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GRUNDY INDUSTRIES, INC.
JOLIET, ILLINOIS

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I. SUMMARY

On February 27, 1986 the National Institute for Occupational Safety and Health (NIOSH) received a request to evaluate a potential health hazard from exposure to asbestos during the manufacture of an asphalt-based roofing compound at Grundy Industries, Inc., Joliet, Illinois.

An environmental survey was conducted in April 1986, and personal samples were collected near the breathing zone of the employees to assess employee exposures to airborne asbestos fibers. A total of six air samples were collected near the breathing zones of four employees. The asbestos bag opener and the control panel operator were monitored for approximately four hours in the morning and four hours in the afternoon, and the forklift driver and a dispensing line worker were monitored for approximately eight hours each.

Total fiber counts were made on five of the six samples collected; the sixth filter was overloaded with particulates and could not be analyzed. Total fiber counts ranged from 0.08 to 0.37 fibers per cubic centimeter of air (fibers/cc) as a time-weighted average (TWA) concentration. The morning sample collected on the asbestos bag opener was identified by the laboratory as asbestos and showed a concentration of 0.37 f/cc. The other four samples were identified as a mix of asbestos and cellulose. Since asbestos was the fiber being used in the product being manufactured on the day of sampling, it is reasonable to assume that the majority of fibers counted were asbestos. Therefore, these sample results are compared to the asbestos criteria. The Occupational Safety and Health Administration (OSHA) Permissible Exposure Limit (PEL) for asbestos is 0.2 fibers/cc. Due to the carcinogenic nature of asbestos, NIOSH recommends that employee exposures be reduced to the lowest feasible limit.

These sample results fall in the same general range as those samples collected during previous NIOSH investigations of this facility (i.e. those described in NIOSH Health Hazard Evaluation Reports 81-477-1192 & 83-438-1479).

On the basis of the environmental data collected, it has been determined that a health hazard from overexposure to asbestos did exist at the time of this survey. Recommendations for maintaining a clean work site and other measures for reducing asbestos exposures are contained Section VIII of this report.

KEYWORDS: SIC 2952 (Paving and Roofing Materials/Asphalt Felts and Coatings), asbestos, roofing compounds.

II. INTRODUCTION

On February 27, 1986, the National Institute for Occupational Safety and Health (NIOSH) received a request from the owner and manager of Grundy Industries, Inc., Joliet, Illinois, to evaluate employee exposures to asbestos during the manufacture of an asphalt/asbestos roofing compound. NIOSH had previously conducted health hazard evaluations of this facility in 1982[1] and 1983[2].

A NIOSH investigator conducted an environmental survey of the facility on April 11, 1986. During this survey personal breathing zone air samples were collected to evaluate employee exposures to asbestos and determine the potential for the spread of asbestos fibers from the bag opening operation to other areas of the facility. A letter was sent to the company on June 30, 1986, detailing the results of the April environmental survey.

III. BACKGROUND

A. Plant Production and Workforce

This company has been at its present location since January 1975. It is a manufacturer of roofing compounds containing primarily asphalt, mineral spirits, and asbestos. At the time of the survey the company had an annual production rate of approximately 3 million gallons and employed up to ten workers in the mixing and packaging department.

B. Process Description and Employee Duties

Asphalt, contained in a storage tank outside the building, is pumped through an enclosed system to an enclosed mixing tank inside the building. Bags containing 50 kilogram cakes of asbestos are opened and fed onto a conveyor system. A fluffing operation to agitate the fibers follows the fiber introduction and the fibers continue down the enclosed conveyor line to the mixing tank. After mixing, the fiber is encapsulated and little asbestos dust is generated. Approximately 1.3 pounds of chrysotile asbestos are added per gallon of asphalt. The asphalt and asbestos mixture is dispensed into containers, capped, labeled, and placed on pallets for transport.

One employee works directly with the 50 kilogram cakes of asbestos, opening and loading them onto a conveyor system. Empty asbestos bags are placed in cardboard boxes, and sent to a trash compactor for disposal. Another employee is responsible for operation of the control panel which monitors and regulates the amount of ingredients in the asphalt/asbestos mixture. The remaining employees are involved in the packaging of the final products and their duties include dispensing, capping, and labeling. Finished products are placed on pallets and transported by forklift trucks to storage areas within the facility. Additionally, one employee working in the packaging area substitutes for the bag opener as necessary.

Recently the company has begun to use a cellulose fiber as a substitute for asbestos. At the time of the April 1986 survey the use of this cellulose roofing product accounted for less than 5% of production.

