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HEALTH HAZARD EVALUATION REPORT 72-43-57
HAZARD EVALUATION SERVICES BRANCH
DIVISION OF TECHNICAL SERVICES

FILE COPY

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U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45202

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HEALTH HAZARD EVALUATION REPORT 72-43
FORTUNE INDUSTRIES INC.
CHELSEA, MICHIGAN
JULY 1973

I. SUMMARY DETERMINATION

Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6), authorizes the Secretary of Health, Education, and Welfare following a written request by 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 National Institute for Occupational Safety and Health (NIOSH) received such a request from an authorized representative of employees regarding exposure to substances used at Fortune Industries Inc., Chelsea, Michigan.

The following is a list of substances which, by their use, were considered to be of potential hazard to the exposed worker. Their respective exposure standards as promulgated by the U.S. Department of Labor (Federal Register Vol. 37, 1910.93, Table G 1,2,&3, October 18, 1972) are also included.

SUBSTANCE	STANDARD CONCENTRATION (8 hour time-weighted average)	
A. Inert or nuisance dusts	Respirable fraction	$5mg/M^3$*
1. Aluminum oxide 2. Silicon carbide 3. Iron oxide	Total dust	$15mg/M^3$
B. Quartz (free SiO_2)	Respirable	$\frac{10mg/M^3}{\% SiO_2 + 2}$
	Total dust	$\frac{30mg/M^3}{\% SiO_2 + 3}$
C. Tremolite (talc, fibrous) use asbestos limit	5 fibers, longer than 5u, per cc of air Ceiling concentration - 10 fibers, longer than 5u, per cc of air	

PHYSICAL AGENT	STANDARD LEVEL
Noise	90 dBA**

* milligrams per cubic meter of air

** dBA-permissible noise level exposure in decibels (A weighting network) based on an eight hour time-weighted average. Higher noise levels are permissible with a shorter duration of exposure than eight hours as calculated by a standard curve and up to a ceiling level of 115 dBA.

NIOSH investigators conducted a combined environmental and medical evaluation in Fortune Industries on January 25,26, and March 22,23, 1973. Based upon the results of the evaluation, it has been determined that a health hazard exists to the one batch-mix operator from exposure to tremolite (asbestos fibers) and silica containing dusts, and to the 13-15 employees exposed to silica containing dust as used and found in the aluminum oxide separation area, inspection and boxing area, material handling area, and special refractory area. This conclusion is based on the following pertinent information:

1. The silica dust levels exceeded the federal silica standard in the aluminum oxide separation area, inspection and boxing area, material handling area, special refracting area, and batch-mixing area. The values ranged from 1 to 3 times the calculated silica standard, with the exception of two samples that were seven times the standard and one that was 14 times the standard. 0.4 to 8.7% free silica was present in all the dust samples. The free silica was the controlling factor in determining the acceptable levels for the dusts involved since the acceptable concentration would be higher (i.e., would be the nuisance level) if silica were not present.

2. The tremolite (asbestos fibers) concentrations exceeded the standard in the batch mix area. The excessive exposure occurs when tremolite is dumped into the hopper, prior to mixing. The levels measured were 33 to 38 fibers per cubic centimeter (cc) of air which exceeds the ceiling concentration of ten fibers, greater than 5u, per cc of air. This high exposure will occur five to ten minutes, four times a day. The fiber count on the other samples collected ranged from 0.07 to 2.1 fibers, greater than 5u, per cc of air.

3. Although there was no evidence that agents in the plant environment had caused any serious respiratory problem, most workers noted a great deal of dust in their nose at the end of the day. Chest x-rays recently taken of all employees were not indicative of harmful effects from the various dust exposures. However, because of the relatively short period of exposure of most workers (less than six years in almost all cases) to atmospheres of asbestos and silica which normally take many years to cause noticeable lung damage, even when levels are above the standard, one would expect few, if any, serious lung problems to be noted at this time.

Environmental measurements for noise indicated that in two areas of the plant, the noise levels (99-100 dBA at the inspection operation, and 93-95 dBA at the pug mill operation) and exposure times may be reached where there is a potential hearing damage to the 12-14 workers involved.

Recommendations have been suggested to alleviate potentially hazardous conditions observed in this evaluation.

Copies of this Summary Determination of the evaluation are available upon request from the Hazard Evaluation Service Branch, NIOSH, U.S. Post Office Bldg., Room 508, Fifth and Walnut Streets, Cincinnati, Ohio 45202. Copies have been sent to:

a. Fortune Industries Inc.
b. Authorized Representative of Employees
c. U.S. Department of Labor - Region V

For purposes of informing the approximately 16 "affected employees", the employer will promptly "post" the Summary Determination in a prominent place(s) near where affected employees work for a period of 30 calendar days.

II INTRODUCTION

Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6), authorizes the Secretary of Health, Education, and Welfare following a written request by 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 concentration as used or found.

The National Institute for Occupational Safety and Health received such a request from an authorized representative of employees at Fortune Industries Inc., Chelsea, Michigan.

Fortune Industries manufactures abrasive chips used to deburr and polish metal parts. There are approximately 36 persons employed at this plant. The plant operates three shifts a day, seven days a week in the kiln area and two shifts, five days a week, in other portions of the plant.

