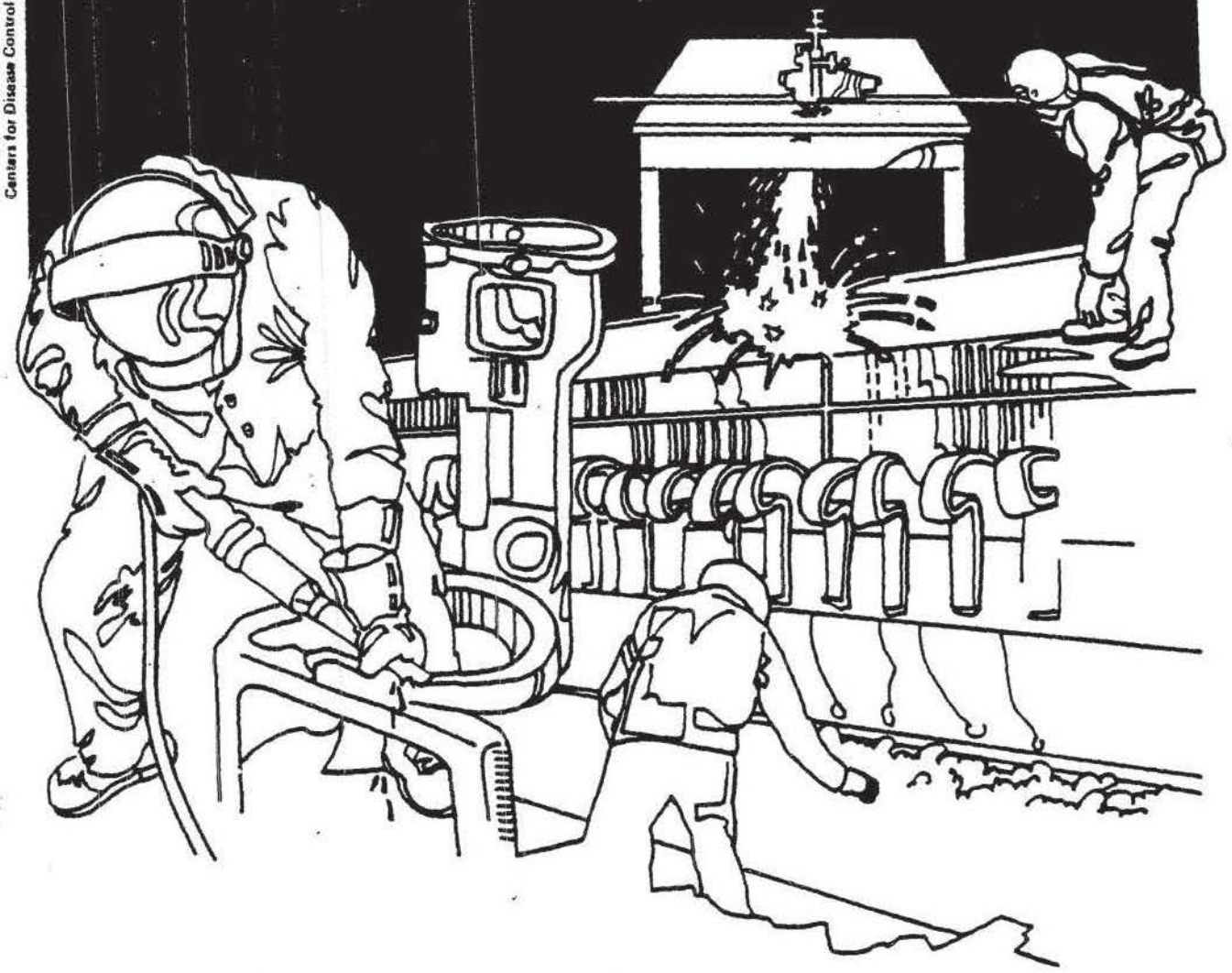
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
Centers for Disease Control ■ National Institute for Occupational Safety and Health

NIOSH



Health Hazard Evaluation Report

HETA 84-167-1662

SIMMONS, USA

KANSAS CITY, KANSAS

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.

