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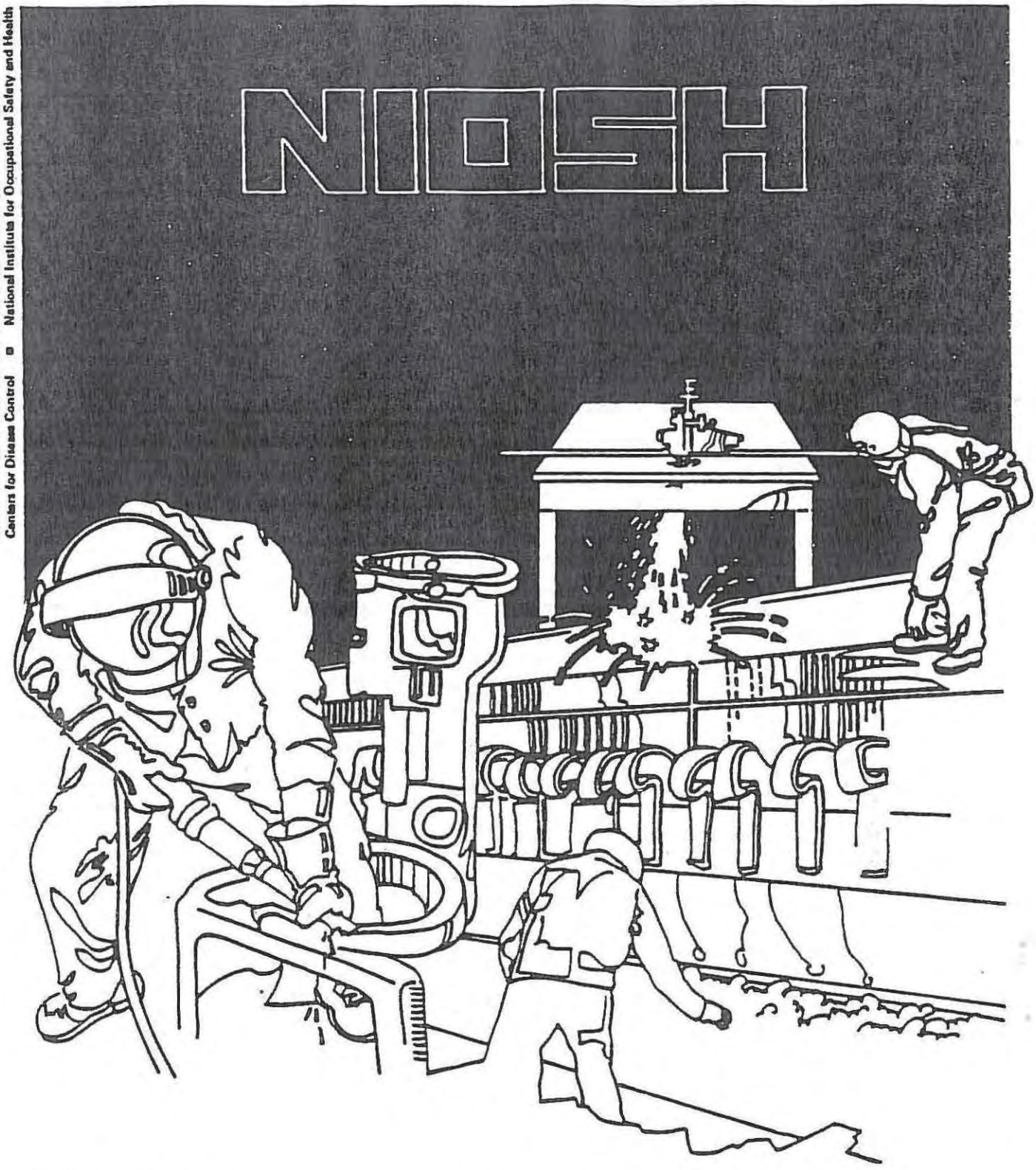

Health Hazard Evaluation Report

HETA 83-438-1479
GRUNDY INDUSTRIES, INC.
JOLIET, ILLINOIS

PREFACE

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

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

HETA 83-438-1479
JULY 1984
GRUNDY INDUSTRIES, INC.
JOLIET, ILLINOIS

NIOSH INVESTIGATORS:
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I. SUMMARY

On September 12, 1983, 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.