III BACKGROUND HAZARD INFORMATION

A. Federal Standards

The Occupational Health Standards as promulgated by the Department of Labor (Federal Register, Part II, Section 1910.93, Tables G-1,2,and 3) applicable to substances of this evaluation are as follows:

SUBSTANCE	STANDARD CONCENTRATION (8 hour time-weighted average)	
Inert or nuisance dusts Aluminum oxide Silicon carbide Iron oxide	Respirable fraction	5mg/M^3*
	Total dust	15mg/M^3
Quartz (free SiO_2)	Respirable	$\frac{10mg/M^3}{\%SiO_2 + 2}$
	Total dust	$\frac{30mg/M^3}{\%SiO_2 + 3}$
Tremolite (talc, fibrous) use asbestos limit	5 fibers, longer than 5u, per cc of air Ceiling concentration - 10 fibers, longer than 5u, per cc of air.	

PHYSICAL AGENT	STANDARD LEVEL
Noise	90 dBA**

* milligrams of substance per cubic meter of air

** dBS-permissible noise level exposure in decibles (A weighting network) based on an eight hour time-weighted average. Higher noise levels are permissible with a shorter duration of exposure than eight hours as calculated by a standard curve and up to a ceiling level of 115 dBA.

B. Toxic Effects

Asbestos

Asbestos is a generic term that applies to a number of naturally occurring hydrated mineral silicates incombustible in air and separable into filaments. The most widely used in industry in the U.S. is chrysotile a fibrous form of terpentine; other types include amosite, crocidolite, tremolite, anthophyllite, and actinolite. Exposures to asbestos usually involve more than one type of fiber, although chrysolite pre-dominates.

The occupational and general public hazard of exposure to asbestos is well established. The perils of developing lung fibrosis (i.e., asbestosis), cancer of the bronchi, linings of the chest cavity, and abdominal cavity, and possibly other malignant tumors have been recorded by many scientific investigators.

Three major types of asbestos fibers are mined from the earth: chrysotile, amosite, and crocidolite, all of which are emminently respirable. Asbestosis results when an individual has been subject to years of exposure and the normal lung architecture becomes replaced by large areas of scarified tissue. When this occurs, oxygen and carbon dioxide cannot be passed through the alveolar membrane in the normal fashion. Furthermore, with or without the development of asbestosis, the mineral is a potent lung cancer producing agent and has been incriminated as a cause of mesothelioma (cancer of the linings of the chest and abdominal cavities) which may occur fifty years following a brief exposure.

The scientific data confirming the above findings has been collected over a period of seventy years but not until as recently as 1964 did the definitive epidemiologic studies become available. At that time, Dr. Irving Seilcoff of the Mount Sinai School of Medicine, New York City reported results of a study of over 600 insulation workers indicating a 25% higher than expected death rate. Of those who died, 45 died of lung cancer while only six deaths from lung cancer would have been anticipated. Further follow-up on this group and other studies on workers exposed to asbestos colloborate these findings.

An excellent review of the literature on the use of asbestos, its hazards, and proposed standard for usage is found in the NIOSH Criteria for a Recommended Standard - Occupational Exposure to Asbestos.

Safe Air levels for tremolite are considered under the same standard as fibrous talc, which in turn is considered under the asbestos standard in Section 1910-93a of the Federal Register, Vol. 37, No. 202, Wednesday, October 18, 1972. The permissible exposure for airborne concentration of asbestos fibers (i.e., fibers greater than 5 micrometers) is 5 fibers/cm^3 for an eight hour time-weighted average (TWA). Effective July 7, 1976, the eight hour TWA will be reduced to 2 fibers/cm^3. A ceiling value is set at 10 fibers/cm^3.

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B. Toxic Effects (continued)

Silica

Finely divided silica (silicon dioxide-SiO_2) in the free state can cause the pneumoconiosis called silicosis. It is the most common and serious of all the pneumoconioses. The silica may be in a crystalline form such as in quartz, cristobalite, and tridymite, or in a non crystalline or amorphous form such as opal. The crystal structure of pure silica has an important influence upon tissue reaction. Among the crystalline forms, tridymite is intensely fibrogenic, cristobalite, and quartz somewhat less so, and the amorphous silica only slightly fibrogenic.

The size of the silica particle is also extremely important in determining the degree of tissue reaction. The optimum size for retention deep within the lung (in the alveolar areas) is about 1 micron. However, particles larger (8-10 microns) and smaller(0.1 micron) have been associated with silicosis.

Many factors appear to play a role in the development of silicosis; for example, the level of exposure to free crystalline silica dust; duration of exposure; the synergistic action of other ions; differences in individual susceptability and the presence of infection, especially tuberculosis.

Silicosis may be recognized either as an acute or chronic process. The acute form (rapidly-developing silicosis) may be recognized after 8-18 months from first exposure and probably develops after massive exposure. Patients note severe shortness of breath and rapid breathing and chest x-rays often show fibrosis with no visible typical modulation of silicosis. Tuberculosis is often present[1].

Chronic pulmonary silicosis is the type most often seen in industry and usually occurs only after years (sometimes 15-30)[2] of exposure to silica dust. A chest x-ray will usually detect silicosis in a relatively early stage. However, an uncomplicated case may progress to an advanced stage while producing only symptoms of moderate shortness of breath[1].

The three chief complications of silicosis, which are also the most frequent causes of death are: pulmonary tuberculosis, respiratory insufficiency, and acute pulmonary infection[2].