Mention of company names or products does not constitute endorsement by the National Institute for Occupational Safety and Health.

HETA 84-167-1662
FEBRUARY 1986
SIMMONS, USA
KANSAS CITY, KANSAS

NIOSH INVESTIGATORS:
John N. Zey, M.S., C.I.H.
James M. Boiano, I.H.

I. SUMMARY

In February 1984, the National Institute for Occupational Safety and Health (NIOSH) received a request from Simmons, USA's corporate headquarters for a health hazard evaluation (HHE) of their Kansas City, Kansas facility, to evaluate employee exposures to airborne cotton dust in the garnetting department and other process areas where cotton material was used.

NIOSH investigators visited the facility on February 27-29, 1984 and conducted area air sampling for total cotton dust in the garnetting, bale press, hide-a-bed, and hog-ringing areas. A return visit to collect size selective cotton dust samples using the vertical elutriator (an area sampler) and personal total cotton dust samples had been planned for the summer of 1984. However, shortly after the initial visit the company initiated a plant-wide remodeling program which lasted approximately one year. Concurrently, the company cut back the garnetting production to about 1/4 the pre-remodeling level. Based on these occurrences and the fact that area total cotton dust levels were all below 700 ug/m^3 during the initial survey, as compared to the OSHA standard in effect at that time of 1000 ug/m^3, Simmons USA and NIOSH agreed to close out the project based on the data collected.

Total airborne cotton dust concentrations collected in February 1984, ranged from 199 to 658 ug/m^3 in garnetting, 199 to 293 ug/m^3 in bale press, 230 to 325 ug/m^3 in hide-a-bed, and 209 to 351 ug/m^3 in hog-ringing. Visual observation of the work areas revealed problems in maintenance of processing equipment and employee work practices. Many dust emission sources were noted in the Garnetting Department. The addition of a mineral oil to the raw materials probably contributed to the relatively low airborne dust levels.

Based on the results, NIOSH has concluded that total cotton dust levels did not exceed the OSHA 1000 ug/m^3 total cotton standard that was in effect at the time the NIOSH site visit was conducted. The NIOSH investigators believe the use of a mineral oil was effective in reducing airborne cotton dust concentration. Recommendations are made in Section VIII for further reducing of the cotton dust concentrations through machinery repair and improved employee work practices.

KEYWORDS: SIC 2515 (Mattresses and Bedsprings), garnetting, hide-a-bed, baling, hog-ringing, cotton batts, cotton dust-total, mineral oil, boric acid.

II. INTRODUCTION

On February 1, 1984 the National Institute for Occupational Safety and Health (NIOSH) received a request from Simmons, USA's corporate office in Columbus, Ohio for a health hazard evaluation (HHE) of their Kansas City, Kansas facility to evaluate employee exposure to airborne cotton dust in garnetting and associated processing areas.

On February 27-29, 1984 a team of NIOSH investigators conducted an initial survey at the Kansas City, Kansas facility. During this visit area airborne total cotton dust samples were collected. A return visit in the summer of 1984 was scheduled to collect both personal total cotton dust and area vertical elutriator samples. The anticipated follow-up survey was postponed due to plant remodeling. By the end of the plant modifications, production in the garnetting department had been reduced to one day per week. At this point a decision was made to close out the evaluation based on information collected during the initial survey.

Initial recommendations were presented in a closing meeting held with company and union representatives on February 29, 1984 and reaffirmed in a letter distributed on March 20, 1984 An interim report presenting environmental data and recommendations was distributed to interested parties in April 1984. Subsequently, letters and memorandums were distributed on May 29, 1984, July 24, 1984, December 12, 1984, April 29, 1985, and August 14, 1985, to keep study participants abreast of the investigation status.

