and eliminate the need for the many small tote bins currently used.

b. Bag opening mechanisms which reduce or eliminate the need for an operator to use his hands to open bags of asbestos, remove asbestos from the bag, or break chunks of asbestos up by hand. These mechanisms will also reduce the amount of asbestos aerosolized during this process.

c. Motorized wet vacuum sweepers in place of the motorized dry vacuum sweepers currently used. A wet vacuum system to clean floors and aisleways will eliminate aerosolization of asbestos fibers during sweeping and does not require filter removal and cleaning (another source of fiber aerosolization).

d. A centralized high-efficiency particulate air (HEPA) filtered vacuum system in place of the many drum type HEPA filtered vacuum cleaners would reduce asbestos exposure potential. The use of numerous individual vacuum cleaners require continuous maintenance, unit cleaning, and filter change. A centralized system, with numerous inlets throughout the plant, would be more convenient for operator use at the necessary work stations and aid in the enforcement of not using brooms for clean-up purposes. Such a system would reduce the amount of maintenance and required filter changes.

e. Local exhaust ventilation (LEV) on equipment or processes recognized to promote fiber aerosolization has been installed by Chrysler. However, the effectiveness of several of these LEV systems are questionable. Some LEV hoods were installed into existing duct work without appropriately adjusting the airflow of the system, or determining if the system had sufficient capacity for additional hoods. Flexible ducting used in the new installations has been identified by Chrysler as contributing to the inefficiency of at least one LEV hood. The LEV systems throughout the plant should be evaluated to assure their full effectiveness. A LEV system should be installed on the skip elevator at the point where the tote bins are removed from the elevator. Large clouds of dust are created when the bins are removed from this point. A LEV system should be installed at the dumping point from the mixers into the bins. Dust clouds were also observed being generated at this point. The drop curtains at this dumping station will not fully contain the dust generated by this process. These curtains were not being utilized during the survey. Of course, implementation of item a. above would not require installation of these LEV systems. All ventilation systems should be balanced in accordance with ACGIH Ventilation Guidelines and ANSI Z9.2-1979.

f. The mixers should be redesigned to prevent aerosolization of dust. A large cloud of dust is generated when the mixers are charged with formulation ingredients. Smaller amounts of dust are also generated during the mixing process. The seals on the charging ports and bearings of these mixers should be evaluated as part of a scheduled maintenance program.

g. Down draft tables should not be blocked with piles of brake pads and sizing plates. Down draft tables should be provided from the weighing table to the press so that the pads are continuously subjected to down draft ventilation. The collection bins of the BiPells should also be equipped with point source exhaust ventilation.

h. The unloading of brake linings from the saw conveyor to the oven racks should also be done on down draft tables.

i. The hammermill mezzanine should be completely enclosed and area exhaust ventilation installed.

j. The drum collection point from the hammermill should be enclosed and ventilated. This would prevent fiber emissions from general use and should an overfilling mishap occur. Also, the collection points should be located away from work stations.

k. Evaluate the feasibility of enclosing the bag house hoppers and screw conveyors which are currently just below roof level inside the facility. Ideally the conveyors should be outside the facility.

l. Should the above mentioned controls and work practices be instituted, consideration should be given to decontaminate the entire facility from top to bottom. This may be done in sections until the entire facility is completed with the intent of removing gross contamination.

13. An industrial hygienist should be assigned, on a full-time basis, to this plant to fully evaluate the extent of the asbestos hazard and implement recommended control measures. This individual could effect the necessary follow-up and communication of a comprehensive health and safety program for the plant. The recommendation is necessary because in the opinion of the NIOSH investigators, the current oversight of this effort by the labor relations and personnel departments, with remote support and input by the corporate industrial hygiene staff, is disjointed and ineffective. There are no clear lines of responsibility, authority, or enforcement. This is evident in the continued use

of brooms to dry sweep asbestos laden dust, smoking at work stations, and the nonchalant attitude toward respirator usage in the plant. Supervisors and employees without respirators were observed to frequent areas throughout the plant where other employees were wearing respirators.