A chest x-ray, together with a case history are basic in making a diagnosis of an early case of silicosis, since the early stage of the disease may be asymptomatic. The chest x-ray is not diagnostic, and needs to be supported by an occupational history of exposure, etc., and appropriate clinical laboratory test to rule out other diseases[2].

Prevention is extremely important since treatment is not effective for the pulmonary lesions. Insuring that levels of free silica are below the federal standard is the best preventative measure.

Aluminum Oxide - Alumina

Aluminum oxide (Al_2O_3) or alumina, exists in a number of natural and synthetic forms. There is a naturally occurring α-alumina and an α-alumina produced by heating hydrated alumina or γ-alumina above 1250C. γ-alumina, is of a dif-

B. Toxic Effects (continued)

Aluminum Oxide - Alumina (continued)

ferent crystalline structure and is produced by heating hydrated aluminas such as Gibbsite (hydragillite) to 900-1000 C.[3] γ-alumina was found to be highly fibrogenic in animals (2u fibers) by Stacey[4], but there are no clinical studies implicating aluminum oxide as a cause of pneumoconiosis in man. The federal standard was therefore set at the level of an "inert" or nuisance dust[3].

"The role of aluminum oxide fume inhaled concurrently with silica fumes in the production of pulmonary fibrosis (e.g. Shaver's disease) is still incompletely understood."[3] It should be noted that Shaver's disease has been reported in the manufacture of alumina abrasives and more specifically in electric furnace operators exposed to both aluminum oxide and silica fumes.[5,6]

Iron Oxide

Iron and iron compounds have not been shown by industrial experience to be particularly toxic. Mottling of the lungs due to inhalation of particulate iron (siderosis) is now regarded as a benign pneumoconiosis[7], producing little or no disability from years of exposure but may present problems in diagnosing other more serious lung conditions masked by the iron particles. Siderosis does not progress to fibrosis and generally requires 6-10 years of exposure to iron oxide fume in order to produce it[8].

Iron oxide dust is considered a nuisance dust and has the standard of 15 mg/M^3. As a fume, 10 mg/M^3 has been established as the standard.

Silicon Carbide (SiC)

There have been two published reports of pulmonary disease associated with SiC dust. Smith and Perina[9] noted three cases of silicosis I or II (scale I - IV) in workers exposed to Al_2O_3 and SiC and without previous history of exposure to other dusts. Brunsgaard[10] reported slight radiographic changes in ten of thirty-two workers exposed exclusively to SiC. Most of the workers had worked for 15 years or more in dusty atmospheres and had only slight respiratory symptoms.

On the basis of such evidence, the nuisance standard of 15 mg/M^3 has been applied to SiC.

Alkaline Compounds

A number of components of the solid abrasives and wet and dry detergents are not of any real health concern except that most are to a lesser or greater extent alkaline in solution. Exposure to skin or mucous membranes to those agents may be irritating and therefore, such exposure should be avoided. Examples of such compounds are: soda ash (Na_2CO_2); bicarbonate of soda ($NaHCO_3$); sodium metasilicate (Na_2SiO_3); Borax-sodium borate ($Na_2B_4O_7 - 10H_2O$)[3]; caustic soda.

IV HEALTH HAZARD EVALUATION

A. Initial Visit - Observational Survey

An initial hazard evaluation survey of Fortune Industries Inc., Chelsea, Michigan was made on August 16,1972 by NIOSH Representative Arvin G. Apol. The function of NIOSH and its relation to Section 20(a)(6) of the Occupational Safety and Health Act of 1970 and the purpose of the visit was explained to [redacted] The NSN Part I Questionnaire was completed.

The following persons were present on a walk thru the plant, [redacted].

There are basically five separate jobs that are conducted in producing the abrasive chips. A short description of each follows:

1. Aluminum Oxide Separation - Aluminum oxide is brought into the plant in 300 pound fiber drums, raised with a fork lift and dumped by hand into a hopper. From the hopper, it passes thru a kiln for drying and then it goes thru a magnetic separator and into a large hopper. The hoppers are lifted with a fork lift and set on top of the screening units. The material passes through a series of vibrating screens for further sizing and then piped into drums for storage. There is a considerable amount of dust produced during the dumping and the screening operations. The hazards to the operator are aluminum oxide and free silica. There is one operator for each of the shifts for a total of three persons exposed.

   There is some local exhaust ventilation being used on the hoppers, screens, and drums, however, it does not appear adequate.

2. Batch Mixer - One man works one shift on this operation. In this operation, all the various ingredients (clay, talc, aluminum oxide, free silica, etc.) that make up the abrasive chips are hand dumped into a ventilated hopper, mixed, and conveyed into 55 gallon drums. The conveyor and transfer points utilize local exhaust ventilation. There are usually four batches mixed per day. The mixing cycle takes 1½ to 2 hours (30 minutes loading, 15 minutes mixing, 45 minutes unloading). The hazard involved is airborne dust, which consists of talc, tremolite, aluminum oxide, silicates, free silica, silicon carbide, and trace amounts of titanium dioxide, soda potash, and other compounds.

   The general area has considerable amounts of settled dust. The cleaning is done by sweeping. (a vaccum system has since been installed and cleaning is now done by vaccuming). The operator wears a respirator during the dumping operation, which is the dustiest part of the mixing operation.