III. BACKGROUND

The Kansas City, Kansas plant began production in 1936. The workforce at the time of the NIOSH visit was 220 with subsequent reductions to about 90 in the summer of 1985. The company manufactures mattresses, bedsprings and sleeper sofas. Production areas using cotton material included garnetting, baling, hide-a-bed and hog-ringing.

In the Garnetting Department bales of raw materials including a cotton textile waste called picker, and linters - short cotton fibers obtained from a cottonseed oil mill, are transported to the feed area. One employee opens the bales which weigh about 600 pounds each and places the raw materials onto one of two feed trays. Scrap materials from the garnetting process are also used. Raw materials go into willow machines where the clumps of raw materials are opened and mixed. Boric acid, a fire retardant, and mineral oil used to hold the powdered boric acid to the cotton material, are added at this point. Next, the material is conveyed to an adjacent room and via an overhead conveyor drops into one of five garnett machines. The garnett machines contain a series of

"toothed" rolls which are designed to separate and align fibers into a thin web. From the garnett machine, the web is transferred via a series of conveyors to the floor apron. The speed of the floor apron and the number of garnett machines running determine the thickness of the cotton pad. Four of the machines are used to form the main cotton pad and one is used for border material (i.e., corner of a mattress). At the end of the conveyor the cotton pad is cut into individual units called batts. One employee works at the take-off position loading the batts onto transport carts.

A third employee worked full time in the department. This employee performed many tasks including clean-up and machinery maintenance. In addition to the three full time employees, a mechanic and a trucker work in the department part time.

The Garnetting Department was the only processing area with local exhaust ventilation equipment. Both feed trays were equiped with a flanged slot. There were also canopy hoods on each garnett machine.

In the baling area, 1-2 employees load individual batts into a baling machine. Two bales are produced simultaneously and wrapped with a plastic cover. Each bale measures approximately 4 x 3 x 2 ft and weighs between 60 and 85 lbs depending on the size of the batts. Individual bales are lifted onto carts and sent to shipping. Production during the survey varied from 2000 to 6400 lbs of material per shift.

In hide-a-beds, approximately eight employees use batts to pad the arms and backs of sleeper-sofas. During the survey 750 to 920 lbs of cotton batts were used. There were two ceiling fans located in the area.

Hog-ringing involved the production of mattresses. Teams of two employees worked together to assemble springs, covers, pads and side panels. Then the mattresses are sent to sewing tables where the assembled unit is sewn together. Depending on the quality of the mattress, cotton batts may be used for both the main pad and corner padding or just for the corner padding. During the survey 1200 lbs of cotton batts were used each shift. There were three ceiling fans located in the area.

IV. METHODS AND MATERIALS

At the time of the initial site visit there were two types of exposure criteria for assessing employee exposures to cotton dust. The OSHA Cotton Dust Standard was based on personal total dust samples. NIOSH however, recommended that cotton dust exposure be evaluated using an area size selective cotton dust sampler called the Lumsden-Lynch vertical elutriator.

The vertical elutriator is a rather bulky (wt = ~8 kg, length = ~100 cm) sampler which requires line power for operation. In order to evaluate cotton dust exposures in a plant with 4-5 separate processing areas in a reasonable amount of time (2-3 days) requires 12-15 samplers.

Due to the bulkiness of the vertical elutriator, the need for line power, and the total amount of equipment needed, the NIOSH investigators decided to conduct an initial survey to collect background information and area total dust measurements.[1-2] During the follow-up personal total cotton dust samples would have been collected also due to uncertainty as to whether the future OSHA standard would be based on personal total dust as it was at the time of the study or an area size selective sampler as NIOSH recommends. Additionally, these measurements would be beneficial in estimating vertical elutriator concentrations so that filter overloading could be prevented.

During the initial plant survey area total dust cotton samples were collected in locations where vertical elutriator sampling was anticipated for the follow-up survey; garnetting, baling, hide-a-bed and hog-ringing.

