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HETA 2000-0250-2837
Winnebago Industries Inc.
Forest City, Iowa

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PREFACE

The Hazard Evaluations and Technical Assistance Branch (HETAB) of the National Institute for Occupational Safety and Health (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 (OSHA) 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.

HETAB also provides, upon request, technical and consultative assistance 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 NIOSH.

ACKNOWLEDGMENTS AND AVAILABILITY OF REPORT

This report was prepared by Bradley King and Jeffery Hess of HETAB, Division of Surveillance, Hazard Evaluations and Field Studies (DSHEFS). Field assistance was provided by Joshua Harney. Analytical support was provided by DataChem Laboratories. Desktop publishing was performed by Robin Smith. Review and preparation for printing were performed by Penny Arthur.

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Highlights of the NIOSH Health Hazard Evaluation

Evaluation of Exposure to Airborne Wood Dust and Possible Work-Related Health Effects

This Health Hazard Evaluation was performed in response to a confidential request from employees of the sawmill building at the Winnebago Industries facility in Forest City, Iowa. Employees were concerned about possible respiratory health effects due to high airborne wood dust levels.

What NIOSH Did

- We took samples for airborne wood dust in several departments of the sawmill building.
- We walked through the building to observe work tasks and work practices.
- We interviewed workers about health problems that might be related to work conditions.
- We reviewed workplace illness and injury logs and health records.

What NIOSH Found

- All employees sampled had exposures below the OSHA limits for exposure to airborne wood dust.
- Several employees in Department 811, and hand routers in Departments 804 and 806, had exposures slightly above the NIOSH recommended exposure limits.
- Workers from Department 811 reported respiratory symptoms consistent with wood dust exposure more frequently than workers in other departments.

What Winnebago Industries Managers Can Do

- Provide local exhaust ventilation to all woodworking equipment in Department 811.
- Re-evaluate the design of the local exhaust ventilation provided for hand routers in Departments 804 and 806.
- Continue a regular schedule of air sampling for wood dust, particularly when levels of production and work activity rise, or work processes change.
- Initiate a medical monitoring program focusing on known health effects of wood dust exposure.

What the Winnebago Industries Employees Can Do

- Become familiar with the employee safety committee for the building as a way to bring up and resolve health and safety concerns.
- Report all potentially work-related health symptoms and concerns to appropriate Winnebago health care personnel.



What To Do For More Information:
We encourage you to read the full report. If you would like a copy, either ask your health and safety representative to make you a copy or call 1-513/841-4252 and ask for HETA Report # 2000-0250-2837



**Health Hazard Evaluation Report 2000-0250-2837
Winnebago Industries Inc.
Forest City, Iowa
April 2001**

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SUMMARY

In April 2000, the National Institute for Occupational Safety and Health (NIOSH) received a request for a Health Hazard Evaluation (HHE) from employees at Winnebago Industries, Inc. in Forest City, Iowa. The HHE request expressed concerns regarding exposures to airborne wood dust during woodworking operations in the production of interior components of motor homes.

In response to this request, a site visit was conducted September 12 - 14, 2000. During this site visit, two NIOSH industrial hygienists and a NIOSH occupational physician conducted a walk-through survey of the sawmill building and discussed the issues with management and employees in the area. Full-shift, personal breathing zone (PBZ) air sampling was performed to measure the levels of exposure to wood dust generated during the normal operation of the facility's woodworking machines such as sanders, routers, saws, and planers. Discussions were held with management regarding the ventilation system plans, personal protective equipment program (PPE), and environmental monitoring programs. Personal interviews were held with employees regarding their medical history and present health concerns related to the potential wood dust exposures.

The Occupational Safety and Health Administration (OSHA) has no specific permissible exposure limit (PEL) for wood dust and therefore regulates it as Particulates Not Otherwise Regulated (PNOR). The results for seventeen air samples showed that no exposures were above this limit of 15 milligrams/cubic meter (mg/m^3) as an 8-hour time-weighted average (TWA). However, seven individuals' exposures were above the NIOSH recommended exposure limit (REL) for wood dust of $1 \text{ mg}/\text{m}^3$ as a full-shift TWA. These exposures included one hand router in each of Departments 804 and 806. These results were $2.2 \text{ mg}/\text{m}^3$ and $1.9 \text{ mg}/\text{m}^3$, respectively. The other area in which results showed exposures over the REL was Department 811. The activities performed during these over-exposures were disc hand sanding ($1.1 \text{ mg}/\text{m}^3$ and $1.3 \text{ mg}/\text{m}^3$), 'Time-Saver' pre-sanding ($1.8 \text{ mg}/\text{m}^3$), trimming ($2.6 \text{ mg}/\text{m}^3$), and the use of a swing saw ($1.3 \text{ mg}/\text{m}^3$).

