U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
CENTER FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45226

HEALTH HAZARD EVALUATION AND TECHNICAL ASSISTANCE
REPORT NO. HE 78-72-618

KENTILE FLOORS INC.
SOUTH PLAINFIELD, NEW JERSEY

SEPTEMBER 1979

I. TOXICITY DETERMINATION

A survey team for the National Institute for Occupational Safety and Health (NIOSH) performed a Health Hazard Evaluation at Kentile Floors Inc., South Plainfield, New Jersey on June 28-29, and October 11-12, 1978, regarding alleged exposures to vinyl chloride monomer, dyes and pigments.

The methodology used to evaluate the workers' environment included: (1) environmental air sampling, (2) a review of materials inventory and materials safety data sheets, (3) medical interviews and evaluations of workers, (4) a review of pertinent scientific literature, (5) a review of the company's respirator program, (6) observations of employees' work practices and engineering controls.

Environmental air samples and bulk samples were collected and analyzed for the following contaminants (Tables I-V): carbon black, polynuclear aromatic hydrocarbons (PNA)-(benzo(a)pyrene, pyrene, chrysene, phenanthrene, anthracene, benzene-soluble fraction), mineral spirits, methyl chloroform, benzene, barium, cadmium, talc, lead and total dust. A potential health hazard was found to exist based on the samples collected for lead. Two personal samples exceeded the recommended OSHA inorganic lead standard, and four samples exceeded the Occupational Safety and Health Administration (OSHA) standard for exposure to total nuisance particulate. Sample results for all other contaminants were below recommended exposure criteria.

No medical evidence of work-related illness was detected at the plant.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report are currently available upon request from NIOSH, Division of Technical Services, Information Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days the report will be available through the National Technical Information Services (NTIS), Springfield, Virginia. Information regarding its availability through NTIS can be obtained from NIOSH Publications Office at the Cincinnati address. Copies of this report have been sent to the following:

A. Kentile Floors Inc., South Plainfield, New Jersey
B. Authorized representatives of United Rubber Workers (URW), Local No. 472, South Plainfield, New Jersey.
C. International Union of URW, Akron, Ohio
D. NIOSH - Region II
E. U.S. Department of Labor - Region II

For the purpose of informing the approximately 50 "affected employees", the employer shall promptly "post" for a period of 30 calendar days, the Determination Report in a prominent place(s) near where the exposed employees work.

III. INTRODUCTION

Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 USC 669(a)(6) authorizes the Secretary of Health Education and Welfare, following a written request by an employer or authorized representative of employees to determine whether any substance normally found in the place of employemnt has potentially toxic effects in such concentrations as used or found. The National Institute for Occupational Safety and Health received such a request from an authorized representative of employees. This request stemmed from a similar request submitted by the Internaional Union representatives on behalf of employees at Kentile Floors, Inc. at Chicago, Illinois. This request alleged that employees may be exposed to vinyl chloride monomer, dyes and pigments. A walk-through survey of the entire facility was performed by NIOSH representatives with union and management representation. This allowed the investigators to better understand the general operation in order to perform a comprehensive evaluation during the follow-up survey. Additionally, this survey allowed the union representative to identify areas the employees considered hazardous.

IV. HEALTH HAZARD EVALUATION

A. Process Description and Evaluation

Kentile Floors Inc. is a manufacturer of vinyl coving and vinyl floor covering. The company employs 275 workers of which 225 are production workers. The employees work one of three 8-hour shifts, five days per week.

Safety equipment such as respirators, goggles, safety shoes, face shields, safety glasses, etc. are furnished to the people, depending upon where the employee works. The employees either clean their own respirators or the respirators may be given to the plant nurse to be cleaned and sanitized. The plant policy requires monthly sterilization of respirators.

Employees who work in extremely dirty areas (e.g. Bldg. 13, the process room, or Bldg. 1, the compounding department) are issued two lockers in order to store clean and dirty clothes separately. Shower facilities are also available; however, showers are not mandatory.

The company performs environmental air sampling for total dust once per year. Sampling for vinyl chloride monomer is no longer performed because the environmental levels were measured to be a factor of five below the OSHA standard.

The areas evaluated were the process room, the scrap blending area, the press area and the compounding department.

1. Process Room - The process room, located in Building 13, is where the chemical weighing and mixing is performed. This department is a one-shift operation comprised of several jobs which include:

   a. Compounding Area - Two compounders load a compound charging hopper with specific quantities of dry chemicals. The quantities and chemicals vary depending upon the product being formulated. These chemicals are conveyed to one of four pre-blenders located on the mezzanine level. Additionally, the compounders add resin and cadmium-barium stabilizers to the pre-blenders. The chemicals are mixed until the Banbury operator presses a switch which allows the pre-blend mix to be conveyed to the *Banbury® mixer on the first level.

   b. Pigment Scale Operator - The operator weighs prescribed quantities of pigments (colors change from day to day) at a table adjacent to the Banbury mixer platform. The pigment is placed in a plastic bag and the bags are conveyed up to the Banbury operators platform. There was no local exhaust ventilation at the pigment table. The ambient air currents measured at the workers' station ranged from 50-125 feet per minute (fpm).

   c. Scrapping Operation - This operator uses a modified fork lift truck to lift 55 gallon drums (two at a time) which are filled with scrap and emptied into one of two hoppers. The scrap material is conveyed to one of seven blenders located on the mezzanine level. The material is mixed for a specific amount of time; afterwhich, the scrap is conveyed to the Banbury mixer with the pre-blend mix.

   d. Banbury Mixer operator - The operator alternately charges one of two Banbury mixers with a batch of chemicals from the

*Mention of commercial names or products does not constitute endorsement by NIOSH

pre-blender and the blender. The operator also adds the tared plastic bag of pigments. The chemicals are mixed and subsequently dropped onto a conveyor belt belwo. The mixture when released is hot (160° - 300°F) due to frictional mixing. The mixture is then pelletized, rolled into sheets, gauged by calendars, cooled, cut and stacked; afterwhich, the vinyl sheets are sent to the curing department.