Total dust cotton samples were collected using pre-weighed polyvinyl chloride filters contained in two-piece cassettes. The filters were attached via flexible tubing to a battery operated pump calibrated at either 1.5 or 2.0 liters of air per minute (LPM) depending on the location and anticipated dust concentration. Subsequent to field collection, cotton dust samples, including field blanks, were returned to the NIOSH laboratory for final weighing on an electrobalance.

The weight of each sample was determined by substracting the final weight of the sample plus the filter from the initial weight of the filter. The electrobalance had a precision of 0.01 milligram per sample.

V. EVALUATION 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 (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 legally required 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 or ceiling values which are intended to supplement the TWA where there are recognized toxic effects from high short-term exposures.

Exposure to airborne cotton dust is associated with a respiratory disease called byssinosis. Byssinosis is characterized by chest tightness and/or shortness of breath. In the early stages of the disease symptoms occur periodically on the first day back to work following a break such as a weekend. Eventually these symptoms occur on each first day back and then on succeeding work days.[3-4]

The prevalence of byssinosis is well documented for the cotton textile industry but less so for the non-textile industry including garnetting/mattress manufacturing. One reason may be the different composition of trash components in non-textile raw materials.[5-6] In a study of the non-textile cotton industry NIOSH documented respiratory problems in four of the five segments studied.[7-11] When OSHA was established in 1970 the existing exposure criterion was the ACGIH TLV of 1000 micrograms total cotton dust per cubic meter of air (ug/m^3).[12-13] This was incorporated into the first set of OSHA standards.

In 1974 NIOSH published a Criteria Document recommending employee exposure to cotton dust be reduced to the lowest level feasible which should be less than 200 ug/m^3, based on lint free dust samples collected with the Lumsden-Lynch vertical elutriator.[14-15] In 1978 OSHA promulgated a cotton dust standard based on vertical elutriator sampling which included a Permissible Exposure Limit (PEL) of 500 ug/m^3 for non-textile facilities such as garnetting.[16] This standard was then stayed and in 1983 OSHA proposed a revised standard exempting all non-textile industries except waste utilization which was to be covered under the total dust standard.[17] In documents submitted prior to, and in testimony presented at the 1983 OSHA public hearing, NIOSH recommended that airborne cotton dust levels in non-textile facilities be reduced to the lowest level feasible and that sampling be conducted using the vertical elutriator.[18-19] The final OSHA standard was promulgated in December 1985. It includes a PEL of 1000 ug/m^3 based on samples collected with the vertical elutriator for the cotton waste industry which includes garnetting facilities.[20]

Based on these factors the NIOSH investigators believe the most appropriate exposure criterion for comparison to the samples collected during this study is the 1000 ug/m^3 total cotton dust OSHA standard which was in force when the field evaluation was conducted.

VI. FINDINGS

A. Environmental Sampling

Table 1 presents the results of area airborne sampling for total cotton dust. Highest concentrations were obtained in the garnetting room where 12 area samples ranged from 182 to 658 ug/m^3. The other three processing areas had airborne dust concentrations of 199 to 293 ug/m^3 in the baling area; 230 to 325 ug/m^3 in hide-a-bed; and 209 to 351 ug/m^3 in hog-ringing.

While it is not possible to directly compare total cotton dust values to cotton concentrations determined using a vertical elutriator, one can assume that the vertical elutriator would give somewhat lower concentrations, since it is a size selective sampler. The airborne concentrations listed in Table 1 were all less than 660 ug/m^3, thus elutriator sample results should be less than those shown.

B. General Observation

The garnetting equipment was old and required continual monitoring. There were several dust emission sources noted including missing panels in some of the machinery. Doors and/or windows that were in-place were often left open. An open trash hopper was another source of dust emissions. The hopper, located near the number one garnett line was filled from an overhead pipe. Airborne dust was generated as trash fell into the hopper. Throwing rather than placing raw materials onto the feedtrays also generated airborne dust. Considering the number of emission points and the trash content of some of the raw materials, one might expect high airborne dust concentrations. The results listed in Table 1 reveal that the airborne concentrations were in fact relatively low. These values are supported by the visual observation of airborne particulates. The NIOSH investigators believe the primary reason for this is the oil added to the raw materials in the garnetting room. Previous articles have discussed the results of using an oil to control airborne emissions.[1,2]

Garnetting employees all wore respiratory protection (3M 8710) during part of the shift. Many times however, respirators were worn improperly in that only one of two straps were used. This practice compromises the effectiveness of a respirator.