Environmental surveys were conducted in October 1983, December 1983, and February 1984. Personal breathing zone and general area air samples were collected to assess employee exposures to airborne asbestos fibers.

During the October 1983 survey, an equipment breakdown occurred at the asphalt mixing tank. Personal breathing zone air samples were collected for asbestos prior to the breakdown and during equipment repairs. These results showed asbestos concentrations of 2.2, 0.5, and 0.21 fibers greater than 5 microns in length per cubic centimeter (fibers/cc). Personal breathing zone air samples collected following repairs showed levels of 0.9, 1.0, 0.25 fibers/cc. Total time weighted average (TWA) concentrations were 1.1, 0.94, and 0.24 fibers/cc. A general work area sample collected during the entire workday showed a level of 0.6 fibers/cc.

Samples from the environmental survey of December 1983 were voided due to the appearance of an unidentifiable "chocolate colored" substance on the filter media. Samples collected in February 1984 showed asbestos concentrations substantially lower than those found in October 1983. Personal breathing zone air samples revealed levels of 0.35, 0.17, and 0.16 fibers/cc. General area air samples showed a non-detectable level in the warehouse and concentrations of 0.17, 0.22, and 0.21 fibers/cc at areas around the bag opening operation.

All personal breathing zone air samples exceeded the NIOSH recommendation that exposure to asbestos be controlled to the lowest feasible limit due to the carcinogenic nature of this substance. However, none of the samples exceeded the Occupational Safety and Health Administration (OSHA) standard. The OSHA standard presently enforced is 2 fibers/cc as an eight-hour TWA concentration but may be lowered in current rule making.

On the basis of the environmental data collected NIOSH has determined that a health hazard from exposure to asbestos did exist at the time of these surveys. Recommendations for maintaining a clean work site and other measures for reducing asbestos exposures are contained in the body of this report.

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

II. INTRODUCTION

On September 12, 1983, the National Institute for Occupational Safety and Health (NIOSH) received a request from the owner and manager of Grundy Industries, Inc., Joliet, Illinois, to re-evaluate employee exposures to asbestos during the manufacture of an asphalt/asbestos roofing compound. NIOSH had previously conducted a health hazard evaluation of this facility in 1982[1].

NIOSH investigators conducted environmental survey visits on October 25, 1983, December 15, 1983, and February 3, 1984. During these surveys personal breathing zone and general area 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. Status letters were sent to the company on December 12, 1983 and May 7, 1984 giving the results of the October 1983 and February 1984 survey visits.

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 surveys 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 leading directly to the mixing tank. 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, sent to a trash compactor and disposed of. One employee is responsible for operation of the control panel which monitors and regulates the amount of the 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.

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 room for employees working in the bag opening area; and 4) added a pneumatic platform to aid the bag opener with the lifting of the 50 kilogram cake of asbestos.

IV. ENVIRONMENTAL METHODS AND MATERIALS

During the surveys environmental sampling was conducted to determine employee exposures to airborne asbestos fibers. Personal breathing zone and general area air samples for asbestos were collected on AA 37 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 P&CAM (Physical and Chemical Analytical Method) 239[2] 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 their exposures 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 recommendations, 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 recommendations and ACGIH TLV's are lower than the corresponding OSHA standards. Both NIOSH recommendations and ACGIH TLV's usually are based on more recent information than are the OSHA standards. The OSHA standards also may be required to take into account the feasibility of controlling exposures in various industries where the agents are used; the NIOSH-recommended standards, 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 only 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 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 recommended standard is set at the lowest level detectable by phase contrast microscopy. 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). The current OSHA standard for asbestos as an 8-hour TWA exposure is 2 fibers/cc and 10 fibers/cc as a 15-minute ceiling concentration. The ACGIH has recommended a TLV of 2 fibers/cc for chrysotile asbestos.

B. Toxicological[3,4]

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 is 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 asbsestos 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

During the survey of October 1983, an equipment malfunction occurred at the mixing tank and the system was shut down for repairs for about one hour. Personal breathing zone air samples taken prior to and during the shutdown showed asbestos fiber concentrations of 0.21, 0.5, and 2.2 fibers/cc. The filter media for all personal samples were changed following completion of equipment repairs and samples were collected for the remainder of the day. These personal breathing zone air samples showed concentrations of 0.25, 0.9, and 1.0 fibers/cc. Total time weighted average concentrations for the day revealed levels of 0.24, 0.94, and 1.1 fibers/cc. One general area air sample collected for the entire workday revealed a TWA concentration of 0.6 fibers/cc approximately 15 feet from the asbestos bag opening operator. An outdoor environmental sample was below the analytical limit of detection. Refer to Table 1 for complete results.