The first floor and the mezzanine level of Building 13 occupy 38,000 and 20,000 square feet (ft^2) respectively. The average ceiling height is estimated to be 25 feet (ft.). The exhaust ventilation rate for Building 13 is reported to be 69,400 cubic feet per minute (cfm). The make up air is reported to be 59,450 cfm. The make up air rate does not include ventilation through the five large doors (10 X 10'). The conveyor exhaust transport velocity was reported to be 7,500 feet per minum (fpm). The building fans are heavy-duty vane axial which can operate at eight inches of water pressure. Each of the blenders and pre-blenders with the exception of one pre-blender have local exhaust ventilation which leads to the roof.

2. Scrap Blending Area - This operation, housed in a portion of Building 6, is operated by two blender operators and one fork lift operator. The process is operated eight hours per day, three days per week. Fifty-five gallon drums of various scrap tile colors are emptied into one of two blenders and mixed to insure a uniform color of the same product. Afterwards, the empty drums are refilled and stored until they are needed.

   The scrap blending area is about 94,428 cubic feet (ft^3). The roof exhaust ventilation was reported to operate at 650 cfm, and the make up air was reported to be 5,800 cfm. Additionally, a curtain door (12' X 12') is continually open to the outside. There is a local exhaust duct (10.5 inches by 2.5 inches) adjacent to the scrap delivery nozzle which is used to collect dust at the source. The exhaust rate at the face of the exhaust duct was 2,000 feet per minute.

3. Press Area - The press operation located in part of Building #1 is a three shift, 8-hour day, 5 day per week operation. There are 9 small presses and eleven large presses. However, all of the presses are not necessarily operated at the same time. The presses are used to cure plain vinyl sheets and/or vinyl sheets with specially designed vinyl inserts. A mold release agent is sprayed on all the presses, and a solvent/wax solution is applied to the vinyl sheets cured on the small presses only. The wax solution may be applied any time after the sheets have been cured, but the workers choose to wax the vinyl sheets as soon as they are removed from the oven.

The press area was estimated to occupy about 314,000 ft^3 and have 2.9 air changes per hour. The exhaust ventilation consists of eight roof mounted exhaust fans which are independently controlled and seven window fans.

4. Compound Department - This department is also located in Building 1. There are several operations performed in this department which include:

   a. Charging Area - Three compounders load various dry chemicals (e.g. calcium carbonate, lead silico sulfate, polyvinyl chloride, etc.) into a charging hopper. The chemicals are vacuumed transported to one of three reserve tanks on the third floor where the compounder adds pigment, resin and stabilizers. Once the chemicals have been thoroughly mixed, the chemicals are conveyed on demand to the Banbury machine. After the reserve tank is emptied, the Banbury operator depresses a switch which sounds an auditory signal to the compounders so that they can recharge the reserve tank.

   b. Waste Scale Area - One worker spends several hours per day weighing out prescribed quantities of pigments and stabilizers into plastic bags. The scale is enclosed on three sides and equipped with two exhaust ducts to control dust generation. Once a 55 gallon drum has been filled with the plastic bags of pigment and stabilizers, the drum is transported to the Banbury operator on the mezzanine level. The compounder then assists the two other workers who charge the compound hopper.

   c. Banbury Operation - The Banbury operator charges the mixer with scrap material, resin, a bag of pre-weighed pigment and a batch load from the reserve tank. The Banbury operator charges the mixer and subsequently empties the hot load onto a conveyor belt below. The material is pelletized, filled into 55 gallon drums, and stored until it is needed.

   The compound department was estimated to be 124,000 ft^3 and the ventilation rate was reported to be 2.9 air changes per hour. The charging hopper which can be loaded from two sides is 9 feet by 6 feet with a one-inch slot exhaust system along the entire center length. The face capture velocity was measured and averaged to be about 1,100 fpm.

   The reserve tanks located on the third floor were all equipped with an exhaust system which was vented to the roof.

The Banbury mixer has two adjacent exhaust ducts at the chute entrance which are designed to operate at 200-300 cfm per square foot of open face area, and one exhaust duct within the mixer.

B. Evaluation Design

1. Environmental/Medical Survey

On June 28, 1978, an initial environmental/medical survey was conducted simultaneously at Kentile Floors, Inc., South Plainfield, New Jersey in order to minimize plant disruption.

After the opening conference a walk-through inspection was made with both management and labor representatives. The entire facility was visited so that the NIOSH representatives would better understand the general operation. Several processes were not operational during our visit (scrap recycling, pulverization process and the scrap mixers); consequently, management volunteered to shift personnel in order to demonstrate those processes not being used. Rather than cause unnecessary disruption to the plant operation, it was decided by the project officer, and agreed to by the plant manager, that those processes not used during the initial visit would be operational for the follow-up survey.