Interviews with employees showed that workers from Department 811 reported experiencing possible work-related respiratory health effects that were not reported by the general area employees. The most commonly reported symptoms included respiratory irritation, nasal congestion, cough, and shortness of breath; less commonly reported were dry nasal and throat mucous membranes, bloody nasal mucous, sore throat, burning of the eyes, and generalized fatigue. Employees in Department 811 were also more likely to report perceived elevated dust levels in the work area than employees in other departments.

NIOSH investigators concluded that a potential health hazard exists at this Winnebago Industries Inc. facility. Results from PBZ sampling showed that a number of individuals working in Department 811 were exposed to wood dust concentrations above the NIOSH REL. Additionally, two individuals working with hand routers in ventilation booths were also exposed to levels of airborne wood dust above the REL. The data collected from our survey suggests that employee symptoms were consistent with the known effects of wood dust exposure and that respiratory health effects appear to be more commonly experienced by workers in Department 811. Recommendations are made in this report concerning further evaluation and control of exposures to wood dust in these areas.

Keywords: 3716 (motor homes) woodworking, softwood, hardwood, wood dust, sanders, routers, planers, saws, respiratory effects.

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INTRODUCTION

On April 17, 2000, the National Institute for Occupational Safety and Health (NIOSH) received a confidential employee request for a Health Hazard Evaluation (HHE) at Winnebago Industries, Inc. in Forest City, Iowa. The requesters expressed concerns regarding potential exposures to airborne wood dust produced during woodworking operations in the production of interior components of motor homes. Health concerns included respiratory symptoms such as congestion, coughing, and shortness of breath.

On September 12 - 14, 2000, two NIOSH industrial hygienists and a NIOSH occupational physician visited the sawmill building of the Winnebago Industries complex to conduct an industrial hygiene and medical survey. Personal breathing zone (PBZ) samples for airborne wood dust were taken from individuals in numerous departments throughout the building. Private interviews were conducted with randomly selected workers to gather information on health symptoms and concerns. Discussions with management were held regarding the building's present ventilation system and anticipated improvements, as well as the company's industrial hygiene and safety programs. An interim letter dated October 31, 2000, was sent to Winnebago management notifying them of the industrial hygiene sampling results.

BACKGROUND

Winnebago Industries, Inc. manufactures motor homes at its headquarters complex in Forest City, Iowa. Built in 1972, the approximately 215,000 square foot (ft²) sawmill building is the production site for wood components to be installed in motor homes. Approximately 275 individuals work in various departments of the sawmill building, although not all perform woodworking operations. The majority of the departments where woodworking operations are performed are located in the 105,000 ft² north side of the

firewall, which divides the building approximately in half. The exception is Department 811, located immediately to the south of the firewall and site of approximately 15 workers. Woodworking operations include the use of hand routers, hand disc sanders, band sanders, swing saws, mitre saws, panel saws, and a pre-sander. Hardwoods such as cherry, maple, and ash, as well as wood particle board are used for construction of cabinets, counters, and other motor home furnishings. The majority of the hardwood woodworking is performed in Department 811, which was identified as the major area of concern due to high dust levels perceived by the employees.

When the sawmill building was built, it was equipped with six local exhaust ventilation (LEV) units. Two LEV units remain in service, the West Collector and the North Collector. Each of these two units can pull 30,000 cubic feet per minute (CFM) of air, removing airborne wood dust to two bag-houses and storage tanks. All the departments in the general work area north of the firewall are connected into the systems of one of these two LEV units, providing a means of capturing the wood dust created during the processes at each station. Certain stations in Department 811 have been added as temporary links into the West Collector system. Prior to installation of these temporary connection ducts, large portable dust collection systems were utilized exclusively at certain stations in Department 811 for dust removal and collection. At the time of the site visit, one station in the department, the time saver pre-sander, had a stand-alone, bagged, local dust collection system. Other stations in this department, such as the hand sanders, did not have LEV. These hand sanders have the ability to generate significant amounts of wood dust and can disperse this dust throughout the work area's air. During discussions with management, information was relayed that a move of the equipment in this department may be imminent.