14. Proper respiratory protection should be provided to employees in the plant who fight oven fires. These fires seem to occur frequently; one occurred two weeks prior to the NIOSH survey. Employees who fought this fire complained of eye irritation, nausea, dizziness, and difficulty breathing. Sampling should be conducted to characterize exposure to smoke, asbestos fibers, and chemicals likely to be encountered during this activity.

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XI. DISTRIBUTION AND AVAILABILITY OF REPORT

Copies of this report are currently available upon request from NIOSH, Hazard Evaluations and Technical Assistance Branch, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days, the report will be available through the National Technical Information Service (NTIS), 5285 Port Royal, Springfield, Virginia 22161. Information regarding its availability through NTIS can be obtained from NIOSH Publications Office at the Cincinnati address. Copies of this report have been sent to:

1. Chrysler Chemical Division
2. United Auto Workers Union, International
3. United Auto Workers Union, Local 372
4. NIOSH, Cincinnati Region
5. OSHA, Region V

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

Table I

Personal Breathing Zone Fiber Exposure Levels
Chrysler Friction Products
Trenton, Michigan

November 17-19, 1987
HETA 87-126

Date/Shift	Job/Location	Sample Time Minutes (Total)	Sample Volume Liters	Fibers/Filter	TEM Confirmed Asbestos*	Fibers/cc	8-hour TWA Fibers/cc
11/17/87							
1st	Weigh-up Mixer Operator	118	354	150000	*	0.42	
		77	231	120000	*	0.52	
		30	90	35000	*	0.38	0.45
1st	Weigh-up Mixer Operator	195	585	17000		0.03	
		170	510	ND		-	
		19	57	5000		0.09	
2nd	Weigh-up Mixer Operator	180	540	14000		0.03	
		194	582	8000		0.01	0.02
11/18/87							
1st	Weigh-up Mixer Operator	138	414	45000	*	0.11	
		160	480	110000	*	0.23	
		115	345	37000	*	0.11	0.16
11/17/87							
1st	Press Operator	221	663	92000	*	0.14	
		115	345	90000	*	0.26	
		65	195	19000	*	0.10	0.17
2nd	Press Operator	170	510	210000		0.41	
		95	285	100000		0.35	0.39
11/18/87							
1st	Press Operator	95	285	230000	*	0.81	
		182	546	170000	*	0.31	0.48

Table I, Page 2 (continued)

Date/Shift	Job/Location	Sample Time Minutes (Total)	Sample Volume Liters	Fibers/Filter	TEM Confirmed Asbestos*	Fibers/cc	8-hour TWA Fibers/cc
11/17/87 1st	Press Operator	146	438	58000		0.25	
		184	552	88000		0.23	
		112	336	69000		0.28	0.25
1st	Press Operator	151	453	87000		0.19	
		144	432	35000		0.08	
		96	288	55000		0.19	0.15
2nd	Press Operator	202	606	44000		0.07	
		214	642	38000		0.06	0.06
2nd	Press Operator	301	903	overload		-	
		84	252	31000		0.12	
2nd	Press Operator	237	711	25000		0.04	
		138	414	61000		0.15	0.08
2nd	Press Operator	149	447	430000		0.96	
		146	438	250000		0.57	0.77
2nd	Press Operator	216	648	99000		0.15	
		147	441	10000		0.02	0.10
11/18/87 1st	Press Operator	163	489	170000		0.35	
		187	561	100000		0.18	0.26
1st	Press Operator	189	567	69000		0.12	
		108	324	69000		0.21	0.15
11/19/87 3rd	Press Operator	317	951	overload		-	
3rd	Press Operator	339	1017	overload		-	
3rd	Press Operator	334	1002	90000		0.09	