2. Environmental

No environmental air samples were collected during the initial visit. The purpose of the initial visit was to perform a cursory evaluation, obtain a copy of the material inventory list, and collect any other information that would be beneficial in planning a comprehensive follow-up survey.

Two bulk samples of talc material were collected and sent to the laboratory for analyses, for the presence of free silica and asbestos.

One employee (#11 mixer operator) was in possession of, but not using, a respirator in poor condition. The respirator was missing an exhaust valve cover, and the exhaust valve was defective. Furthermore, the employee was not cognizant that his respirator was in poor condition.

Several employees in the curing room complained of inadequate air movement and improperly operating exhaust fan louvers. The ventilation system, for the curing room, was inspected with the maintenance supervisor. He stated that the ventilation system

is inspected and lubricated twice a year. However, the exhaust fan louvers are not periodically maintained. The two banks of exhaust fans revealed the following difficulties. One bank, consisting of four exhaust fans only had one fan switch turned on and three switches turned off. The remaining three switches were activated and found to be operational. The second bank, consisting of two exhaust fans, had two defective switches, one of which was cracked. These exhaust fan louvers appeared to be coated with an oil residue. An attempt was made to inspect the louvers more closely to determine whether the louvers were movable or stationary; however, the louvers were not visually accessible from the roof.

Additionally, it could not be determined who was responsible for activating the exhaust fan switches at the beginning of the shift.

3. Medical

Medical evaluation consisted of (1) a walk-through inspection of the facilities with the President of URW, Local 472, and with management representatives; (2) private consultation with any employees who believed their health was adversely affected by working conditions in the plant; (3) consultation with the Kentile Industrial physician; (4) interviews with workers randomly selected during the second walk-through inspection on the second day.

During the walk-through inspection of June 28, 1978, the NIOSH physician ascertained from the President, URW, Local 472 that apart from one worker who claimed that his chest was affected by fumes from a mixer, he was not aware of any significant work-related health problems among the employees.

It was requested of him that he inform all workers that the government doctor would be present in the plant on the following day, and would be available for private consultation with any employee who believed that their health was adversely affected by working conditions in the plant.

On the following morning the NIOSH doctor met the industrial physician retained by Kentile Floors, Inc., for the past 25 years. He attends for one hour each day, for four days in the week.

He stated that there were no significant health problems in the plant, and that there is a broad health and welfare program in effect.

Management responds to all his recommendations with respect to potential health hazards.

This industrial physician performs all pre-placement examinations, receives all physicians' return-to-work slips, and he sees all forms received from insurance health claims.

He also interviews any worker who has been absent from work, for health reasons, for a period in excess of 3 days.

The NIOSH medical officer then repeated the previous day's walk-through, speaking to workers, at random, and questioning them as to whether they or their co-workers, believed that they were suffering from any work-related disease.

The physician was again informed that a worker on a mixer believed that his chest was affected. This man was not then present for consultation.

Men working on the waxing hot sheet complained of headaches and upper respiratory tract irritation, whilst this process was in operation.

The NIOSH doctor experienced throat irritation whilst speaking to these workers.

Four workers presented at the First Aid room for consultation one of whom was the man referred to by the President, URW, Local 472.

None was currently suffering from any work-induced - or aggravated - health problems associated with materials handled and/or generated at this plant.

The men complaining of chest problems were briefly examined.

One of these workers who requires medical follow-up has been informed by letter of this recommendation.

C. Evaluation Methods

Environmental

Personal and area samples were used to evaluate employee exposure. The personal samples were attached to the workers' shirt collar in order to characterize a breathing zone sample. The area samples were 1.0 foot to 5.0 feet from the workers' breathing zone. Depending upon the type and condition of the filter, samples were either

collected for as much of an eight-hour shift as possible, or 2 four-hour samples were collected. Additionally, the sampling pump flow rates were calibrated daily.

Carbon Black - Carbon black dust samples were collected with Mine Safety Appliance (MSA)® Model G battery operated personnel sampling pumps. A known volume of air is drawn through a cassette containing a tared 37-millimeter (mm) diameter 2.0 micrometer (um) pore-sized polyvinyl chloride (PVC) filter (type FWSB). The sampling pumps operated at 1.5 liters per minute for four hours. The analytical method consists of weighing the filter in a clean tared crucible. The crucible and filter were placed in a muffle and the filter was ashed by gradually raising the termperature to 800°C. After ashing, the crucible was re-weighed. The loss on ignition represents the weight of the filter plus the carbon black contained in the sample.

Benzene-Soluble Fraction and Polynuclear Aromatic Hydrocarbon - Collection of benzene-soluble fraction is accomplished by using a MSA pump in conjunction with a sampling cassette containing a 37-mm diameter/0.8 um pore size glass fiber-silver membrane filters. The sampling train (pump and filter) is operated at 1.5 liters per minute (lpm).

1. Benzene-Soluble Fraction - The samples were analyzed by NIOSH Physical and Chemical Analytical Method (P&CAM) #217. The particulate matter on the filters was extracted with benzene ultrasonically. After extraction, the benzene solution was filtered and evaporated to dryness in a tared Teflon boat; the weight gain was due to the benzene-soluble residue in one-half the sample.