METHODS

Industrial Hygiene

To quantitatively assess the levels of airborne wood dust to which Winnebago workers in the sawmill building were being exposed, industrial hygiene samples were taken in the general work area north of the dividing firewall as well as in Department 811 south of the firewall. Of a total of seventeen samples taken for airborne wood dust at this site, nine samples were taken on personnel operating equipment in various departments in the general work area. This equipment included hand routers in Departments 804 and 806, a sander in Department 806, a double mitre saw and a swing saw in Department 807, a swing saw in Department 871, and a panel saw in Department 876. The remaining eight samples were taken from personnel operating equipment in Department 811. This equipment included a pre-sander, hand sanders, a trimmer, a band sander, and a swing saw.

PBZ air samples were collected for total and respirable airborne wood dust throughout these various woodworking departments of Winnebago's sawmill building during the 6:00 a.m. to 3:00 p.m. shift on September 13, 2000. Of the 17 workers who wore sampling devices, 12 wore devices collecting total wood dust while five wore devices collecting respirable wood dust. These five individuals were performing processes identical or similar to at least five of the 12 individuals who were wearing the total wood dust collector. The PBZ samples for total wood dust particulates were collected on 37-millimeter (mm) cassettes containing a tared 5-micrometer (μm) pore-size polyvinyl chloride (PVC) filter attached to either the right or left lapel area of the worker. Tygon® tubing connecting the sampler and a personal sampling pump allowed air to be drawn through the sampling train at a calibrated flow rate of 2.0 liters per minute (LPM.)¹

For sampling the respirable fraction of airborne wood dust, a cyclone was attached to the sampling

cassette so that only the respirable fraction of the dust would be collected. A personal sampling pump pulled air through the cassette at a calibrated flow rate of 1.7 LPM.² Typically, monitoring for total particulates is the recommended course of action for airborne wood dust; NIOSH's and the American Conference of Governmental Industrial Hygienist's (ACGIH's) environmental exposure criterion for wood dust are both for the total portion of airborne particulates, which are those particles of a size that would be inhaled. Respirable particulates are those airborne particles of a size that would allow them to reach the deepest region of the lungs, the respiratory bronchioles, alveolar ducts, and alveolar sacs across which gas exchange occurs. Respirable sampling was performed to see if a significant amount of dust may reach these regions of the lungs. However, since respirable sampling only collects a fraction of the total airborne wood dust, the workers' total exposure to wood dust can be assumed to be higher than the respirable wood dust collected.

Gravimetric analysis was performed on all filters to determine the mass of the wood dust collected on each filter. The total weight of each sample was determined by weighing the sample plus the filter on an electro-balance and subtracting the previously determined tare weight of the filter. Studies on the physical integrity of various PVC filters have shown that the weight of the filter may vary by 0.02 milligrams (mg). Because of this factor, the analytic limit of detection (LOD) of wood dust for this report is 0.02 mg. The minimum detectable concentration (MDC) for airborne wood dust, therefore, is 0.02 milligrams/cubic meter (mg/m^3) based on the analytic LOD and a sample volume of 950 liters.

Medical

The NIOSH medical officer conducted confidential interviews with every tenth general area worker and every other Department 811 worker chosen from a first-shift master departmental roster provided by the company. The interview consisted of questions regarding

respiratory symptoms, medical history, and potential exposure to respiratory irritants. In addition, individuals were given the opportunity to ask questions and voice additional concerns.

Along with employee interviews, the Occupational Safety & Health Administration Log and Summary of Occupational Injuries and Illnesses (OSHA 200 log) from January 1, 1999, through August 31, 2000, was reviewed. Additionally, a review of medical records of one employee from Department 811 was performed at the request of the employee. The medical record included pulmonary function test (PFT) results, which were evaluated utilizing a longitudinal trend analysis technique recommended by the American Thoracic Society (ATS).³ This technique can detect smaller changes in PFT results not noted during customary interpretation.

EVALUATION CRITERIA

As a guide to the evaluation of the hazards posed by workplace exposures, NIOSH field staff employ environmental evaluation criteria for the 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 even though 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 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

increases 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 Recommended Exposure Limits (RELs),⁴ (2) ACGIH® Threshold Limit Values (TLVs®),⁵ and (3) the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PELs).⁶ Employers are encouraged to follow the OSHA limits, the NIOSH RELs, the ACGIH TLVs, or whichever are the more protective criterion.