C. Engineering, Administrative, and Personal Protective Controls

Local exhaust ventilation is provided at the bag opening operation and employees (bag opener and control panel operator) are required to wear a single use disposable mask and disposable coveralls as additional protection. Since the time of the first NIOSH Health Hazard Evaluation the company has: 1) made modifications in the local exhaust ventilation system at the asbestos bag opening operation; 2) installed a dust collection system equipped with a high efficiency particulate air (HEPA) filter at the asbestos bag opening operation; 3) built a change and shower room for employees working in the bag opening area; 4) added a pneumatic platform to aid the bag opener with the lifting of the 50 kilogram cake of asbestos; 5) installed a dust collection system equipped with a HEPA filter at the trash compactor; and 6) enclosed the trash compactor by building walls around the equipment.

IV. ENVIRONMENTAL METHODS AND MATERIALS

During the survey environmental sampling was conducted to determine employee exposures to airborne asbestos fibers. Personal breathing zone air samples for asbestos were collected on AA 25 millimeter filters connected via tygon tubing to battery powered sampling pumps operating at 2.0 liters per minute. All samples collected were analyzed according to NIOSH method 7400[3] utilizing phase contrast microscopy.

V. EVALUATION CRITERIA

A. Environmental Criteria

As a guide to the evaluation of the hazards posed by workplace exposures, NIOSH field staff employ environmental evaluation criteria for assessment of a number of chemical and physical agents. These criteria are intended to suggest levels of exposure to which most workers may be exposed up to 10 hours per day, 40 hours per week for a working lifetime without experiencing adverse health effects. It is, however, important to note that not all workers will be protected from adverse health effects if theirexposures are maintained below these levels. A small percentage may experience adverse health effects because of individual susceptibility, a pre-existing medical condition, and/or a hypersensitivity (allergy).

In addition, some hazardous substances may act in combination with other workplace exposures, the general environment, or with medications or personal habits of the worker to produce health effects even if the occupational exposures are controlled at the level set by the evaluation criterion. These combined effects are often not considered in the evaluation criteria. Also, some substances are absorbed by direct contact with the skin and mucous membranes, and thus potentially increase the overall exposure. Finally, evaluation criteria may change over the years as new information on the toxic effects of an agent become available.

The primary sources of environmental evaluation criteria for the workplace are: 1) NIOSH Criteria Documents and recommended exposure limits (RELs), 2) the American Conference of Governmental Industrial Hygienists' (ACGIH) Threshold Limit Values (TLV's), and 3) the U.S. Department of

Labor/Occupational Safety and Health Administration (OSHA) occupational health standards. Often, the NIOSH RELs and ACGIH TLVs are lower than the corresponding OSHA standards. Both NIOSH RELs and ACGIH TLVs usually are based on more recent information than are the OSHA standards. The OSHA standards also may be required to take into account the feasibility of controlling exposures in various industries where the agents are used; the NIOSH RELs, by contrast, are based primarily on concerns relating to the prevention of occupational disease. In evaluating the exposure levels and the recommendations for reducing these levels found in this report, it should be noted that industry is required by the Occupational Safety and Health Act of 1970 (29 USC 651, et seq.) to meet those levels specified by an OSHA standard.

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

NIOSH recommends that employee exposures to asbestos be reduced to the lowest feasible limit, due to the carcinogenic nature of this substance. The NIOSH REL set in September 1976 is 0.1 fibers greater than 5 microns in length per cubic centimeter (fibers/cc), which was at that time the lowest level detectable by phase contrast microscopy[4]. Phase contrast microscopy is the only practical analytical technique currently available to industry and official agencies which is valid and reproducible. The lowest level detectable by phase contrast microscopy is 0.1 fibers greater than 5 microns in length per cubic centimeter (fibers/cc). On June 20, 1986, OSHA issued a final standard for asbestos which loweredthe PEL from 2.0 fibers/cc to 0.2 fibers/cc as an 8-hour TWA exposure. The ACGIH has recommended a TLV of 2 fibers/cc for chrysotile asbestos, the type being used in this operation.

B. Toxicological[5,6]

Asbestos is a generic term applied to a number of hydrated mineral silicates, including chrysotile, amosite, crocidolite, tremolite, and anthophyllite. Asbestos consists of fibers of varying size, color, and texture. The uses of asbestos are numerous and include thermal and electrical insulation, fire blankets, safety garments, filler for plastics, and roofing materials. The most toxic route of entry into the human body for asbestos is through inhalation. The most widely recognized diseases caused by asbestos are asbestosis, cancer of the lungs and digestive tract, and mesothelioma.