2. PNA - The samples were analyzed by reversed-phase high pressure liquid chromatography. Analytical procedures involve the application of a methanol/water solvent gradient. The ultraviolet detection scans the sample at 365 nanometers (nm) and 280 nm simultaneously which aids in compound identification. (P&CAM 206 modified technique)

Solvents - (Mineral Spirits, Methyl Chloroform and Benzene) - A sampling train consisting of a Sipin® vacuum pump and a 150 milligram charcoal tube was used to sample a known volume of air. Air contaminants are adsorbed to the charcoal grains and later analyzed. The two sections of the charcoal tube are separately desorbed in a 1.0 ml of carbon disulfide

containing dodecane as an internal standard. An aliquot is analyzed by gas chromatography with a flame ionization detector according to the NIOSH method #127 modified.

Metals (Barium, Cadmium and lead) - A sampling train (MSA pump and a 37-mm 0.8 um pore size mized cellulose ester membrane filter) was operated at a flow rate of 1.5 lpm. The filters were dissolved in nitric acid and perchloric acid. An aliquot was subsequently analyzed by atomic absorption spectrophotometry (NIOSH method No. 173).

Total Nuisance Particulate - A personal sampling train with a tared 37-mm diameter/5.0 um pore size, tared polyvinyl chloride filter or its equivalent was used to collect nuisance dust. The pump was operated at 1.5 lpm for the prescribed time or until the filter appeared to be overloading with dust particulate. The filter was analyzed gravimetrically according to NIOSH method #29. The weight of the sample was determined by subtracting the tare weight from the total weight.

Bulk Samples - Several bulk samples were submitted to the laboratory for analyses:

1. Talc - Two bulk samples were submitted to the laboratory for analyses of free crystalline silica and asbestos identification.

2. Carbon Black - One bulk sample was submitted for analyses of benzene soluble fraction and PNA identification.

D. Evaluation Criteria and Toxicity Data

There are several criteria used to evaluate the toxic air contaminants for an employee's work environment: (1) NIOSH Criteria Documents for a Recommended Occupational Health Standard, (2) Proposed and Recommended Threshold Limit Values (TLV's) as suggested by the American Conference of Governmental Industrial Hygienists (ACGIH), 1976, (3) the OSHA Standards.

The criteria for each contaminant are based upon the current state of knowledge concerning toxicity of these substances. The criteria are designed to allow an occupational exposure for up to a 10-hour work day, 40-hour work week as a time-weighted average (TWA) over a normal lifetime without the worker experiencing discomfort. In some instances, a few employees may experience adverse health effects at or below the TWA.

There are some airborne contaminants for which this TWA is inadequate; consequently, the substance may be proceeded by the letter "C'. This

letter indicates a ceiling value for a sampling interval of 30 minutes or less. the ceiling value is used to identify hazardous substances which are fast acting and should not be exceeded.

The criteria mentioned above has been tabulated, footnoted and compared to the OSHA Standard listed in the Code of Federal Regulations (CFR), (1978) Title 29, Part 1910, Subpart 2, Section .1000. The OSHA Standard has been cited so that the reader may see which of the standards have been exceeded.

SUBSTANCE	TIME-WEIGHTED AVERAGE 8-HOUR	TIME-WEIGHTED AVERAGE 10-HOUR	CEILING VALUE	MINUTES
Carbon Black[1]		3.5 mg/m^3[a] and 0.10 mg/m^3 as cyclohexane extractable substance		
Polynuclear Aromatic Hydrocarbons (PNA)[2]		0.2 mg/m^3 as benzene or 0.1 mg/m^3 cyclohexane extractable in the presence of specific PNA's		
Refined Petroleum Solvents[3] (Mineral Spirits or Naphtha)		55 ppm[b]	283 ppm	15
Methyl Chloroform[4]		350 ppm		
Benzene[5]			1 ppm	60
Barium[6] (soluble compounds)	0.5 mg/m^3			
Cadmium[7]		40 ug/m^3[c]	200 ug/m^3	15
Inorganic Lead[8]		0.05 mg/m^3		
Inert Nuisance Dust[9]		10 mg/m^3		

a) mg/m^3 - Approximate milligrams of particulate per cubic meter of air
b) ppm - parts of a vapor or gas per million parts of contaminated air by volume
c) ug/m^3 - Approximate micrograms of particulate per cubic meter of air

1. NIOSH Criteria Document (1978). The OSHA Standard (1978) is 3.5 mg/m^3.

2. NIOSH has no specific criteria for each PNA. Thus, PNA's are evaluated as cyclohexane extractable substances in the presence of PNA's for a

specific substance, e.g. coal tar pitch, carbon black, etc. The OSHA standard and TLV evaluates PNA's as a benzene soluble fraction (0.20 mg/m^3) for a specific substance, e.g. coal tar pitch.

