APPENDIX

FIRST AID

ACCIDENTS AND FIRST AID

**INSIST THAT ACCIDENTS, NO MATTER HOW SMALL,
BE REPORTED TO YOU.**

Always fill out a report form and submit it through the proper channels in your district.

1. **WASH OFF** AREA-Wash with water any area that might have something spilled on it.

2. **FLOOD ANY BURNED AREA WITH** *COLD WATER -This* will draw the heat away from the burn. Continue to do this until further help can be obtained. You should NOT apply any ointments.

3. **COMPRESS THE WOUND - All** first aid kits should have large sterile pads. After removing any foreign material from a cut, compress it to stop the bleeding. You should NOT apply any ointment or tourniquets.

4. **WASH SPILLS TO THE EYES AND SKIN FOR 15 FULL MINUTES - Use** an eye wash bottle or station and hold the eyes wide open. If eyewashes are unavailable then splash water from your hands. If there is any danger from caustics then eye safety glasses should be worn.

5. **DO NOT TREAT MAJOR INJURIES YOURSELF, CALL FOR ASSISTANCE OR 911**

6. **POISON CONTROL CENTER-1-800-456-7707.**

First Aide Certification for the instructors of CTE programs is the local districts responsibility and is a condition of local employment.

FIRST AID BOX SUPPLIES

1 box of Band Aids
2 (8 x 10) pressure pads
1 triangular bandage
1 roll of adhesive tape
1 scissors
1 Ace bandage
2 eye pads
2 pkg. of rolled gauze bandage
assorted gauze sponges
4 sterile gauze pads
4 Telfa pads
1 First Aid flip chart
1 instant cold pack
6 vinyl gloves
1 CPR mouth barrier

First Aid boxes should be maintained in each cafeteria, custodial office, PE locker room, FACS class area, science class area, art class area and each industrial tech class area. They should be cleaned and restocked at least once each school year.

- **Fire can spread quickly through a workshop. It is important to know the procedures to take during a fire.**

INSERT FIRE DRILL INSTRUCTIONS FOR YOUR BUILDING HERE.

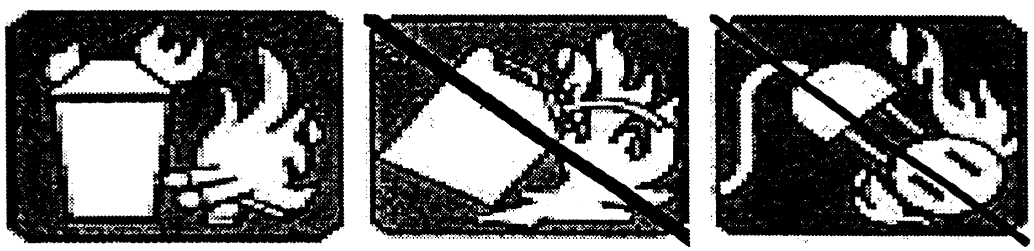
This Is Your New ABCDs of Portable Fire Extinguishers

A fire extinguisher is a storage container for an extinguishing agent such as water or chemicals. It is designed to put out a small fire, not a big one.

An extinguisher is labeled according to whether the fire on which it is to be used occurs in wood or cloth, flammable liquids, electrical, or metal sources. Using one type extinguisher on another type fire can make the fire much worse. So learn how extinguishers are labeled and used.

Traditionally the labels A, B, C, or D have been used to indicate the type of fire on which an extinguisher is to be used.

Recently pictograms have come into use. These picture in blue the type of fire on which an extinguisher is to be used. Shown in black with a red slash are pictures of fires on which the extinguisher is not to be used. For example, on a class "A" type, the following symbols would appear:



Ordinary Combustibles — Flammable Liquids — Electrical Equipment

NFPA 10, S ... beled with pictogr... may n... A, B, ... pictograms and ... on an extinguisher.

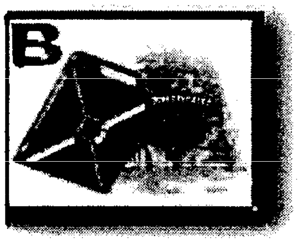
Fire extinguishers where you work.

It is *management's* job to have extinguishers available for use and *your* job to know how they work.

ABCDs

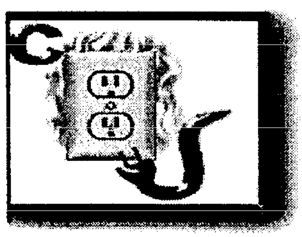
Class A—Extinguish ordinary combustibles by cooling the material below its ignition temperature and soaking the fibers to prevent re-ignition.

Fires in paper, cloth, wood, rubber, and many plastics require a water-type extinguisher labeled A.



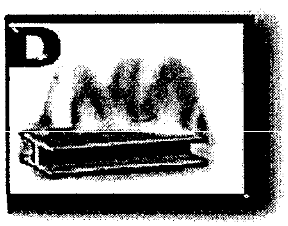
Class B—Extinguish flammable liquids, greases or gases by removing the oxygen, preventing the vapors from reaching the ignition source or inhibiting the chemical chain reaction.