Studies have conclusively shown the association between asbestos exposure and cancer and asbestosis in humans. Asbestosis is a lung disorder characterized by a diffuse interstitial fibrosis, including pleural changes of fibrosis and calcification. Asbestos bodies may be found in the sputum, and the worker exhibits restrictive pulmonary function. Accompanying clinical changes may include fine rales, finger clubbing, dyspnea, dry cough, and cyanosis. These findings may be delayed in onset 10 - 15 years following cessation of exposure.

Bronchogenic carcinoma and mesothelioma of the pleura and peritoneum are also caused by asbestos exposure. Excesses of cancer of the stomach, colon, and rectum have been found among asbestos workers. These cancers may occur following a very limited exposure 20 to 30 years earlier.

VI. RESULTS AND DISCUSSION

Total fiber counts were made on five of the six asbestos samples collected, a sixth filter was overloaded with particulates and could not be analyzed. Total fiber counts on the remaining five analyzable samples ranged from 0.08 to 0.37 fibers per cubic centimeter of air (fibers/cc) as a time weighted average (TWA) concentration. The morning sample collected from the asbestos bag opener was identified by the laboratory as asbestos and showed a concentration of 0.37 f/cc. The other four analyzable samples were identified as a mix of asbestos and cellulose. Since, asbestos was the fiber being used in the product being manufactured the day of sampling it is reasonable to assume that the majority of fibers counted were asbestos. Therefore, these sample results are compared to the asbestos criteria.

The morning and afternoon samples collected near the breathing zone of the asbestos bag opener were both above the NIOSH REL and the less stringent OSHA PEL. The morning sample collected near the breathing zone of the control panel operator was overloaded with particulates and was not analyzable while the afternoon sample was above the NIOSH REL and the OSHA PEL. Samples collected from the forklift operator and one employee working on the dispensing line were above the analytical limit of detection but were below the OSHA PEL. Sample results along with all pertinent sample data are presented in Table I.

Since the time of the last NIOSH health hazard evaluation in 1984 several of the NIOSH recommendations were implemented, including; 1) enclosing the asbestos bag opening conveyor, 2) enclosing the asbestos bag trash compactor, and 3) installing local exhaust ventilation equipped with a HEPA filter at the asbestos bag trash compactor.

Prior to this latest HHE, empty bags from the asbestos bag opening operation were placed in cardboard boxes and sent to a trash compactor when the box was full. This compactor was located in an open area away from the mixing line, however; the compactor was not enclosed and was not local exhaust ventilated. During compaction air displacement would cause the escape of small amounts of asbestos fibers remaining in the bags into the general workroom air. Since this time the trash compactor has been enclosed and equipped with a dust collection system to prevent the spread of asbestos fibers to other areas of the facility.

During the April 1986 survey employees were still using single-use respirators for protection against asbestos dust fibers. Single-use respirators will not provide adequate protection against the cancer causing potential of asbestos[7]. The new OSHA standard for asbestos specifies the use of half mask respirators equipped with high efficiency particulate air (HEPA) filters in areas where asbestos is above the OSHA PEL.[8] NIOSH recommends the use of supplied air respirators or a self contained breathing apparatus as protection against asbestos because of concern about the use of dust, fume, and mist respirators, and other air-purifying respirators, against carcinogenic substances including asbestos. Excessive leakage of a substance such as asbestos into the respirator due to either ineffective filtration or leakage around a poor seal is unacceptable and presents a potentially serious hazard to the wearer.[7]

While the company has installed a change and shower room for the employees working with the asbestos fibers it is not required that these employees shower prior to leaving the facility each afternoon. In order to comply with the new standard it is recommended that the company require and enforce the use of showers each afternoon prior to employees leaving the facility.[8]

The practice of smoking, eating, and drinking in work areas is inappropriate. Smoking can act in combination with chemical and physical agents in the workplace to produce or increase the severity of a wide range of adverse health effects. Placing food, drink, or other substances, which are potentially contaminated with toxic agents found in the workplace, in the mouth, may

increase a worker's absorption of these agents. Smoking has other detrimental effects which are relevant to occupational health and safety[9].

VII. CONCLUSIONS

Based on the environmental samples collected, it was concluded that a hazardous situation did exist from exposure to asbestos during this evaluation. All personal breathing zone air samples collected exceeded the NIOSH recommendation that exposure to asbestos be controlled to the lowest feasible level due to its carcinogenicity. Time-weighted average concentrations for the asbestos bag opener exceeded the OSHA PEL for asbestos. Additionally, the afternoon sample collected near the breathing zone of the control panel operator also exceeded the OSHA PEL for asbestos. Samples collected at the dispensing line and the forklift operator were below the OSHA PEL.