3. Pug Mill - There are four employees on the day shift and three employees on the night shift. Each employee operates a mueller and an extrusion machine. The mixed material is brought to this operation in 55 gallon drums from the batch mix. The drums are mechanically hoisted and dumped into muellers where water is added to bind the mix. There are four muellers in the room. Each mueller is covered and ventilated to a bag house collector located outside. After the material is mixed and wet, it is in a form that can be shaped and cut. It is transported from the mueller by a belt to the extrusion machine, where it is extruded into various shapes and then cut into short lengths. The chips are now in their final basic form. Each operator runs seven or eight batches per day. The operators are exposed to the same dusts as listed in the batch mix (#2), but since the material is wet most of the time, the dust exposure is greatly reduced. The dust is generated when the dry material is being dumped in the mueller, and when cleaning dried material from the extrusion machine. When the extrusion machine is operating, a noise problem may exist.

4. Special Refactory area - The kilns are operated 24 hours a day, seven days a week. There is one employee per shift Mondays thru Thrusdays, and two operators per shift on Fridays, Saturdays, and Sundays.

   The chips are put on trays and placed between the kilns for 24 hours for drying. They are then dumped by hand into a small hopper and conveyed to a small vibrating machine, which contains local exhaust ventilation where the rough edges are removed to avoid twins. The chips are mechanically dropped in a sagger (a type of tray) and loaded on racks. The racks are pulled mechanically thru a kiln for 24-36 hours at 2150°F for fusion. They are then hand dumped out of the sagger into 55 gallon drums for transportation to the inspection and boxing area.

   The exposure to the employees consist of airborne dusts (same dusts as listed in #2, batch mix) and occurs during the dumping and vibrating operations.

5. Inspection and Boxing - There are two employees per shift, two shifts per day, in this area. One is the inspector and the other is a material handler. The finished chips come from the special refractory area in 55 gallon drums. They are mechanically hoisted and dumped into an unvented hopper, conveyed to a vibrating screen, dropped on a moving belt where the inspector inspects them. The chips drop off the end of the belt and into boxes. The boxes are sealed and placed in storage. The hazards these persons are exposed to are airborne dust (same as those listed in #2 batch mix) and noise. There is no local exhaust ventilation used in this area.

6. Soap Mix area - The company blends and mixes liquid and dry soap for use with their abrasive chips. The soap mixing is done about five hours per week.

The liquid soap is concentrated and premixed and comes in 55 gallon drums. About 4 gallons of the liquid is pumped in a pail, emptied in a 100 gallon vat and diluted to 100 gallons with water. The solution is mixed and bottled.

The different liquid soaps made, each have their own formulation. Some of the substances found in the liquid soaps are coco alkylo-amide, diethanolamine, oleate, glycerine, disoldium phosphate, anyhyrous potassium silicate, EDTA, sodium metasilicate, sodium nitrite, 2-cocoyl - 2-imidazolinium hyroxide - 1-(2-hydroxyethyl 1) carboxy ethyl sodium salt, pine oil and alcohol ethoxolate.

Because the handling time of the concentrate is very short, the operation occurs infrequently and the operator adequately protected with protective clothing, the investigators felt that the operation did not warrant additional investigation.

The dry soap is mixed several hours a month and formulated in a large unventilated mixer. The ingredients are weighed on a scale, lifted to the top of the mixer with a fork lift and hand dumped into the mixer. The mixed soap is transferred to fiber drums by placing the drums below the mixer and letting the soap fall into the drum. The operator wears a half face respirator (for use with dusts), gloves, and a long sleeve shirt. The chemicals used in the soap are (each soap is different) borax, neutral high titer synthetic soap, trisodium phosphate, soda ash, caustic soda, alkyl aryl sulfonate, aluminum oxide, silicon carbide, sodium nitrite, sodium metasilicate, and silica.

The investigators felt the operation did not warrant further investigation. The handling of the material is rather infrequent, and the operator adequately protected except for exposed skin areas. These areas can be wet with perspiration and thus cause irritation when in contact with alkaline materials. Also, the company is planning to contract out this mixing when their present stock is depleated.

Every operation where the dry materials are handled, mixed, dumped, etc., appears to produce a considerable amount of dust. This is indicated by the accumulation of dust on the floors, stored materials, and equipment. The local exhaust ventilation, as utilized, does not appear to be doing the job. In general, the overall housekeeping should be improved.

Fortune Industries has implemented a program to improve the existing ventilation systems and is installing additional systems on the dusty operations. Several of these contracts for these systems have been let and will be installed in the near future.

B. ENVIRONMENTAL EVALUATION

The environmental study and medical study were conducted January 25-26, and March 22-23, 1973. The environmental sampling was conducted by NIOSH representatives Arvin G. Apol, and Richard Kramkowski, and the medical survey by Steven Shama, M.D.

1. Sampling Methods and Procedures

   a. Tremolite dust (asbestos fibers) - Employee exposures to airborne tremolite dusts (asbestos fibers) were measured using personal air sampling equipment which sampled in the close proximity of the employees breathing zone. MSA model G vaccum pumps were used to draw air through open faced millipore cassetts fitted with millipore 37mm type AA, 0.8u cellulose membrane filters. Air sampling rates were maintained at 2.0 liters per minute. The samples were brought to Cincinnati where the fibers collected on the filters were counted using a phase contract microscope.

   b. Silica bearing dusts - Employee exposure to total and respirable airborne dusts were measured using personal air sampling equipment which sampled air in the close proximity of the employees breathing zone. MSA model G vaccum pumps were used to draw air through millipore cassettes fitted with pre-weighed, 37mm MSA (FWS-B), 5.0u PVC filters. Air sampling rates were maintained at 1.8 liters per minute. The respirable dust samples were drawn through a 10mm nylon cylone assembly prior to passing through the filter. The filters were weighed before and after sampling. The filters were then sent to the NIOSH laboratory at Salt Lake City, Utah, where the free silica content of the samples was determined.