3. NIOSH Criteria Document (1977). The OSHA standard (1978) is 63 ppm.

4. NIOSH Criteria Document (1976). The OSHA standard (1978) is 350 ppm.

5. NIOSH Recommendation Revised as part of NIOSH testimony at OSHA Hearing (1977). The a OSHA standard is 10 ppm.

6. The OSHA Standard (1977) and TLV Document (1977).

7. NIOSH Criteria Document (1976). The OSHA Standard (1978) is .2 mg/m^3 as an 8-hour TWA.

8. The OSHA Standard (1979) is 0.05 mg/m^3.

9. ACGIH TLV Document (1978). The OSHA Standard (1978) is 15.0 mg/m^3.

Toxicity Data

Lead

Although capable of causing acute toxicity when absorbed in large amounts, lead is usually associated with chronic toxicity due to absorption of lesser amounts over prolonged periods of time. The major route of entry of lead, and its inorganic compounds, is the lung, although slight amounts may be ingested.

The early effects of lead poisoning are non-specific, and except for laboratory testing, are difficult to distinguish from the symptoms of minor seasonal illness. The symptoms are decreased physical fitness, fatigue, sleep disturbance, headache, aching bones and muscles, digestive symptoms (particularly constipation), abdominal pains, and decreased appetite. These symptoms are reversible and complete recovery is possible when removed from exposure.

The three systems most commonly affected are the bone marrow (producer of red blood cells), the nervous system, and the kidneys.

Because of more efficient material handling methods and biological monitoring, serious cases of lead poisoning are rare in industry today.

Inert Dust

Although exposure to levels of inert, or nuisance, dust in excess of OSHA's standard has not been shown to cause irreversible and/or

persistent lung damage, a dusty environment can cause mucous membrane irritation and worker discomfort.

E. EVALUATION AND DISCUSSION

Environmental

Only three carbon black samples (personal and area) were collected during the two days because very little black pigment was used in the formulation (Table I). The laboratory analyses of the filters showed that no black pigment could be detected.

It was observed that one of two local exhaust ducts for the compound scale was used to hold a piece of cardboard that contained weight requirements for each of the pigments. Unfortunately, this cardboard interferred with the proper use of the exhaust duct.

The analyses of the carbon black bulk was performed to determine the PNA and benzene-soluble fraction composition. The analyses detected two PNA's (benzo(a)pyrene B(a)P and pyrene) at concentrations of 12.6 micrograms per gram of sample (ug/g) and 148 ug/g respectively. The benzene soluble fraction concentration was reported to be 8.69 milligrams per gram of sample. Although no carbon black was detected on the limited number of samples collected a potential health hazard exists due to the presence of specific PNA's identified in the bulk sample. Ergo, further sampling would be warranted for the carbon black scaling operation.

Ten PNA samples (personal and area) were collected from several areas (Table II): Compound-Banbury area and the Compound Waste area at the scale. Since PNA's such as B(a)P and chrysene can be measured in the ambient air, it was decided to do simultaneous sampling outside the process room. A laboratory analysis indicated that the sample chromatograms did not contain any peaks which could be interpreted as polynuclear aromatic hydrocarbon compounds.

Eight personal samples were collected for mineral spirits, methyl chloroform and benzene. The laboratory analyses of the charcoal tubes did not detect any benzene solvent. The concentration of mineral spirits and methyl chloroform were well below the NIOSH recommended standards (Table III).

The application of the solvent/wax solution to the hot vinyl sheets, which are cured in the small presses, produced vapors which irritated the eyes and/or throat of the workers. The NIOSH medical officer experienced throat irritation while talking to the employees at their work stations.

Although it was suspected that mineral spirit vapors could cause mucous membrane irritation, the levels measured during the follow-up

survey were all below NIOSH recommended criteria. The fact that all exhaust ventilation systems were not operational during the initial survey may have contributed to a vapor accumulation around the press areas. All exhaust fans were fully operational during sampling on the follow-up survey.

It should be noted that the employees were given squeegees with long handles so that the workers would not have to stand over the vinyl sheets while waxing. However, the employees still complained of physical irritation.

Nine samples (personal and area) were collected from two general areas where barium, cadmium, and lead dusts could be exposing the workers. The sources of contamination are the barium/cadmium stabilizers and the dibasic lead sulfate. Of those three metallic dusts, two dust samples (inorganic lead) exceeded the OSHA standard of 0.05 mg/m^3. Even though two samples did exceed the current OSHA lead standard, this does not constitute a major work area exposure. The significantly higher lead concentration measured on one filter would indicate that a re-evaluation of the compound-charging area is necessary to determine whether the sample filters were inadvertently contaminated or whether the employee's work practice is significantly different than the other workers, or whether the ambient lead levels are high due to the work operation. The laboratory analyses of the bulk sample of dibasic lead sulfate indicated that 49% of the compound was lead.

Thirty-eight total nuisance dust samples (personal and area) were collected (Table IV and V). Four personal samples collected from the compounders in the process room exceeded the OSHA standard of 15.0 mg/m^3. It was anticipated to sample some of the other chemicals used in the formulations (e.g. talc, amorphous silica, calcium carbonate, etc.); however, the products being manufactured did not include all of these chemicals. The major constituent sampled was calcium carbonate.

Two bulk talc samples were submitted to the laboratory for analyses of free crystalline silica and asbestos content. One bulk sample was destroyed during shipment. An analysis of the other bulk sample did not detect any free crystalline silica, but the talc did contain 30-40% block tremolite asbestos. About 10% of the block tremolite was observed to be a true tremolite fiber which by definition has an aspect ratio (length to width ratio) of 3 to 1. The talc material used on the follow-up was not reported to contain asbestos or free silica.

It was attempted to sample all the chemicals cited in the Health Hazard Evaluation Request. Unfortunately, the ingredients for the various products changed frequently due to marketing demands.