A walkway located overhead in the garnetting room feed area needs to have a rail installed on certain sections. The guardrail will help prevent employees from falling onto processing equipment.

Garnett machine conveyors had broken slats which may have contributed to processing problems that occurred during the survey.

There were problems with existing ventilation equipment in the garnetting department. Ducts on many of the hoods were crimped at the point of attachment to the hood. Visual observations of the feed trays exhausts indicated that they were not controlling dust generated on the feed trays. In addition to the crimped ducts, the flanged slots did not extend the full length of the tray.

Problems noted in other locations included employees in bagging that wore disposable (3M 8710) respirators with one strap removed. Additionally, this operation required lifting the bales of batts onto a cart. Although two employees were assigned to the area, at times only one employee lifted the bales which weigh up to 80 lbs and measure 4 x 3 x 2 ft. As the cart was filled, some lifts were 4 to 5 ft above the floor.

Some items or work practices were noted during the initial survey that the NIOSH investigators believe are effective and should be continued.

These items are as follows:

1. Hair covers worn by garnetting employees help keep hair free of cotton material.

2. The use of windows as opposed to openings where it is necessary to observe the flow of material inside processing equipment, is a good control technique.

3. The application of a mineral oil to the raw materials in the garnetting feeding area, as previously noted, is a proven control technique for helping reduce airborne dust emissions. While the oil holds boric acid on the cotton material, it also, if used properly, effectively reduces airborne dust emissions.

VII. DISCUSSION AND CONCLUSIONS

The results indicate that airborne cotton dust concentrations were below the OSHA 1000 ug/m^3 total cotton dust standard that was in force at the time of the NIOSH investigation. It should be noted that the measurements were collected with area samplers and the OSHA standard is intended for personal sampling. The samples were collected in locations where vertical elutriator sampling would have been conducted if a follow-up survey had been conducted. Cotton dust concentrations collected with the size selective vertical elutriator would have been less than the total dust values obtained.

There were a number of emission points in the Garnetting Department. Missing machinery panels, the open trash hopper, use of compressed air, and throwing raw materials onto the feed trays all increase airborne dust levels. The investigators believe the use of the mineral oil was suspressing airborne dust levels. A similar situation was noted during a previous health hazard evaluation at a garnetting facility.[1] In an experiment conducted by the United States Department of Agriculture cotton dust levels were reduced by up to 75% in a textile carding operation. For example, total dust levels of 2500 ug/m^3 with no oil additive were reduced to approximately 600 ug/m^3.[21]

The dust levels measured during this investigation could probably be reduced further by proper maintenance and/or repair of machinery. Improving work practices would also help, such as placing rather than throwing material onto feed trays, and reducing the use of compressed air for clean-up. Reducing airborne cotton dust concentrations through correcting the noted problems is consistent with NIOSH's recommendation that cotton dust levels be reduced to the lowest level feasible.

There are a number of published reports of environmental investigations conducted in non-textile cotton facilities such as cotton gins, cottonseed oil mills, and cotton waste utilization plants. Some of these studies have been conducted by NIOSH and several studies have been conducted by other organizations.[1, 22-34] There are however, relatively few published reports of environmental assessments in garnetting facilities. NIOSH has conducted five previous investigations, including two HHEs.[1,31-34] Cotton dust levels were measured in these studies using either the vertical elutriator and/or a total dust sampler. Cotton dust levels obtained in Garnetting Departments in four of the five studies were higher regardless of the measurement technique. Total dust levels ranged from 1,500 to greater than 10,000 ug/m^3.[30-33] In the other study, vertical elutriator concentrations ranged from 50 to 680 ug/m^3.[1]

VIII. RECOMMENDATIONS

The following recommendations are those the NIOSH investigators believe will help reduce the measured cotton dust levels, most of which would probably involve a minimal financial expenditure:

1. Garnetting ventilation equipment should be inspected and repaired as necessary. The crimped ducts should be repaired. Extending the slots hoods to the full length of the trays and adding flexible side panels should increase the hoods' effectiveness.