2. Results and discussion

Environmental air samples for airborne silica containing dusts were collected at seven different job areas. (aluminum oxide separation, batch mixing, pug mill operation, inspection, material handling, special refractory operation, and fork lift operation) involved in making abrasive chips. Eighteen samples were collected for total dust and sixteen for respirable dust. Each respirable dust sample was collected simultaneously with a total dust sample for comparison purposes. Free silica was the controlling factor in calculating the acceptable levels for the dusts involved since the acceptable concentration would be higher, (i.e., would be the nuisance level) if silica were not present. Excessive silica dust levels for both the total dust and respirable fractions were found at all the jobs except the pug mill operation, and ranged from 1 to 3 times the calculated silica standard with exception of two samples, which were seven times the standard and one which was 14 times the standard. The batch mix, aluminum oxide separation and the inspection and material handling areas had the highest silica dust levels. The dust levels measured would have exceeded the nuisance dust standard (had the silica not been present) in the aluminum oxide separation, batch mixing, inspection, and material handling areas. When the airborne dust levels are reduced below the silica standard, the nuisance dust levels will also be controlled. The individual values are listed in Table I, Section IV. The recommendations are listed under Section V (titled recommendations of this report).

Samples were collected for tremolite (asbestos fibers) at six different job locations. Ninety-six samples were collected with the sampling

volumes at each location ranging from six to ninety liters of air. The largest volume sampled in each series, was able to be counted in all cases. The person counting the sample reported that any additional volume of air sampled would have resulted in counting difficulties because of the non-fibrous dust loading on the filters. Of the 96 samples collected, 22 were counted. The fiber count, except for two samples, ranged from 0.07 fibers per cc to 2.1 fibers per cc. The two high samples contained 33 and 38 fibers per cc of air. Both of these occurred while the batch-mix operator was dumping tremolite into the hopper prior to mixing. The dumping of tremolite occurs five to ten minutes, four times a day. The federal eight hour time-weighted average standard for asbestos fibers is five fibers, greater than 5u, per cc of air. The ceiling concentration that is not to be exceeded at any time is 10 fibers, greater than 5u, per cc of air. The levels found during the dumping of the tremolite exceeded this ceiling value. The individual results are listed in Table II, Section VI. The recommendations are listed in Section V of this report.

Noise levels were measured by the inspection operator, and by the pug mill operators. The inspection operation consists of the chips passing over a vibrating screen and then are dropped on a vibrating metal plate and then on a conveyor. The noise levels measured were 99-100 dBA. The permissible exposure time per day at this level is two hours. Since this unit operates more than two hours per day, the standard is exceeded.

The noise levels measured in the pug mill area by the operators at the extrusion machines is 93 to 95 dBA. There are four machines in operation so the noise is almost continuously above 90 dBA. The permissible exposure time at these levels is 4 to 5 hours per day. Since the noise is almost continuous, the noise standard is exceeded. The measurements indicate that the noise levels and exposure times were reached where permanent hearing damage can occur.

C. MEDICAL EVALUATION

1. Results & Discussion
Almost all workers (15 of about 20) who usually work in areas of potential dust exposure were interviewed.

Areas of Concern

Aluminum Oxide (Al_2O_3) Area:

Both men (2 shifts) were interviewed. Neither employee worked in the Al_2O_3 area longer than six months. Both men noted dust in their nose after a shift but reported no obvious respiratory problems.

Batching Area:

Only one worker is exposed in this area. This area probably poses the greatest health hazard since large amounts of raw material (powdered form)

are handled daily. Nytal - a brand name for tremolite (a form of asbestos) and silica - containing compounds pose the greatest hazard to this worker. Blackhill-IMC is Bentonite and contains silica (65%) alumina 21%, and 3% iron oxide. Mullite is made from the fusion of alumina and silica and may contain unreacted material. In addition, bauxite, mostly Al_2O_3, may contain silica.

The remaining components handled by the worker are not of great health significance except if their levels reach nuisance dust standards. As noted in the Toxic Effects Section, some substances, when in aqueous solution, can cause local irritation to skin and mucous membranes. Such contact should be avoided.

This worker has been working in the batch area for about nine months. He reports dust in his nose at the end of the shift, but does not have shortness of breath or a cough. He has a smoking history of one pack a day for 15 years.

Inspection - Material Handling Area:

Of the two workers interviewed here, both reported some respiratory problems. One worker, an inspector, was working for six years with only a mild dry throat and dry nose. The other worker, a material handler, with only 10 months exposure reported mucous production and some wheezing, both having their onset about 10 months ago. The worker, however, did give a history of lung surgery one year prior to his employment at the plant. Since the finished product, when inspected, is dusty, concern for these workers should not be overlooked.

Pug Mill - Operation

All seven men (4 day and 3 evening) were interviewed. Many were heavy smokers and admitted to shortness of breath dating well before company employment. Range of employment was from two years to eight years. Dust did not seem to be too great a problem here, however, workers did note that there is a considerable amount of dust in their nose at the end of a shift.