On December 15, 1983, NIOSH investigators returned to the plant to resample the operation for the purpose of determining if the previous sample results were higher as a result of the equipment malfunction and shutdown. Discussions with laboratory personnel indicated that analysis of these samples was not feasible due to the appearance of an unidentifiable "chocolate colored" substance on the surface of the filter media.

On February 3, 1984, personal breathing zone and general area air samples revealed TWA concentrations substantially below those of the October 1983 site visit. Personal breathing zone air samples collected showed TWA concentrations of asbestos fibers of 0.35 fibers/cc (calculated 8-hour TWA = 0.29) for the bag opener, 0.17 fibers/cc (calculated 8-hour TWA = 0.14) for the control panel operator, and 0.16 fibers/cc (calculated 8-hour TWA = 0.13) for the forklift driver. General area air samples collected revealed TWA concentrations of asbestos fibers of 0.17 fibers/cc (calculated 8-hour TWA = 0.15) at the end of the conveyor belt at the bag opening operation, 0.22 fibers/cc (calculated 8-hour TWA = 0.20) at the newly installed dust collector, 0.21 fibers/cc (calculated 8-hour TWA = 0.18) approximately 2 feet above the bag disposal box, and a level below the analytical limit of detection in the final product storage area. See Table II for complete sample results. Tables III and IV show sample results from the previous NIOSH health hazard evaluation and have been provided for comparison purposes.

VII. DISCUSSION AND CONCLUSIONS

Based on the environmental samples collected, a hazardous situation did exist from exposure to asbestos during this evaluation. All personal breathing zone and general area air samples exceeded the NIOSH recommendation that exposure to asbestos be controlled to the lowest feasible level due to its carcinogenicity. All eight-hour TWA concentrations for asbestos were below the OSHA permissible exposure limits specified by law.

Results obtained during the October 1983 survey were substantially higher than those of the previous NIOSH health hazard evaluation of 1981-82. This increase in asbestos concentrations is believed to be a direct result of an equipment malfunction which occurred during that survey visit. The February 1984 survey showed a reduction in employee exposures. These results fell in the same general range as those of the 1981-82 evaluation with the exception of personal samples collected for the control panel operator.

Improvements in the local exhaust ventilation system at the asbestos bag opening operation seem to have helped to reduce personal exposures for the control panel operator, during normal operations, by capturing asbestos fibers at the bag opening operation and preventing the spread of fibers to other areas. Results of the February 1984 survey showed a personal breathing zone concentration of 0.17 fibers/cc as a TWA concentration while personal sampling from May 1982 showed a TWA concentration of 0.73 fibers/cc. These results indicate a reduction of approximately 75% for this individual.

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. To remove an additional source of asbestos contamination it is recommended that this operation be properly enclosed and ventilated or that this practice be discontinued.

Employees were wearing single-use respirators for protection against asbestos dust fibers. Single-use respirators will not provide adequate protection against the cancer causing potential of asbestos[5].

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[6].

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, 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. In addition to the local exhaust ventilation system and dust collection system that was installed at the asbestos bag opening operation the entire conveyor belt should be completely enclosed to prevent the escape of asbestos fibers.

3. Empty asbestos bags placed in cardboard boxes for transport to the trash compactor should not be compressed to make space for additional bags.

4. If the practice of compacting boxes containing empty bags from the asbestos bag opening operation is to continue the trash compactor should be isolated and properly vented. These bags contain small amounts of asbestos which may escape to the general workroom environment when they are compacted.

5. 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.

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

7. 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.

8. The type of respirator selected for use should be based on the contaminate concentrations expected to be present. Supplied air respirators should be used in areas of high concentrations. For lower concentrations a properly fitted, non-disposable half-face respirator with NIOSH approved filter for asbestos is appropriate.

9. 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.

10. The practice of wearing disposable coveralls should be continued. In addition employees should be provided with and required to wear disposable head coverings which cover the entire scalp to prevent asbestos fibers from getting into their hair.

11. Employees should not be allowed to leave the workplace or enter designated lunch areas until established decontamination procedures have been followed.