Consequently, specific chemicals were evaluated based on the relative toxicity, quantity, and frequency of use.

No monitoring was performed for dyes because it was determined that dyes are not used by the company. Also, monitoring was not performed for vinyl chloride monomer because the polyvinyl chloride resin was not considered to be a potential problem based on the method of usage. Furthermore the company reported that the levels of vinyl chloride concentrations were a factor of 5 below the criteria.

It was observed that some respirators were not being worn properly. One employee fastened only one of the two straps on the respirator. Another employee pulled his respirator off his face immediately after loading the compound hopper even though dust was visibly present in the air. The loading technique of the compounders in the process room varied considerably. One worker handled the bags of chemicals harshly, and the other worker emptied the bags gently so as to not create unnecessary dust.

The fork lift operator for the scrapping operation was observed emptying the 55-gallon drums of scrap quickly into the hopper, thereby, generating much dust. In addition, the large doors adjacent to the scrapper hopper were usually open. Thus, the air currents entering the process room dispersed the dust throughout the room.

The noise in the process room was so loud that the people working side by side had to yell to one another. Hearing protectors were not required in the area.

One employee indicated that he cleans his respirator every day or two. He indicated that the frequency of cleaning the respirator is apparently left to the discretion of the worker.

The doors on the pre-blenders in the mezzanine level of the process room were not always closed during the mixing operation. Also there appeared to be a considerable amount of dust accumulation on the floors where the pre-blenders and the blenders are located. This is also where the barium/cadmium stabilizers are stored.

Medical

Analysis of personal samplers indicated that two of the workers were exposed to levels of lead in air in excess of the OSHA standard - one minimally, and the other considerably. Although these workers wear respirators, and occasional, and brief, exposures to levels of lead dust above the standard are unlikely to adversely affect the health of the workers, nevertheless, lead is toxic, and every effort

should be made to adhere to NIOSH's recommendations. These men have been notified, by letter, of their exposure, and they have been advised to consult the plant - and/or their private physicians, to have blood-lead estimations performed to establish whether, or not, excessive lead absorption is occuring. Furthermore, four of the samples indicated that dust levels exceeded the OSHA standard.

F. Recommendations

1. The company should review their material inventory list to determine which chemicals are potentially toxic. Those chemicals should be monitored periodically.

2. Employees should be given periodic training regarding how to properly wear and clean their respirators.

3. Employees should be required to clean their respirator daily.

4. Compounders should be instructed to empty bags of chemicals more gently in order to prevent dust generation.

5. The fork lift operator in the process room should be instructed to slowly emply the 55-gallon drums in order to control dust generation.

6. A noise survey should be performed in the process room to determine the sound pressure levels.

7. The mezzanine level should be cleaned daily. Also the doors on the blenders and pre-blenders should have spring latches installed to insure the doors are properly closed during mixing.

8. One pre-blender should have a canopy exhaust duct installed so that dust does not accumulate in the mezzanine area.

9. Environmental sampling should be performed in the compound waste area to determine the airborne lead concentration.

10. The employees should apply the solvent/wax solution to the vinyl sheets after the sheets are cooled in order to reduce irritation.

11. The bi-annual inspection and lubrication of the exhaust ventilation system should be modified to include maintenance of the exhaust fan louvers.

12. One person should be responsible for turning on exhaust fan switches at the beginning of each shift.

V. AUTHORSHIP AND ACKNOWLEDGEMENTS

Report Prepared By:

Pierre L. Belanger
Industrial Hygienist
NIOSH - Region IX
San Francisco, Ca.

Elva Elesh, M.D.
Medical Section
Hazard Evaluation and
Technical Assistance Branch
Cincinnati, Ohio

Originating Office:

Jerome P. Flesch
Acting Chief
Hazard Evaluation and
Technical Assistance Branch
Cincinnati, Ohio

ACKNOWLEDGEMENTS

Environmental Evaluation:

Bill Evans
Bill Ollinger
Gary Verst
Industrial Hygiene Section
Hazard Evaluation and
Technical Assistance Branch

Analytical Laboratory Services:

Measurement Support Branch
Cincinnati, Ohio

Report Typed By:

Dorothy Chandler

VI. REFERENCES

1. Criteria for a Recommended Standard...Occupational Exposure to Carbon Black, (1978) HEW Publication No. 78-204

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3. Revised Recommended Asbestos Standard, (1976) HEW Publication No. 77-169

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TABLE I
Summary of Air Sampling for Carbon Black
Kentile Floors
South Plainfield, New Jersey

October 11-12, 1978

Date	Sample Number	Type Sample	Job Classification or Location	Sample Period	Volume(Liters)	Concentration (mg/m3)[1]
10/11	1690	Area	Compounding-Waste Area Above Hood	0743-0900	116	N.D.[2]
10/11	1682	Personnel	Compounding-Waste Area	0740-0855	113	N.D.
10/12	1683	Personnel	Compounding-Waste Area	0710-1135	668	N.D.

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1. mg/m3 - Approximate milligrams of contaminant per cubic meter of air.
2. N.D. - None detected (Limit of detection is 0.5 mg).
3. TWA - Time weighted average.

NIOSH Criteria:
1. Carbon Black - 3.5 mg/m^3;
   - 0.1 mg/m^3 TWA[3] as cyclohexane soluble fraction in presence of polycyclic aromatic hydrocarbons.