Special Refractory Area:

Two workers normally work here (seven months and three years employment histories) and both were interviewed. Both note dust in their nose, but no respiratory symptoms.

Soap Operations:

The wet detergent operation is of no significant concern since the chance of inhalation of dust is small.

The dry mix preparation is not a serious hazard since the procedure is done relatively few hours each month. Since silica may be used and it and other dusts may become airborne, the respirator used by the employee is good practice. He denies respiratory symptoms. The mild

dermatitis he has occasionally in the summer is possibly due to the alkaline compound he mixes and their dissolution on his forehead when he sweats. A small towel about his forehead prevents the occurrence. Furthermore, his use of rubber gloves and apron protects him well from the occasional splashes that occur.

2. SUMMARY:

Almost all workers in this abrasive company who were exposed to various dust were interviewed. Although there was no evidence that agents in the plant environment had caused any serious respiratory problems, most workers noted a great deal of dust in their nose at the end of the day. Because of the relatively short period of exposure of most workers (less than six years in almost all cases) to atmospheres of asbestos and silica which normally take many years to cause noticeable lung damage, even if levels are above the standard one would expect few, if any, serious lung problems to be noted at this time.* Nevertheless, air levels of such agents must be kept below Federal Standards and appropriate respirators and ventilation used to insure safe working conditions. The areas of greatest risk to silica and asbestos exposure were considered to be the batching area, the inspection, and material handling area.

Workers are also exposed to a number of nuisance dusts which do not cause any serious lung disease, e.g., Aluminum oxide, iron oxide, and silicon carbide. Levels of these dusts should be kept below the standard for nuisance dusts.

The wet and dry preparation of detergents was not considered a hazardous job because of the short period of exposure and because of an adequate and effective respirator and other protective clothing used by the worker involved.

D. CONCLUSIONS

Based upon the results of the evaluation, it has been determined that a health hazard exists to the one batch mix operator from exposure to tremolite (asbestos fibers) and silica containing dusts, and to the 13-15 employees exposed to silica containing dust as used and found in the aluminum oxide separation area, inspection and boxing area, material handling area, and special refractory area. This conclusion is based on the following pertinent information:

1. The silica dust levels exceeded the federal silica standard in the aluminum oxide separation area, inspection and boxing area, material handling area, special refracting area, and batch mixing area. The values ranged from 1 to 3 times the calculated silica.

*This is confirmed by the recent chest x-ray results showing only two abnormal chest x-rays, only one of which is suggestive of a pneumoconiosis, but more probably is due to chronic bronchitis, secondary to very heavy smoking.

standard, with the exception of two samples that were seven times the standard and one that was 14 times the standard. 0.4 to 8.7% free silica was present in all the dust samples. The free silica was the controlling factor in determining the acceptable levels for the dusts involved since the acceptable concentration would be higher (i.e., would be the nuisance level) if silica were not present.

2. The tremolite (asbestos fibers) concentrations exceeded the standard in the batch mix area. The excessive exposure occurs when tremolite is dumped into the hopper, prior to mixing. The levels measured were 33 to 38 fibers per cubic centimeter (cc) of air which exceeds the ceiling concentration of ten fibers, greater than 5u, per cc of air. This high exposure will occur five to ten minutes, four times a day. The fiber count on the other samples collected ranged from 0.07 to 2.1 fibers, greater than 5u, per cc of air.

3. Although there was no evidence that agents in the plant environment had caused any serious respiratory problem, most workers noted a great deal of dust in their nose at the end of the day. Chest x-rays recently taken of all employees were not indicative of harmful effects from the various dust exposures. However, because of the relatively short period of exposure to most workers (less than six years in almost all cases) to atmospheres of asbestos and silica which normally take many years to cause noticeable lung damage, even when levels are above the standard, one would expect few, if any, serious lung problems to be noted at this time.

Environmental measurements for noise indicated that in two areas of the plant, the noise levels (99-100 dBA at the inspection operation, and 93-95 dBA at the pug mill operation) and exposure times may be reached where there is a potential hearing damage to the 12-14 workers involved.

V RECOMMENDATIONS

Some of the following recommendations are in the process of being conducted and will be noted.

1. Use a non-fibrous material in place of the tremolite. This is currently being looked into and several substitute materials will be tried.

2. Install a local exhaust system on the two vibrating screens and hoppers in the inspection area. The materials to accomplish this have been ordered and should be received in the near future. The units should be enclosed as much as possible to reduce the chance of dust escaping into the atmosphere.

3. The present method of dumping material in the batch mix hoppers is the major source of the operator's exposure to both tremolite and silica containing dusts. Although the hopper is enclosed and ventilated, the operator has to lean into the hood to break and dump the bag and then

RECOMMENDATIONS (continued)

place the dusty bag in a large wire cage. The company is presently considering conveying the bags into the hopper and then handling them by means of a glove box. This seems to be a logical approach to the problem.

4. A supplied air hood should be worn by the batch mix operator when loading a hopper until the engineering controls are installed. A supplied air hood was received during the March visit. The hood is adequate and contains, as a unit, the oil and water traps and charcoal filters, so it can be used on plant compressed air.

5. Section 1910.93a (asbestos) of the Federal Register, Vol. 37, October 18, 1972 has detailed requirements for working with asbestos, this includes such things as labeling, special clothing when the ceiling level is exceeded, respirators, medical examinations, environmental monitoring, etc.