12. 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.

13. 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.

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

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

IX. REFERENCES

1. National Institute for Occupational Safety and Health. Health Hazard Evaluation Report 81-477-1192. Cincinnati, Ohio: National Institute for Occupational Safety and Health, 1981. (DHEW (NIOSH) Publication No. HETA 81-477-1192).

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IX. 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

Breathing Zone and General Area Air Concentrations of Asbestos Fibers

Grundy Industries, Inc.
Joliet, Illinois

October 25, 1983

Job Classification/Location		Sample Time (minutes)	Fibers/cc*
Blank		---	<LOD
Environmental Sample (outdoor)		430	<LOD
Area Sample (approximately 15 ft. from bag opening)		453	0.6
Control Panel Operator		79	2.2†
		379	0.9
	TOTAL	458	1.1
Asbestos bag opener		84	0.5†
		340	1.0
	TOTAL	424	0.94
Forklift Driver		65	0.21†
		384	0.25
	TOTAL	449	0.24

* - fibers greater than 5 microns in length per cubic centimeter (fibers/cc)
† - samples taken during system shutdown
<LOD - less than laboratory limit of detection

LABORATORY LIMIT OF DETECTION: 0.03 fibers per field or 4500 fibers per filter

EVALUATION CRITERIA:

OSHA - 2.0 fibers/cc
ACGIH TLV - 2 fibers/cc for chrysotile asbestos
NIOSH - lowest feasible limit for cancer causing agent

TABLE II

Personal Breathing Zone and General Area Air Concentrations of Asbestos Fibers

Grundy Industries, Inc.
Joliet, Illinois

February 3, 1984

Job Classification/Location	Sampling Time (Minutes)	Fibers/cc*	8-hour TWA (Calculated)
Blank	-0-	<LOD	----
Asbestos bag opener	395	0.35	0.29
Control Panel Operator	395	0.17	0.14
Forklift Driver	391	0.16	0.13
Area Sample (End of Loader Belt)	431	0.17	0.15
Area Sample (Above dust collector)	429	0.22	0.20
Area Sample (Above bag disposal box)	420	0.21	0.18
Area Sample (Warehouse)	412	<LOD	----

* - fibers greater than 5 microns in length per cubic centimeter (fibers/cc)
<LOD - less than laboratory limit of detection

LABORATORY LIMIT OF DETECTION: 0.03 fibers per field or 4500 fibers per filter

EVALUATION CRITERIA:

OSHA - 2.0 fibers/cc
ACGIH TLV - 2 fibers/cc for chrysotile asbestos
NIOSH - lowest feasible limit for cancer causing agent

TABLE III

Breathing Zone and General Area Air Concentrations of Asbestos Fibers

Grundy Industries, Inc.
Joliet, Illinois

November 19, 1981

Job Classification/Location	Sampling Time (Minutes)	Fibers/cc*
Blank	---	**
Area Sample (across aisle from bag opening)	461	0.17
Control Panel Operator	469	0.73
Environmental Sample (outside)	446	**
Forklift Driver	462	0.15
Asbestos bag opener	402	0.32
Area Sample (dispensing area)	461	0.16

* - fibers greater than 5 microns in length per cubic centimeter (fibers/cc)
** - below laboratory limit of detection

EVALUATION CRITERIA:

OSHA - 2.0 fibers/cc
ACGIH TLV - 2 fibers/cc for chrysotile asbestos
NIOSH - lowest feasible limit for cancer causing agent

LABORATORY LIMIT OF DETECTION: 0.03 fibers per field or 4500 fibers per filter

TABLE IV

General Area Air Concentrations of Asbestos Fibers

Grundy Industries, Inc.
Joliet, Illinois

May 17, 1982

Location	Sampling Time (Minutes)	Fibers/cc*
Blank	---	**
Area Sample (asbestos hood, six feet above floor, front of hood)	140	0.55
Area Sample (asbestos hood, six feet above floor, back of hood)	136	0.72

* - fibers greater than 5 microns in length per cubic centimeter (fibers/cc)
** - below laboratory limit of detection

EVALUATION CRITERIA:

OSHA - 2.0 fibers/cc
ACGIH TLV - 2 fibers/cc for chrysotile asbestos
NIOSH - lowest feasible limit for cancer causing agent

LABORATORY LIMIT OF DETECTION: 0.03 fibers per field or 4500 fibers per filter