2. Raw materials should be placed rather than thrown onto feed trays.

3. All windows/panels on processing machinery should be kept closed. Missing panels or doors should be replaced as needed.

4. The use of compressed air for clean-up should be reduced to a minimum and replaced with vacuum cleaning whenever possible. Those employees conducting blow down should wear eye protection in addition to respirators.

5. The open trash container in garnetting should be covered or enclosed.

6. The missing guardrails on the overhead walkway located near feed line no. 1 in the garnett room should be replaced. If access to overhead machinery is required, a gate rather than a rail should be installed.

7. Broken slats on garnetting machine conveyors should be replaced.

8. The employees at the baling station should always work in pairs when lifting bales of cotton batts. Although the weight of an individual bale is not necessarily excessive (60-80 lbs), the bulkiness of the bale and the height of some lifts make it a potentially hazardous activity.

9. The available respiratory protection should be improved so that employees have access to different size respirators and employees should be trained as to the importance of wearing respirators properly (i.e., both head straps should be used).

VIII. REFERENCES

1. National Institute for Occupational Safety and Health. Health hazard evaluation report no. HETA 81-406-1150 Cincinnati, Ohio: National Institute for Occupational Safety and Health, 1982.

2. Zey JN. Industry surveys conducted by NIOSH. IN: Annals of the American Conference of Governmental Industrial Hygienists: Vol 2. Agricultural Respiratory Hazards (W.D. Kelley, ed.) pp 37-47. ACGIH. Cincinnati, Ohio, 1982.

3. Bouhuys A, Heaphy LJ, Schilling RSF, Welborn JW. Byssinosis in the United States. New Eng. J. Med. 1967;227:170-175.

4. Merchant JA, Lumsden JC, Kilburn KH, O'Fallon WM, Ujda JR, Germino VH, Hamilton JD. Dose response studies in cotton textile workers. J. Occup. Med. 1973;15:222-230.

5. Morey PR. Vegetable ingredients of dusts in textile and non-textile cotton industries. In: Weill H, guest ed. International conference on byssinosis. Chest 1981;79:975-1015.

6. Morey PR, Wakelyn PJ. Plant trash in linters and willowed picker: materials used in the cotton garnetting industry. Am. Ind. Hyg. Assoc. J. 1976;37:413-17.

7. National Institute for Occupational Safety and Health. Respiratory disorders and dust exposures in sectors of the cotton industry of the United States, part 1: cotton gins. Morgantown, WV: National Institute for Occupational Safety and Health.

8. National Institute for Occupational Safety and Health. Respiratory disorders and dust exposures in sectors of the cotton industry of the United States, part 2: cotton warehouse compresses. Morgantown, WV: National Institute for Occupational Safety and Health.

9. National Institute for Occupational Safety and Health. Respiratory disorders and dust exposures in sectors of the cotton industry of the United States, part 3: cottonseed oil mills. Morgantown, WV: National Institute for Occupational Safety and Health.

10. National Institute for Occupational Safety and Health. Respiratory disorders and dust exposures in sectors of the cotton industry of the United States, part 4: cotton classing offices. Morgantown, WV: National Institute for Occupational Safety and Health.

11. National Institute for Occupational Safety and Health. Characterization of byssinosis and other pulmonary abnormalities in the cotton waste utilization industry. Morgantown, WV: National Institute for Occupational Safety and Health.