TABLE 1.
Summary of Air Sampling for Polynuclear
Aromatic (PNA) Hydrocarbons
Kentile Floors
South Plainfield, New Jersey
October 11-12, 1978

Date	Sample Number	Type Sample	Job Classification or Location	Sample Period	Sample Volume(liters)	Concentration (µg/sample)[1] Benzo(a) pyrene	Pyrene	Chrysene	Phenanthrene	Anthracene	Benzene soluble	(mg/m³)[2]
10/11	P-13	A[3]	Process Room-Outside of Bldg. Door near scrapper	0855-1459	546	N.D.[4]	N.D.	N.D.	N.D.	N.D.	N.D.	
10/11	P-19	A	Process Room-Outside of Bldg. Door Near Scrapper	0855-1459	546	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	
10/12	P-2	A	Process Room-Outside of Bldg. Door Near Scrapper	0905-1451	519	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	
10/12	P-1	A	Process Room-Outside of Bldg. Door Near Scrapper	0739-1451	648	N.D.	N.D.	N.D.	N.D.	N.D.	0.06	
10/11	P-17	A	Compounding-Above Banbury Controls	0755-1447	618	N.D.	N.D.	N.D.	N.D.	N.D.	0.03	
10/11	P-16	A	Compound Waste Area-Above Hood	0743-0900	116	N.D.	N.D.	N.D.	N.D.	N.D.	0.17	
10/11	P-14	P[5]	Compounding-Banbury Area	0750-1450	585	N.D.	N.D.	N.D.	N.D.	N.D.	0.07	
10/11	P-15	P	Compound Waste Area	0740-0855	113	N.D.	N.D.	N.D.	N.D.	N.D.	0.17	
10/12	P-3	A	Compounding-Above Banbury Controls	0735-1504	674	N.D.	N.D.	N.D.	N.D.	N.D.	0.03	
10/12	P-10	P	Compounding-Banbury Area	0750-1504	599	N.D.	N.D.	N.D.	N.D.	N.D.	0.17	

1. µg/sample - Microgram of particulate per sample
2. mg/m^3 - Approximate milligrams of particulate per cubic meter of air.
3. A - Area sample.
4. N.D. - None detected
5. P - Personnel sample

Limits of Detection:
1. Benzo (a) pyrene - 1.0 µg/sample
2. Pyrene - 5.0 µg/sample
3. Chrysene - 2.5 µg/sample
4. Phenanthrene - 2.0 µg/sample
5. Anthracene - 5.0 µg/sample
6. Benzene soluble - 0.02 mg/sample

TABLE III
Summary of Personnel Air Sampling for Solvents
in the Curing Area
Kentile Floors
South Plainfield, New Jersey

October 11-12, 1978

Date	Sample Number	Job Classification or Location	Sample Period	Volume(liters)	Concentration (PPM)[1] Mineral Spirits	Methyl Chloroform	Benzene
10/11	1	Operator-Press 5&6	0750-1500	22.1	3.2	0.10	N.D.[2]
10/11	2	Operator-Press 3&4	0800-1500	20.0	6.0	2.7	N.D.
10/11	3	Operator-Press 1&2	0804-1500	21.8	8.0	3.6	N.D.
10/11	4	Operator-Press 1&2	0821-1500	18.6	7.8	2.2	N.D.
10/12	5	Operator-Press 1&2	0724-1435	25.8	2.5	0.6	N.D.
10/12	6	Operator-Press 1&2	0724-1433	23.3	2.7	0.9	N.D.
10/12	7	Operator-Press 6&7	0720-1431	23.9	0.3	0.8	N.D.
10/12	8	Operator Press 6&7	0720-1437	21.5	2.0	0.2	N.D.

1. PPM - Parts of a gas or vapor per million parts of contaminated air by volume at 25°C. and 760 millimeters of mercury pressure.

2. N.D. - None detected.

3. mg - Milligrams

Limits of Detection:
1. Mineral Spirits - 0.01 mg[3].
2. Methyl Chloroform - 0.01 mg.
3. Benzene - 0.001 mg.

NIOSH Criteria:
1. Mineral Spirits - 55 PPM
2. Methyl Choloroform - 350 PPM
3. Benzene - 1.0 PPM

TABLE IV
Summary of Environmental Sampling
For Metals and Total Dust
Kentile Floors
South Plainfield, New Jersey

October 11-12, 1978

Date	Sample Number	Type Sample	Job Classification or Location	Sample Period	Volume(Liters)	Concentration(mg/m^3)[1] Barium	Cadmium	Lead	Total Dust
10/11	1673	P[2]	Process Room, Compounder	0853-1455	472	0.04	0.02	N.D.[3]	6.92
10/11	1728	P	Process Room, Compounder	0853-1455	461	0.03	0.03	N.D.	17.09
10/12	1666	P	Process Room, Compounder	0720-1454	626	N.D.	N.D.	N.D.	4.87
10/12	1664	P	Process Room, Compounder	0723-1454	621	N.D.	N.D.	0.01	15.08
10/12	1707	A[4]	North End of Compd. Charging Hopper	1033-1440	371	N.D.	N.D.	0.04	0.75
10/12	1687	A	Center of Compd. Charging Hopper	1035-1440	368	N.D.	N.D.	0.03	0.46
10/12	1676	P	Cmpd. Charging Area	0715-1500	645	N.D.	N.D.	0.43	5.83
10/12	1663	P	Cmpd. Charging Area	0720-1500	635	N.D.	N.D.	0.07	3.92
10/12	1698	A	Cmpd. Charging Area	0721-1511	705	N.D.	N.D.	0.05	0.62

1. mg/m^3 - Approximate milligrams of contaminant per cubic meter of air.
2. P - Personnel sample.
3. N.D. - None detected.
4. A - Area sample.
5. TWA - Time weighted average.
6. µg - microgram.