OSHA requires an employer to furnish employees a place of employment that is free from recognized hazards that are causing or are likely to cause death or serious physical harm [Occupational Safety and Health Act of 1970, Public Law 95-596, sec. 5.(a)(1)]. Thus, employers should understand that not all hazardous chemicals have specific OSHA exposure limits such as PELs and short-term exposure limits (STELs). An employer is still required by OSHA to protect their employees from hazards, even in the absence of a specific OSHA PEL.

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 STEL or ceiling values which are intended to supplement the TWA where there are recognized toxic effects from higher exposures over the short-term.

Wood Dust

Airborne wood dust exposures have been associated with mucosal irritation, bronchitis, hypersensitivity pneumonitis, impairment of respiratory function, and asthma.⁷ An association between exposures to airborne wood dust and an increased risk of nasal tumors (primarily adenocarcinomas) has also been reported.⁸ In most cases, the component in wood dust that

brings about these conditions is not fully understood. Some of the conditions have been related to chemical compounds contained within the wood dust, mechanical irritation due to the dust, and mold or mold metabolic products in the wood. Although exposure to several different types of hardwood dust has been shown to cause work-related asthma in exposed individuals, the prevalence of occupational asthma due to wood dust is not known.⁹ Hypersensitivity pneumonitis and cryptogenic fibrosing alveolitis, conditions related to wood dust exposure, can result in pulmonary fibrosis and restrictive lung changes.¹⁰ Most cases of hypersensitivity pneumonitis related to wood dust have been noted in sawmill and paper mill workers.^{9,10} The International Agency for Research on Cancer has classified hardwood dust as carcinogenic to humans.¹¹

A number of health and safety organizations have set standards for airborne wood dust exposures. OSHA regulates wood dust exposure under the requirements for Particulates Not Otherwise Regulated (PNOR). This standard sets the PEL for an 8-hour TWA exposure to total airborne wood dust at 15 mg/m³.⁴ However, NIOSH recommends a more protective exposure limit of 1 mg/m³ as a TWA for up to a 10-hour workday and 40-hour workweek based on the risk of pulmonary dysfunction, respiratory effects, and its potential as an occupational carcinogen.⁶ ACGIH has set a TLV for hardwoods such as oak and beech of 1 mg/m³ as a TWA for a conventional 8-hour workday and 40-hour workweek based on the health effects of irritation, mucostasis, dermatitis, and cancer. Their TLV for softwoods is a TWA of 5 mg/m³. ACGIH, however, has proposed changing the TLVs for all wood dust (hardwood and softwood), except western red cedar, to 5 mg/m³ for an 8-hour TWA. No evaluation criteria exist specifically for respirable wood dust.

RESULTS

Industrial Hygiene

Observation

Two types of LEV were observed in the woodworking departments. These two types differed in respect to the placement of the LEV's exhaust hood. On equipment such as the mitre and swing saws, the exhaust hood was placed in the ejection path of the wood dust that the machine created. Additionally, it was located within inches of the point where the equipment's blade contacted the wood, enabling the LEV to capture a substantial portion of the wood dust. In comparison, the engineering control for equipment such as certain hand routers included a three sided booth with a larger exhaust hood located flush on the booth's back panel. The hand routing equipment was placed in the center of the booth, level with the exhaust hood, approximately two to three feet away. During observations of work practices at these stations, it was noticed that these hoods were less successful in their ability to capture wood dust created during these processes. Due to the mobility of the hand router, often times, the ejection path of the wood dust was anywhere from 90 to 180 degrees away from the direction of the exhaust hood. It was also observed that an employee at these booths could, and in fact did, stand between the hand router in the center of the booth and the exhaust hood on the back panel, disrupting the flow of the exhaust hood. These factors, in addition to the general increase in distance from the point of dust creation as compared to the other types of equipment, decreased the effectiveness of this exhaust ventilation.