12. American Conference of Governmental Industrial Hygienists. Threshold limit values for Airborne Contaminants for 1968. Cincinnati, Ohio: ACGIH, 1968.

13. Department of Labor. Occupational safety and health act of 1970. Public Law 91-596. U.S. Governmental Printing Office. December 29, 1970.

14. National Institute for Occupational Safety and Health. Criteria for a recommended standard: occupational exposure to cotton dust. Cincinnati, Ohio: National Institute for Occupational Safety and Health, 1975. (DHEW publication no. (NIOSH) 75-118).

15. Lynch JR. Air sampling for cotton dust, in transactions of the national conference on cotton dust and health. (D.A. Frazier and M.C. Battigelli, eds.) pp 33-43. University of North Carolina, Chapel Hill, North Carolina, 1971.

16. Occupational Safety and Health Administration. OSHA safety and health standards. 29 CFR 1910.1043. Occupational Safety and Health Administration, revised 1980.

17. Occupational Safety and Health Administration. Occupational exposure to cotton dust: proposed rule. Federal Register June, 1983;48(113):26962-26984.

18. National Institute for Occupational Safety and Health. Comments to docket H-052E: Cotton Dust Proposed Occupational Health Standard. Washington, D.C. August 1983.

19. National Institute for Occupational Safety and Health. Testimony presented at the Occupational Safety and Health Administration. U.S. Department of Public Labor hearing on the proposed standard for occupational exposure to cotton dust. Washington, D.C. September 21, 1983.

20. Occupational Safety and Health Administration. Occupational exposure to cotton dust: Final Standard. Federal Register December 13, 1985; 50(240):51120-51179.

21. Perkins, H. H., Cocke, J.B. Effects of additives on cotton dust generation during carding. USDA, ARS Cotton Research Station, Clemson, SC.

22. Zey JN, Piacitelli GM, Jones WG. Characterization of airborne cotton dust concentrations in the non-textile cotton industry. Am. Ind. Hyg. Assoc. J. 45(8):538-46. 1984.

23. Palmer A, Finnegan W, Herwitt P, Waxweiler R, Jones J. Byssinosis and chronic respiratory disease in U.S. cotton gins. J. Occup. Med. 20:96-102. 1978.

24. Bethea RM, Morey PR. Occupational dust exposure in west Texas cotton gins. Am. Ind. Hyg. Assoc. J. 38:284-94. 1977.

25. Wesley RA, Hatcher JD, McCaskill OL, Cocke JB. Dust levels and particle-size distributions in high capacity cotton gins. Am. Ind. Hyg. Assoc. J. 39:368-77. 1978.

26. Larson RK, Barman ML, Smith DW, Nicol LN. Study of respiratory effects of short- and long-term cotton gin exposure. Chest 79:22s-26s. 1981.

27. Noweir MH. Some observations on epidemiologic studies in Egyptian gins. Cotton processing plants, and cottonseed oil extraction plants. Chest 79:15s-20s. 1981.

28. Jones RN, Hughes J, Hammad YY, Glindmeyer H, Butcher BT, Diem JE, Weill H. Respiratory health in cottonseed crushing mills. Chest 79:30s-33s. 1981.

29. Hodgkins AM. Control of levels in cotton classing offices. In: Prceedings, Special Session on Cotton Dust, January 1977. (P.J. Wakelyn and P.E. Sasser, eds.) National Cotton Council, Memphis, Tennessee, 1977.

30. Chinn DJ, Cinkotai FF, Lockwood MG, Logan SHM. Airborne dust, its protease content and byssinosis in willowing mills. Ann. Occup. Hyg. 19:101-108. 1976.

31. National Institute for Occupational Safety and Health. Health hazard evaluation report no. HETA 76-073-523. Cincinnati, Ohio: National Institute for Occupational Safety and Health, 1977.

32. National Institute for Occupational Safety and Health. Industry Wide Studies Report cotton dust and industrial hygiene survey report, May 1972. (Available from National Technical Information Services, publication no. PB-82-151-200/A02).