Date/Shift	Job/Location	Sample Time Minutes (Total)	Sample Volume Liters	Fibers/Filter	TEM Confirmed Asbestos*	Fibers/cc	8-hour TWA Fibers/cc
11/17/87 1st	Grinder Operator	201	603	35000	*	0.06	
		170	510	40000	*	0.08	
		72	216	19000	*	0.09	0.07
11/18/87 1st	Grinder Operator	149	447	32000	*	0.07	
		233	699	39000	*	0.06	0.06
11/17/87 1st	K-Car Grinder Operator	198	594	10000		0.02	
		192	576	7000		0.01	0.02
11/18/87 1st	OEM Grinder	131	393	37000		0.09	
		192	576	65000		0.11	
		106	318	110000		0.35	0.16
11/17/87 1st	Saw Operator	143	429	110000	*	0.26	
		191	573	83000	*	0.15	
		48	144	23000	*	0.16	0.19
1st	Saw Operator	145	435	44000		0.10	
		187	561	29000		0.05	
		98	294	20000		0.07	0.07
11/18/87 1st	Saw Operator	116	348	46000	*	0.13	
		123	369	28000	*	0.08	
		110	330	21000	*	0.06	0.09
11/18/87 1st	Barker Bonder	177	531	78000	*	0.15	
		151	453	45000	*	0.10	
		99	297	37000	*	0.13	0.13
11/19/87 3rd	Barker Bonder	292	876	62000		0.07	0.07

Date/Shift	Job/Location	Sample Time Minutes (Total)	Sample Volume Liters	Fibers/Filter	TEM Confirmed Asbestos*	Fibers/cc	8-hour TWA Fibers/cc
11/17/87 1st	Materials Driver	113	339	27000		0.08	
		170	510	32000		0.06	
		60	180	10000		0.06	0.06
11/17/87 1st	Materials Driver	157	471	22000		0.05	
		193	579	40000		0.07	
		94	282	17000		0.06	0.07
2nd	Materials Driver	342	1026	28000		0.03	
		100	300	10000		0.03	0.03
11/18/87 1st	Materials Driver	148	444	30000		0.07	
		155	465	10000		0.02	
		116	348	17000		0.05	0.05
11/19/87 3rd	Materials Driver	326	978	15000		0.15	0.15
11/17/87 1st	Millwright	177	531	130000	*	0.25	
		172	516	70000	*	0.14	
		104	312	43000	*	0.14	0.18
1st	Millwright	178	534	33000		0.06	
		145	435	24000		0.06	
		126	378	8000		0.02	0.05
2nd	Millwright	177	354	20000		0.07	
		240	480	overload		-	
		168	336	15000		0.04	

Table I, Page 5 (continued)

Date/Shift	Job/Location	Sample Time Minutes (Total)	Sample Volume Liters	Fibers/Filter	TEM Confirmed Asbestos*	Fibers/cc	8-hour TWA Fibers/cc
11/17/87 2nd	Millwright	167	501	49000		0.10	
		119	357	4000		0.01	0.06
11/18/87 1st	Millwright	130	390	86000		0.22	
		139	417	23000		0.06	
		139	417	21000		0.05	0.11
1st	Millwright	133	399	16000		0.04	
		135	405	1500		<0.01	
		157	471	overload			
11/19/87 3rd	Millwright	353	1059	140000		0.13	0.13
11/17/87 1st	Millwright	73	219	10000		0.05	0.05
11/17/87 1st	Electrician	181	543	95000		0.18	
		175	525	55000		0.11	
		99	297	29000		0.10	0.17
11/17/87 1st	Electrician	278	834	39000		0.05	
2nd		173	519	<1500		ND	
11/19/87 3rd	Electrician	386	1158	68000		0.06	0.06
11/17/87 1st	Jitney Repair	196	588	72000		0.12	
		187	561	16000		0.03	
		62	186	2100		0.11	0.08

Table I, Page 6 (continued)