Sampling

The results of PBZ samples collected for airborne wood dust are listed in Table 1. The range of exposures shown by the seventeen samples collected was 0.028 mg/m³ to 2.6 mg/m³. Specifically, the range for the twelve total wood dust samples was 0.076 mg/m³ to 2.6 mg/m³; the range for the five respirable wood dust samples taken was 0.028 mg/m³ to 1.9 mg/m³. All results were well below OSHA's PEL for particulates not otherwise regulated. However, the NIOSH recommended exposure limits for wood dust were

exceeded in seven of the samples. Of these seven, five were from personnel working in Department 811. Not surprisingly, the majority of these five were samples from individuals working with the hand sanders. These results were 1.3 mg total particulates/m³, 1.1 mg total particulates/m³, and 2.6 mg total particulates/m³. The sample worn by the individual working at the 'Time-Saver' pre-sander returned a result of 1.8 mg total particulates/m³, while that worn by the individual working on the swing saw returned a result of 1.3 mg total particulates/m³. Two hand routers, one in Department 804 and the other in Department 806, also had exposures above the NIOSH REL. The individual in Department 804 was exposed to 2.2 mg total particulates/m³ averaged over the length of time worked during the shift. The exposure level for the individual sampled operating the hand router in Department 806 was 1.9 mg respirable particulates/m³ averaged over the length of time worked during the shift. (This individual's sample for respirable particulates represents only a portion of exposure to total wood dust, which can be assumed to be even higher.)

Medical

Interview Results

All 10 general area and all 7 Department 811 employees selected agreed to be interviewed. The group of employees from the general plant and Department 811 both had similar proportions of smokers and of individuals who reported a pre-existing history of asthma or allergy. Both areas also had a similar proportion of individuals with non-work-related activities that potentially exposed them to dust (such as farming or woodworking at home).

Employees interviewed from the general plant area did not consistently report any specific symptoms while at work. Most stated that they felt that dust in their work environment was well controlled.

Employees interviewed from Department 811 reported a variety of respiratory symptoms. Those reported most frequently while performing job tasks in the work area were respiratory irritation (6), nasal congestion (5), cough (4), and shortness of breath (4). Among these symptoms respiratory irritation and nasal congestion were reported to occur during the work shift and typically resolved within two to twelve hours of leaving the worksite. Cough, when present, was reported to occur while performing woodworking tasks. The reported frequency of cough varying from once a shift to more than ten times a shift. One individual reported that performing tasks which produced high dust levels (i.e. sanding) was more likely to produce cough. One individual reported cough mostly in the morning after awaking. Two individuals reported cough productive of phlegm that was not due to a cold or other infectious process. One individual reported shortness of breath symptoms infrequently and only while at work. The other three individuals reported shortness of breath consistently at work and at home. One individual reported that the shortness of breath used to resolve shortly after leaving the worksite but now symptoms are more severe and do not resolve. Less frequently reported symptoms included, dry nasal or throat mucous membranes (2), bloody nasal mucous (1), sore throat (1), burning of the eyes (1), and generalized fatigue (1). Many of the Department 811 employees reported a decrease in the frequency and severity of respiratory symptoms following the removal of portable dust collectors and the installation of a temporary exhaust ventilation duct connecting some of the equipment in their area to the main exhaust ventilation system. No specific pattern regarding symptoms and job title, use of specific equipment, or specific tasks could be determined from data collected.

The OSHA 200 logs showed one entry related to a respiratory complaint. That entry indicated that the individual worked in Department 811; no other information concerning the entry was available.

Record Review

One employee's medical record was reviewed at the request of that employee. The individual reported various respiratory symptoms that were present in the work environment and resolved when the individual went home. PFT results suggested the development of a slowly progressive restrictive lung defect. It should be noted that this individual does have a history of smoking, stopping in 1997, and has exposure to numerous animals in the home environment.

DISCUSSION AND CONCLUSIONS

During the site visit by the NIOSH team, exposures to airborne wood dust were present in amounts at or slightly above the NIOSH REL for certain personnel at the Winnebago sawmill facility. These exposures were concentrated in Department 811 where various processes such as sanding and cutting of hardwoods occur, as well as one process in the general work area, hand routing. The engineering control (LEV) in place for the other processes appear to be providing adequate worker protection. Addition of such engineering controls to equipment currently lacking them (such as the hand sanders), and a redesign of the controls on other equipment (such as the hand routers), would likely reduce these exposures to below the NIOSH REL. While all the sampling results were well below the OSHA PEL, NIOSH recommends that employers attempt to limit exposures according to the most stringent exposure criterion for maximum protection of employees' health.