33. National Institute for Occupational Safety and Health. Byssinosis: industrial hygiene and medical survey report, April 1973. (Available from National Technical Information Services, publication no. PB-82-214-453/A03).

34. National Institute for Occupational Safety and Health. Cotton dust measurements in mattress manufacturing, August 1972. (Available from National Technical Information Services, publication no. PB-82-150-863/A02).

IX. AUTHORSHIP AND ACKNOWLEDGEMENTS

Survey Conducted and Report Prepared by:	John N. Zey, M.S., C.I.H. Certified Industrial Hygienist Industrial Hygiene Section
	James M. Boiano Industrial Hygienist Industrial Hygiene Section
Evaluation Assistance: Field Evaluation	George Carson, Ph.D., C.I.H. NIOSH, Region VII Kansas City, Missouri
Laboratory Analysis:	Measurements Support Branch Division of Physicial Sciences and Engineering
Originating Office:	Hazard Evaluations and Technical Assistance Branch Division of Surveillance, Hazard Evaluations, and Field Studies
Report Typed By:	Jacqueline Grass Clerk Typist Industrial Hygiene Section

X. DISTRIBUTION AND AVAILABILITY OF REPORT

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

1. Simmons, USA, Kansas City, Kansas
2. Simmons, USA, Corporate Office, Columbus, Ohio
3. Upholsteries International Union, Local No. 173
4. NIOSH, Region VII
5. OSHA, Region VII

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

Table 1

Area Airborne Total Dust Samples

Simmons, USA
Kansas City, Kansas
HETA 84-167

February 28-29, 1984

Location	Volume (liters)	Sample Time	Date	Dust Concentrations (ug/m^3)
Garnett Room, Near Boric Acid Addition	746	0710-1527	2/28	255
Garnett Room, Near Boric Acid Addition	996	0712-1530	2/29	393
Garnett Room, By Willow preceding machine No. 2	747	0708-1526	2/28	549
Garnett Room, By Willow preceding machine No. 2	994	0712-1529	2/29	231
Garnett Room, On Wall Across From Garnett Machine No. 5	503	0850-1525	2/28	199*
Garnett Room, on Wall Across From Garnett Machine No. 5	988	0712-1526	2/29	658
Garnett Room, On Beam Located 6' From Walk-Way Over Floor Apron	501	0850-1524	2/28	279*
Garnett Room, On Beam Located 6' From Walk-Way Over Floor Apron	988	0712-1526	2/29	577
Garnett Room, On Left side Of Take Off (as you face take-off)	494	0854-1523	2/28	182*

(Continued)

Table 1 (Continued)

Location	Volume (liters)	Sample Time	Date	Dust Concentrations (ug/m^3)
Garnett Room, On Left Side Of Take Off (as you face take-off)	984	0712-1524	2/29	498
Garnett Room, On Right Side Of Take Off (as you face take-off)	503	0852-1527	2/28	199*
Garnett Room, On Right Side Of Take Off (as you face take-off)	984	0712-1524	2/29	274
Bale Press (Bagging)	990	0712-1527	2/28	293
Bale Press (Bagging)	1004	0658-1523	2/29	199
Hide-A-Bed, Backs	990	0718-1533	2/28	313
Hide-A-Bed, Backs	1002	0702-1528	2/29	279
Hide-A-Bed, Arm	986	0721-1534	2/28	325
Hide-A-Bed, Arm	1002	0705-1526	2/29	230
Hog Ringing	968	0725-1529	2/28	351
Hog Ringing	1004	0700-1522	2/29	209

* Filters were changed and disgarded after 1.5 hours because of large particulates on filter. NIOSH investigators suspected tampering. Filters collected 2nd day did not have large particulates.

Evaluation Criteria, Total Cotton Dust (ug/m^3): 1000** OSHA as an 8-hour time-weighted average.

**This was the OSHA standard enforce at the time of the NIOSH plant survey (February 1984).