VIII. RECOMMENDATIONS

1. Substitution is the recommended method for controlling occupational exposures to toxic substances. Asbestos should be replaced where technically feasible, by a substitute with the lowest possible toxicity. The use of a substitute would prevent exposure of current employees to a cancer causing agent as well as prevent future exposures of roof tear-off workers.

2. Application of engineering control methods (isolation, enclosure, and ventilation) should be used to control occupational exposure to asbestos if a suitable substitute does not exist.

3. A routine housekeeping procedure should be established and performed every day at the end of the workshift. The area should be cleaned using an industrial type vacuum equipped with a High Efficiency Particulate Air (HEPA) filter. Dry sweeping of the area should never be allowed. Good housekeeping, regularly scheduled maintenance, and work practices are essential to maintaining low levels of airborne asbestos.

4. Respirators should be used during non-routine operations (e.g. cleaning a spill at the bag opening workstation, cleaning or repairing exhaust ductwork, etc.) or at any time when the potential for exposure to asbestos above the NIOSH recommended levels exists.

5. The use of respirators requires the establishment of an effective respirator program. Respirators require quantitative fit testing, maintenance, cleaning, and training of employees in order to be effective.

6. NIOSH recommends the use of supplied air respirators or a self contained breathing apparatus as protection against asbestos. Air purifying respirators are not acceptable for use when working with asbestos or asbestos-containing products.

7. Employees who are required to wear respiratory protection should be clean shaven to the point that there is no possible interference with the sealing surfaces of the respirator.

8. The practice of wearing disposable coveralls and disposable head coverings which cover the entire scalp should be continued.

9. Employees should not be allowed to leave the workplace or enter designated lunch areas until established decontamination procedures have been followed. Employees should be required to stow and change clothes prior to leaving the facility in the afternoon to return home.

10. Workers should be counseled on the potential dangers from exposure to asbestos. Workers who do not speak, read, write, or understand English should be provided with training or written information on the hazards of exposure to asbestos in their native language.

11. Eating, drinking, and smoking should be prohibited in rooms where asbestos is handled or processed. Employees should not carry their cigarettes on the work site when working with asbestos.

12. Environmental sampling should be conducted on a regular basis to assure that employee exposures are below acceptable limits.

13. Medical monitoring of asbestos workers should be continued and should include preplacement and annual physical examinations with emphasis on the pulmonary system.

IX. REFERENCES

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4. National Institute for Occupational Safety and Health. Revised Criteria for a Recommended Standard - Occupational Exposure to Asbestos. Cincinnati, Ohio: National Institute for Occupational Safety and Health (NIOSH) 1977. [DHEW (NIOSH) Publication No. 77-169].

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7. National Institute for Occupational Safety and Health. Notice to All Respirator Manufacturers, August 25, 1980. Morgantown, West Virginia: National Institute for Occupational Safety and Health, 1980.

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9. National Institute for Occupational Safety and Health. Current Intelligence Bulletin 31 - Adverse Health Effects of Smoking and the Occupational Environment. Cincinnati, Ohio: National Institute for Occupational Safety and Health, 1979. (DHEW (NIOSH) Publication No. 79-122).

X. AUTHORSHIP AND ACKNOWLEDGEMENTS

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XI. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, 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), Port Royal Road, Springfield, Virginia 22161. Information regarding its availability through NTIS can be obtained from the NIOSH publications office at the Cincinnati address. Copies of this report have been sent to the following:

A. Grundy Industries, Inc.

B. U.S. Department of Labor, OSHA - Region V

C. NIOSH Regional Offices/Divisions

For the purposes of informing the affected employees, copies of the report should be posted in a prominent place accessible to the employees, for a period of 30 calendar days.

TABLE 1

Personal Breathing Zone Total Fibers per Cubic Centimeter (fibers/cc)

Grundy Industries, Inc.
Joliet, Illinois

April 11, 1986

Job Classification/Location	Sample Time (minutes)	Fibers/cc*
Asbestos bag opener	232	0.37¶
	211	0.23
Control Panel Operator	234	**
	213	0.23
Forklift Driver	476	0.07
Filler @ dispensing line	474	0.08

* - fibers greater than 5 microns in length per cubic centimeter (fibers/cc)

** - Filter was overloaded with particulates and was not analyzed

¶ - sample was identified as asbestos fibers, all other samples were a mixture of asbestos and cellulose

LABORATORY LIMIT OF DETECTION: 0.03 fibers per field or 1500 fibers per filter

EVALUATION CRITERIA:

OSHA - 0.2 fibers/cc

ACGIH TLV - 2 fibers/cc for chrysotile asbestos

NIOSH - lowest feasible limit for cancer causing agent