Date/Shift	Job/Location	Sample Time Minutes (Total)	Sample Volume Liters	Fibers/Filter	TEM Confirmed Asbestos*	Fibers/cc	8-hour TWA Fibers/cc
11/17/87							
1st	Inspector	167	501	72000	*	0.14	
		170	510	65000	*	0.13	
		102	306	76000	*	0.23	0.16
1st	Inspector, K-Car	121	363	10000		0.03	
		170	510	25000		0.05	
		75	225	3000		0.01	0.04
11/18/87							
1st	Inspector, Barker	146	438	26000		0.06	
		154	462	42000		0.09	
		106	318	53000		0.17	0.10
1st	Inspector	154	462	140000		0.30	0.30
1st	Inspector, Grinder	162	486	180000		0.37	
		149	447	56000		0.13	
		134	402	28000		0.07	0.20
11/19/87							
3rd	Inspector	379	1137	250000		0.22	0.22
11/17/87							
1st	Relief Man	144	432	52000		0.12	
		185	555	48000		0.09	
		102	306	59000		0.19	0.12
11/18/87							
1st	Janitor	124	372	72000		0.19	
		268	804	8000		0.01	0.06
1st	Janitor, Oiler	104	312	87000	*	0.28	
		124	372	41000	*	0.11	
		63	189	49000	*	0.26	0.20

Date/Shift	Job/Location	Sample Time Minutes (Total)	Sample Volume Liters	Fibers/Filter	TEM Confirmed Asbestos*	Fibers/cc	8-hour TWA Fibers/cc
11/19/87 3rd	Plate Coater	321	963	42000		0.04	0.04
11/19/87 3rd	Shop Steward	153	459	9000	*	0.02	0.02

* - Confirmation of asbestos fibers and type of asbestos (chrysotile) performed by Transmission Electron Microscopy (TEM) on these selected samples. Chrysotile asbestos was identified in all samples selected for this analysis.

The analysis of these filter samples was conducted according to NIOSH Method 7400, Phase Contrast Microscopy, using the A counting rules. The fibers reported in this table are >5um in length and >0.25um in diameter. The Limit of Detection for this particular set of analyses was determined to be 0.03 fibers/field or 1500 fibers/filter for 25mm filters.

The OSHA personal exposure limit to which any worker may be exposed shall not exceed 0.2 fibers per cubic centimeter as an eight-hour time-weighted average. It is NIOSH's contention that there is no safe concentration of asbestos exposure.

Table II

Personal Breathing Zone Fiber Exposure Levels
Chrysler Friction Products
Trenton, Michigan

March 29-30, 1988
HETA 87-126

Date/Shift	Job/Location	Sample Time Minutes (Total)	Sample Volume Liters	Fibers/Filter	Fibers/cc	8-hour TWA Fibers/cc
3/29/88	#2 BiPell					
1st	Operator	108	292	120,000	0.41	
		78	234	120,000	0.51	0.18
1st	#2 BiPell					
	Operator	108	120	83,000	0.69	
		78	86	63,000	0.71	0.27
1st	K-Car					
	Grinder Operator	105	294	62,000	0.21	
		99	282	82,000	0.29	0.11
1st	K-Car					
	Grinder Operator	105	116	20,000	0.17	
		99	109	63,000	0.58	0.16
1st	Hi-Lo Driver	85	238	96,000	0.40	
		105	301	90,000	0.30	0.14
1st	Hi-Lo Driver	85	85	51,000	0.60	
		105	105	27,000	0.26	0.16
3/29/88	2.6 BiPell	87	244	360,000	1.48	
1st	Press Operator	98	284	380,000	1.33	0.54
1st	2.6 BiPell	87	78	200,000	2.56	
	Press Operator	98	98	200,000	2.04	0.88

Table II, Page 2 (continued)