Individuals working in the general plant areas infrequently reported experiencing respiratory symptoms they related to the work environment. Because we interviewed only a sample of the employees, information obtained from this group may not be truly representative of the entire workforce. We have no reason to believe, however, that this was a problem in our evaluation. Department 811 employees reported having the impression that dust levels in their

work area were elevated compared to the general plant area. Department 811 employees reported experiencing an increased number and severity of respiratory related symptoms that they felt were due to dust in their work environment. Only one individual's medical record was reviewed, which documented pulmonary effects consistent with symptoms experienced by the individual.

Department 811 employees reported respiratory symptoms that could be related to wood dust exposure, although the reported symptoms are not specific to wood dust exposure. The temporal pattern of symptoms, however, is consistent with workplace exposure to wood dust.

RECOMMENDATIONS

1. Management should add engineering controls (i.e., LEV) to all woodworking stations in Department 811. During interviews, workers from Department 811 reported a decrease in the frequency and severity of respiratory symptoms after the installation of the LEV ducts connecting certain equipment in their area to the main exhaust ventilation system. Connecting all the equipment in this department to the either the North or West collection system would likely further decrease levels of airborne wood dust and reported health concerns.
2. Evaluate the design of the LEV for the hand router booths as well. An LEV system located at the router head would control wood dust emissions much more effectively than the LEV system currently present. NIOSH has published Hazard Control documents specifically describing control systems which successfully reduced dust emissions on routers and hand sanders. Copies of these documents were provided to Winnebago management during the site visit; NIOSH may be contacted at 1-800-35-NIOSH to provide more copies should they be needed.
3. Winnebago may want to initiate a medical monitoring program that focuses on known health effects of wood dust exposure. Such a program

could include performing a baseline PFT for all new employees prior to beginning work in areas where occupational exposure to wood dust could occur, and performing a baseline/reference PFT for all current employees occupationally exposed to wood dust.

4. Winnebago employees should report all potentially work-related health problems to appropriate health care personnel assigned to the Winnebago plant. Every employee should understand how and to whom health complaints should be reported. Employees should also be assured that reporting health concerns will not put their job in jeopardy. Reported health problems should be investigated on an individual basis by company-based or consulting health care providers. Winnebago should monitor reported health problems in a systematic manner designed to identify particular job duties, work materials, machines, or areas of the plant, which may be associated with particular health effects. Employees should bring safety concerns to their building safety committee or to the overall Winnebago Safety Division, which has responsibility over all Winnebago facilities.

5. Continue a regular schedule of air sampling for wood dust, particularly in situations when levels of production and work activity rise, or when work processes change.

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Table 1
Personal Breathing Zone Results for Total and Respirable Wood Dust Particulates
Sawmill Building, Winnebago Industries
September 13, 2000

Department	Machine	Sample #	Sample time (minutes)	Total Particulate (mg/m ³)	Respirable Particulate (mg/m ³)
804	hand router	PVC 4	543	2.2	–
806	hand router	PVC 10	459	–	1.9
806	hand router	PVC 8	524	0.39	–
806	hand router	PVC 15	521	–	0.035
806	sander	PVC 16	507	–	0.043
807	double mitre saw	PVC 3	539	0.60	–
807	swing saw	PVC 5	534	0.47	–
811	time saver pre-sander	PVC 9	507	1.8	–
811	sander	PVC 12	499	0.40	–
811	disc circular sander	PVC 6	494	1.3	–
811	disc hand sander	PVC 17	492	–	0.028
811	disc hand sander	PVC 1	432	1.1	–
811	trimming and disc hand sander	PVC 13	477	2.6	–
811	band sander	PVC 14	467	0.73	–
811	swing saw	PVC 11	464	1.3	–
871	swing saw	PVC 7	291	0.076	–
876	panel saw	PVC 2	460	–	0.054

Minimum Detectable Concentration (MDC), mg/m ³	0.02	0.02
NIOSH REL, mg/m ³ , TWA	1.0	
ACGIH TLV, mg/m ³ , TWA	1.0	
OSHA PEL (for PNOR), mg/m ³ , TWA	15.0	

* **bolded information indicates an exposure above the NIOSH REL**

**For Information on Other
Occupational Safety and Health Concerns**

**Call NIOSH at:
1-800-35-NIOSH (356-4674)
or visit the NIOSH Web site at:
www.cdc.gov/niosh**



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- **Safety and health at work for all people
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