NIOSH CRITERIA:
1. Cadmum - 0.04 mg/m3 (8-HR TWA.)[5]
   0.20 mg/m^3 (Ceiling-15min)
2. Lead - 0.10 mg/m^3

Limits of Detection:
1. Barium - 5.0 µg[6]
2. Cadmium - 2.0 µg
3. Lead - 5.0 µg

E V

Summary of Environmental Sampling
For Total Nuisance Particulate
Kentile Floors
South Plainfield, New Jersey

October 11-12, 1978

Date	Sample Number	Type Sample	Job Classification or Location	Sample Period	Sample Volume(Liters)	Total Dust Concentration(mg/m^3)[1]
10/11	3047	A[2]	Blending Room-Rear Drum Support	0730-1455	667.	0.46
10/11	3032	P[3]	Blending Room&Incinerator-Fork Lift Driver	0740-1430	468.	3.14
10/11	3052	P	Blender Operator	0725-1439	510.	1.04
10/11	3041	P	Blender Operator	0720-1452	517.	0.58
10/12	3035	P	Blender Operator	1045-1453	310.	1.77
10/12	3038	P	Blender Operator	1108-1451	576.	0.52
10/12	3037	A	Blending Room-Rear Drum Support	0746-1456	645.	0.51
10/12	3023	P	Blending Room&Incinerator-Fork Lift Driver	0743-1440	559.	4.44
10/12	3043	P	Blender Operator	0748-1453	576.	1.61
10/12	3059	P	Blender Operator	1047-1451	310.	0.94
10/12	3000	A	Blending Room-Inner Drum Support	1053-1456	309.	0.58
10/11	3061	P	Process Room-Mixer Clean-up Man	0805-1505	555	2.58
10/11	3031	P	Press Room-Scrapper #1	0750-1525	623	0.69
10/11	3024	A	Process Room-Scrapper #2	0750-1500	645	7.33
10/11	3048	A	Process Room-Pigment Scale Table	0745-1505	660	1.03
10/11	3039	P	Process Room-Compounder	0741-1455	576.	15.49
10/11	3036	A	Process Room-Top of Mixer #1	0745-1454	644.	0.65
10/11	3063	P	Process Room-Compounder	0735-1505	641	15.18
10/11	3025	P	Process Room-Pigment Scale Operator	0715-1505	705	0.99
10/11	3057	A	Process Room-Top of Mixer Control Panel	0725-1450	668	0.67
10/11	3029	P	Process Room-Compounder-at hopper	0740-1455	582	6.70

1. mg/m^3 - Approximate milligrams of contaminant per cubic meter of air.
2. A - Area sample.
3. P - Personnel sample.

ACGIH TLV:
1. Total Dust 10.0 mg/m^3

TABLE V (continued)
Summary of Air Sampling
For Total Nuisance Particulate
Kentile Floors
South Plainfield, New Jersey

October 11-12, 1978

Date	Sample Number	Type Sample	Job Classification or Location	Sample Period	Volume(Liters)	Total Dust Concentration(mg/m^3)[1]
10/11	3028	P[2]	Process Room-Mixer Operator	0720-1453	680.	1.15
10/12	3053	P	Process Room-Compounder	0723-1454	624.	3.69
10/12	3020	A[3]	Process Room-Above Mixer #1	0730-1449	674	1.77
10/12	3007	A	Process Room-Scrapper #1	0736-1451	653	1.00
10/12	3008	A	Process Room-Above Mixer #2	0730-1449	659	0.99
10/12	3060	P	Scrapper Operator	0735-1447	603	0.88
10/12	3004	A	Process Room-Pigment Scale	0727-1447	660	1.05
10/12	3040	P	Process Room-Compounder	0720-1454	629	3.51
10/12	3044	P	Process Room-Clean-up Man	0742-1500	563	0.82
10/12	3064	P	Process Room-Mixer Operator	0705-1445	690	0.72
10/12	3001	P	Process Room-Pigment Scale Operator	0710-1449	651	1.08
10/11	3042	P	Compound Charging Area	0722-1430	642	5.30
10/11	3045	P	Compound Charging Area	0722-1430	642	1.88
10/11	3050	A	Between two Compounders	0729-1431	633	0.52
10/11	3018	P	Compound-Mixer Area	0750-1450	675	0.09
10/11	3046	A	Compound-Above Mixer Controls	0755-1447	618	0.24
10/12	3005	P	Compound-Mixer Operator	0750-1504	599	0.12
10/12	3009	A	Compound-Above Mixer Controls	0735-1504	674	0.06

1. mg/m^3 - Approximate milligram of containment per cubic meter of air.
2. P - Personnel sample.
3. A - Area sample.

ACGIH TLV:
1. Total Dust 10.0 mg/m^3