Date/Shift	Job/Location	Sample Time Minutes (Total)	Sample Volume Liters	Fibers/Filter	Fibers/cc	8-hour TWA Fibers/cc
3/29/88						
1st	2.6 M-Body	82	226	470,000	2.08	
	Press Operator	95	276	540,000	1.96	0.74
1st	2.6 M-Body	82	82	260,000	3.17	
	Press Operator	95	142	410,000	2.89	1.11
1st	Saw Operator	83	241	260,000	1.08	
		89	267	86,000	0.32	0.25
1st	Saw Operator	83	83	78,000	0.94	
		89	98	110,000	1.12	0.37
1st	Supervisor	98	284	63,000	0.22	0.05
1st	Supervisor	98	98	20,000	0.20	0.04
3/30/88						
1st	K-Car					
	Press Operator	89	254	130,000	0.51	
		96	278	110,000	0.40	0.17
1st	K-Car					
	Press Operator	89	98	90,000	0.92	
		96	106	53,000	0.50	0.27
1st	Mixer Oper.					0.11
	OEM Batch	89	254	100,000	0.39	
	1860 Batch	56	162	59,000	0.36	
1st	Mixer Oper.					0.17
	OEM Batch	89	98	84,000	0.86	
	1860 Batch	56	45	6,000	0.13	
1st	Saw Operator	88	264	120,000	0.45	
		146	438	140,000	0.32	0.18
1st	Saw Operator	88	88	38,000	0.43	
		146	146	42,000	0.29	0.17

Table II, Page 3 (continued)

Date/Shift	Job/Location	Sample Time Minutes (Total)	Sample Volume Liters	Fibers/Filter	Fibers/cc	8-hour TWA Fibers/cc
3/20/88						
1st	2.6 Barker Oper.	89	267	130,000	0.48	
		150	450	160,000	0.36	0.20
1st	2.6 Barker Oper.	89	98	44,000	0.45	
		150	180	50,000	0.28	0.17
1st	OEM Grinder Oper.	98	287	68,000	0.23	
		135	391	52,000	0.13	0.08
1st	OEM Grinder Oper.	98	88	160,000	1.82	
		135	121	20,000	0.17	0.42
1st	Hi-Lo Driver	84	244	51,000	0.21	
		101	303	45,000	0.15	0.07
1st	Hi-Lo Driver	84	101	38,000	0.38	
		101	111	28,000	0.25	0.12
3/30/88						
1st	Extruder Operator	131	380	81,000	0.21	0.06
1st	Extruder Operator	131	144	9,000	0.06	0.02
1st	K-Car Barker Oper.	80	240	110,000	0.46	
		113	328	180,000	0.55	0.21
1st	K-Car Barker Oper.	80	88	45,000	0.51	
		113	113	53,000	0.47	0.20
1st	2.6 Press Oper.	71	202	290,000	1.43	
		99	277	420,000	1.52	0.53
1st	2.6 Press Oper.	71	71	260,000	3.66	
		99	99	270,000	2.73	1.10

Table II, Page 4 (continued)

Date/Shift	Job/Location	Sample Time Minutes (Total)	Sample Volume Liters	Fibers/Filter	Fibers/cc	8-hour TWA Fibers/cc
3/30/88 1st	Supervisor	239	720	110,000	0.15	0.07
1st	Supervisor	239	263	55,000	0.21	0.10

****
The analysis of these filter samples was conducted according to NIOSH Method 7400, Phase Contrast Microscopy using the A counting rules. The fibers reported in this table are >5um in length and >0.25um in diameter. The Limit of Detection for this particular set of analyses was determined to be 7 fibers/mm^2 or 3000 fibers/filter for 25mm diameter filters.

****
The OSHA Permissible Exposure Limit (PEL) to which any worker may be exposed shall not exceed 0.2 fibers per cubic centimeter as an eight-hour time-weighted average. It is NIOSH's contention that there is no safe concentration of asbestos exposure. For presentation of the 8-hour TWA exposure in this table, the unsampled time period was assigned a concentration of 0.0 fibers/cc in the calculation of the full-shift exposure level. This approach provides a conservative estimate of exposure; however, it is reasonable to assume the unsampled portion of the shift was similar in exposure potential.