6. The housekeeping should be improved throughout the entire plant. The floors should be vaccumed in lieu of sweeping, as sweeping tends to create more airborne dusts. The company has ordered four industrial vaccum units and has received the first one. The exhaust of the vaccum is being piped into the local exhaust system.

7. The aluminum oxide area has local exhaust at most points where the dry materials are transferred or dumped. In most cases the transfer points are not enclosed and although exhaust ventilation is present, it does not appear to be capturing the dusts. These points should be enclosed as much as possible as this will prevent the dust from escaping to the atmosphere.

   Since the volume of air required to capture the dust at the source is less when the open area of a hood is reduced, better utilization can be made of the existing fans and bag house.

8. Several loose and broken ducts were noticed. An on-going maintenance program is needed in order to keep the ventilation systems in proper working order. Without this, the efforts involved in reducing the dust levels are negated.

9. Avoid using compressed air to blow the dust out of the extrusion machines in the pug mill area. The desired method is to vaccum it.

10. The hoppers and other transfer points in the special refactory area are a source of dust in that area. These points should be enclosed as much as possible and provided with local exhaust ventilation.

11. Respirators should be supplied and worn by the inspectors, material handler, aluminum oxide separation operator, and the special refractory operators when performing jobs that produce airborne dusts. Respirators are used as a temporary control measure until engineering controls can be put in operation. A NIOSH or Bureau of Mines approved respirator (either the half face cartridge type respirator or an approved

disposable respirator) can be used for use with pneumoconiosis and fibrous producing dusts. If non-disposable respirators are used, a cleaning and maintenance program should be initiated.

12. Engineering controls should be utilized to reduce the noise in the pug mill and inspection area below acceptable levels. There may be several ways of accomplishing this. In the pug mill area, mufflers should be installed on the air releases and the motors and drive units on the extrusion machines enclosed. The vibrating screen in the inspection area is the main source of noise there. Fixing the screen to the frame around the entire circumference could help. Placement of a rubber type material on the metal sheets on which the chips drop may reduce the noise. When the enclosure is put on the unit for the ventilation system an added benefit may be that of effective noise reduction.

13. Hearing protection, ear plugs or ear muffs, should be worn in the pug mill and the inspection area until the noise is reduced through engineering methods.

14. Where personnel protective devices are used, the employees must use them. The best protective device is one that is worn.

15. Medical surveillance of workers exposed to asbestos and silica includes periodic physical examinations, chest x-rays, and pulmonary function testing. A complete discussion of recommended surveillance for asbestos (which will be adequate for silica exposure) appears in the NIOSH Criteria Document for a Recommended Standard for Asbestos.

16. A hearing correction program should be provided to the employees in high noise areas. It should include issuing and wearing of hearing protective devices (ear plugs or ear muffs) and an initial and yearly audiogram. Initial audiograms have already been performed.

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VII TABLES

TABLE I
ATMOSPHERIC EXPOSURES TO DUSTS
CONTAINING FREE SILICA
JANUARY 25,26, 1973

DUST SAMPLES

JOB	TOTAL DUST (T) OR RESPIRABLE (R)	% FREE SiO_2	CALCULATED STANDARD* mg/M^3	mg/M^3 (SAMPLE)	"RATIO" SAMPLE RESULTS DIVIDED BY STANDARD
Aluminum oxide separation (BZ)**	T	0.6	8.4	21.9	2.6
	R	0.4	4.2	12.5	3.0
	T	1.5	6.8	14.7	2.2
	R	0.6	3.8	2.2	0.6
Batch Mix (BZ)	T	3.6	4.5	31.0	6.9
	R	3.8	1.7	3.1	1.8
	T	6.5	3.1	44.8	14.5
	R	2.5	2.2	2.8	1.3
Inspection & Boxing (BZ)	T	4.0	4.3	7.2	1.7
	R	4.8	1.5	1.4	0.9
	T	2.2	5.8	17.5	3.0
	R	3.6	1.8	4.4	2.4
Material Handler (BZ)	T	6.4	2.2	6.2	2.8
	R	4.2	1.6	0.9	0.6
	T	5.4	3.6	22.1	7.1
	R	5.8	1.3	2.7	2.1
Pug Mill Operator (BZ)	T	2.4	6.8	3.5	0.5
	R	2.6	2.2	0.3	0.1
	T	2.9	6.1	2.4	0.4
	R	2.6	2.2	0.4	0.1
Special Refractory (BZ)	T	8.7	2.6	3.5	1.3
	R	4.0	1.7	0.3	0.2
	T	3.3	5.7	8.0	1.4
	R	4.0	1.7	1.0	0.6
Fork Lift Operator (BZ)	T	1.7	6.4	1.8	0.3
	R	3.6	1.8	0.6	0.3
	T	3.2	4.8	4.0	0.8
	R	4.0	1.7	1.0	0.6
Aluminum oxide separation (area sample)	T	0.6	8.4	1.9	0.2
Batch Mix (area sample)	T	2.2	5.8	0.7	0.1

*TLV Calculated using quartz standard with values for % free Silica
**BZ - Breathing zone sample