TABLE III

Area Air Monitoring for Fibers
Chrysler Friction Products
Trenton, Michigan

November 17-19, 1987
HETA 87-126

Area Location	Sample Volume Liters	Asbestos Fibers/Filter	Fibers/cc
Cafeteria	160	8000	0.05
Union Room/Bldg. 20	690	3000	0.01
Alley between Bldg. 20 and Friction Products	685	ND	ND
Inside Bldg. 20	610	ND	ND
Roof of Friction Products	912	ND	ND
Parking Lot	810	ND	ND
Outside of Dust Collector House	670	ND	ND
Outside next to overhead door into Friction Products	645	ND	ND

Samples were collected by portable sampling pump and 25 mm diameter cellulose ester filters. The filters were analyzed by PCM according to NIOSH Method 7400.

ND - Non-Detectable

TABLE IV

Asbestos Contamination of Personal Clothing & Automobiles
Chrysler Friction Products
Trenton, Michigan

November 17-19, 1987
HETA 87-126

Job	Source of Vacuum Sample	Asbestos Contamination
Inspector	Personal Clothing	Positive
Millwright	Personal Clothing	Positive
Fork Lift Operator	Personal Clothing	Positive
OEM Grinder Operator	Personal Clothing	Positive
Inspector	Personal Clothing	Positive
BiPell Press Operator	Personal Clothing	Positive
Inspector k-Car	Seat of Automobile	Positive
Barker Bonder	Personal Clothing	Positive
Millwright	Seat of Automobile (car less than 1 year old)	Negative
Electrician	Seat of Automobile	Positive
Jitney Repair	Seat of Automobile	Positive
OEM Grinder Operator	Seat of Automobile	Negative
Press Operator	Seat of Automobile	Positive

Samples were collected by using a portable sampling pump and a 25 mm diameter cellulose ester filter to "vacuum" the sampled surface for 3 minutes. The filters were analyzed by PCM for determination of fibers; confirmation of asbestos fibers was made by TEM analysis.

TABLE V

Bulk Settled Dust Samples for Asbestos Content
Chrysler Friction Products
Trenton, Michigan

October 14, 1987
November 17-19, 1987
HETA 87-126

Date	Sample Location	% Chrysotile Asbestos
10/14/87	Vent. duct above Mix/Weigh-up Area	10
	Floor below #4 Mixer	30-40
	I-Beam Structure Supporting Mixer	20-25
	I-Beam above #2 BiPell Press	40-50
	Floor below Screw Conveyor for Cyclone Dust Collector	40-50
	Light fixture above OEM Grinder	5-10
11/17-19/87	Debris below Dust Collector Exhaust outside building	10
	Debris below Dump Chute from Dust Collector	5-10
	Debris below Conveyor from Dust Collector	5-7
	Dust on roof of building	1-2
	Dust at air intake on roof of building	5-10
	Dust from Push Broom	1-3
	Dust at Sewer Grate where filters from Vacuum Sweeper are washed in Bldg. 20.	1-3

These samples were analyzed for percent and type of asbestos according to polarized light microscopy. The percentage of asbestos is estimated by a microscopic examination of the sample. If present, asbestos identities are confirmed with the appropriate refractive index liquids applying dispersive staining techniques.

TABLE VI

Cumulative Years of Workforce Experience
Chrysler Friction Products
Trenton, Michigan

November 17-19, 1987
HETA 87-126

	10 or more years		15 or more years		20 or more years	
	# Persons	% Workforce	# Persons	% Workforce	# Persons	% Workforce
Chrysler	158	92%	140	82%	71	42%
Chemical Products	80	47%	59	35%	29	17%
Friction Products	83	49%	52	30%	16	9%