TABLE II
ATMOSPHERIC EXPOSURES TO
TREMOLITE
(ASBESTOS FIBERS)
MARCH 22,23, 1973

JOB	SAMPLE VOL LITERS	FIBER COUNT FIBERS, 5u and longer/CC OF AIR	COMMENTS
Special Refractory (BZ)*	90 90	0.07 0.31	
Special Refractory (area)*	90 90	0.07 0.41	
Pug Mill (BZ)	90 90	0.85 0.34	
Pug Mill (area)	90 90	0.34 0.20	
Aluminum oxide separation (area)	90 96	0.17 0.38	
Batch mix (area)	90 90	0.41 0.20	
Batch mix (BZ)	80 60	2.1 1.2	All operations, except dumping material into the hopper.
Batch mix (BZ)	6 8	38.7 33.6	during dumping of tremolite into the hopper.
Inspection (BZ)	90 90	0.75 0.48	
Material Handler (BZ)	90 90	0.54 0.48	
Inspection (area)	90 90	0.07 0.41	

* Breathing zone sample
** Area sample

U.S. DEPARTMENT OF HEALTH, EDUCATION AND WELFARE
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45202

HEALTH HAZARD EVALUATION REPORT 72-43-57
FORTUNE INDUSTRIES INC.
CHELSEA, MICHIGAN
JULY 1973

I. SUMMARY DETERMINATION

Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6), authorizes the Secretary of Health, Education, and Welfare following a written request by 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 National Institute for Occupational Safety and Health (NIOSH) received such a request from an authorized representative of employees regarding exposure to substances used at Fortune Industries Inc., Chelsea, Michigan.

The following is a list of substances which, by their use, were considered to be of potential hazard to the exposed worker. Their respective exposure standards as promulgated by the U.S. Department of Labor (Federal Register Vol. 37, 1910.93, Table G 1,2,&3, October 18, 1972) are also included.

SUBSTANCE	STANDARD CONCENTRATION (8 hour time-weighted average)	
A. Inert or nuisance dusts	Respirable fraction	$5mg/M^3$*
1. Aluminum oxide 2. Silicon carbide 3. Iron oxide	Total dust	$15mg/M^3$
B. Quartz (free SiO_2)	Respirable	$\frac{10mg/M^3}{\% SiO_2 + 2}$
	Total dust	$\frac{30mg/M^3}{\% SiO_2 + 3}$
C. Tremolite (talc, fibrous) use asbestos limit	5 fibers, longer than 5u, per cc of air Ceiling concentration - 10 fibers, longer than 5u, per cc of air	

PHYSICAL AGENT	STANDARD LEVEL
Noise	90 dBA**

* milligrams per cubic meter of air

** dBA-permissible noise level exposure in decibels (A weighting network) based on an eight hour time-weighted average. Higher noise levels are permissible with a shorter duration of exposure than eight hours as calculated by a standard curve and up to a ceiling level of 115 dBA.

NIOSH investigators conducted a combined environmental and medical evaluation in Fortune Industries on January 25,26, and March 22,23, 1973. Based upon the results of the evaluation, it has been determined that a health hazard exists to the one batch-mix operator from exposure to tremolite (asbestos fibers) and silica containing dusts, and to the 13-15 employees exposed to silica containing dust as used and found in the aluminum oxide separation area, inspection and boxing area, material handling area, and special refractory area. This conclusion is based on the following pertinent information:

1. The silica dust levels exceeded the federal silica standard in the aluminum oxide separation area, inspection and boxing area, material handling area, special refracting area, and batch-mixing area. The values ranged from 1 to 3 times the calculated silica standard, with the exception of two samples that were seven times the standard and one that was 14 times the standard. 0.4 to 8.7% free silica was present in all the dust samples. The free silica was the controlling factor in determining the acceptable levels for the dusts involved since the acceptable concentration would be higher (i.e., would be the nuisance level) if silica were not present.

2. The tremolite (asbestos fibers) concentrations exceeded the standard in the batch mix area. The excessive exposure occurs when tremolite is dumped into the hopper, prior to mixing. The levels measured were 33 to 38 fibers per cubic centimeter (cc) of air which exceeds the ceiling concentration of ten fibers, greater than 5u, per cc of air. This high exposure will occur five to ten minutes, four times a day. The fiber count on the other samples collected ranged from 0.07 to 2.1 fibers, greater than 5u, per cc of air.

3. Although there was no evidence that agents in the plant environment had caused any serious respiratory problem, most workers noted a great deal of dust in their nose at the end of the day. Chest x-rays recently taken of all employees were not indicative of harmful effects from the various dust exposures. However, because of the relatively short period of exposure of most workers (less than six years in almost all cases) to atmospheres of asbestos and silica which normally take many years to cause noticeable lung damage, even when levels are above the standard, one would expect few, if any, serious lung problems to be noted at this time.

Environmental measurements for noise indicated that in two areas of the plant, the noise levels (99-100 dBA at the inspection operation, and 93-95 dBA at the pug mill operation) and exposure times may be reached where there is a potential hearing damage to the 12-14 workers involved.

Recommendations have been suggested to alleviate potentially hazardous conditions observed in this evaluation.

Copies of this Summary Determination of the evaluation are available upon request from the Hazard Evaluation Service Branch, NIOSH, U.S. Post Office Bldg., Room 508, Fifth and Walnut Streets, Cincinnati, Ohio 45202. Copies have been sent to:

a. Fortune Industries Inc.
b. Authorized Representative of Employees
c. U.S. Department of Labor - Region V

For purposes of informing the approximately 16 "affected employees", the employer will promptly "post" the Summary Determination in a prominent place(s) near where affected employees work for a period of 30 calendar days.