Fires in oils, gasoline, some paints, lacquers, grease in a frying pan or in the oven, solvents, and other flammable liquids require an extinguisher labeled B.



Class C—Extinguish energized electrical equipment by using an extinguishing agent that is not capable of conducting electrical currents.

Fires in wiring, fuse boxes, energized electrical equipment, and other electrical sources require an extinguisher labeled C.



Class D—Extinguish combustible metals such as magnesium, titanium, potassium, and sodium with dry powder extinguishing agents specially designated for the material involved.

Combustible metals such as magnesium and sodium require special extinguishants labeled D.

*..FROM MINNESOTA STATE STATUTES., 1974

126.20 EYE PROTECTIVE DEVICES.

Subdivision 1. Every person shall wear industrial quality eye protective devices then participating, observing or performing any function in connection with any, courses or activities taking place in eye protection areas, as defined in subdivision 3, or any school, college, university, or other educational institution in the state.

Subdivision 2. Any, student failing to comply with such requirements may be temporarily suspended from participation in said course and the registration of a student for such course may be canceled for willful, flagrant, or repeated failure to serve the above requirements.

Subdivision 3. Eye protection areas shall include, but not be limited to, vocational or industrial art shops, science or other school laboratories, or school facilities in which activities are taking place and materials are being used involving:

a. Hot molten metals

b. milling, sawing, turning, shaping, cutting, grinding or stamping of any solid materials

c. heat treatment, tempering or kiln firing of any metal or other metals

d. gas or electric arc welding

e. repair or servicing of any vehicle or mechanical equipment

f. any other activity, or operation involving work in any area that is potentially hazardous to the eye...

WEAR GOGGLES FOR GRINDING (b), BUFFING (f) FLEXIBLE SHAFT OR DREMEL WORK (b) (f), CASTING (a), ENAMELING (c) SOLDERING, HEAT TEXTURING, ANINTEALING (c), WELDING (d), ETCHING (f), CHISELING (b) (f), USING POWER EQUIPMENT (b) (f).

Technology Education Safety Checklist

School:	Instructor:
Shop Area:	Date:

Item	Yes	No	N/A	Comments
Technology Education Safety Management Plan is available in the shop area.				
An instructor supervises the students at all times while in the shop area.				
Chemical inventory and associated MSDS'a updated and available.				
All chemicals are properly labeled.				
Chemical storage requirements fulfilled.				
Aisles and egresses are maintained open and unobstructed.				
Dust collection system is operational and is used during woodworking activities.				
Instructors and students are observing clothing and safe dress procedures.				
PPE requirements have been identified and equipment is available and maintained.				
All machine safeguards are in place and operational.				
Damaged or non-compliant equipment is not used and is properly labeled.				
Machinery, equipment and tools are only used for their designated usage.				
Hand and power tools are used with the correct PPE, shield or guard as recommended by the manufacturer.				
Damaged electrical equipment has been taken out of service.				
All electrical equipment and cords are properly grounded.				
Access to electrical service panels and emergency shut-off are unobstructed.				
Compressed gas cylinders are labeled and secured.				
Compressed air regulators are reduced to below 30 psi.				
Safety equipment, including fire extinguishers, fire blankets and eyewash fountains are accessible and operational.				
Eye wash fountains are flushed weekly by the instructor.				
Spill control material (floor dry) is available.				
Emergency phone numbers and emergency procedures are clearly posted.				

Instructors are responsible for inspecting shop areas under their control. The inspection checklists are to be maintained by the instructor as part of the Technology Education Safety Management Plan. Please forward a copy of the completed checklist to EH&S.

STUDENT SAFETY PERFORMANCE RECORD

School:	Instructor:	
Program:	Period	Grade:

____ has observed SAFE operating procedures,
Student

passed the required SAFETY exam with 100% and is permitted to operate the following items and equipment according to accepted SAFETY regulations.

Item/Tool Equipment	Teacher Demonstration Date Completed	Written Test 100 % Date Completed	Performance Test 100% Date Completed

The instructor will keep this record until the student exits the program.

TEACHER OBSERVATION REPORT OF STUDENTS

School:	Instructor:	
Program:	Period	Grade:

Unsafe Acts or Distractions

100%	Demonstrates SAFE and good working habits and participation.
-20%	Failure to wear personal safety gear.
-20%	Horseplay.
-20%	Poor housekeeping practices.
-10%	Poor Participation.
-10%	Using equipment without permission.

Student Names	Monday	Tuesday	Wednesday	Thursday	Friday	Total Grade
	/ /	/ /	/ /	/ /	/ /	
	/ /	/ /	/ /	/ /	/ /	
	/ /	/ /	/ /	/ /	/ /	
	/ /	/ /	/ /	/ /	/ /	
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STUDENT INJURY REPORT FORM

Use this form to report a student injury that occurs during school related activities inclusive of co-curricular and extra-curricular activities.

INJURED PERSON *	Name of person injured________________________Grade__________ DOB____________________ **(Please Print Legible)**
TIME & PLACE *	School____________________Time________________________A.M.□ P.M.□ Date of accident________________________Extracurricular? Yes □ No □ Place where accident occurred____________________________

	Remember to include what happened, how it happened & people involved.
DESCRIPTION OF INCIDENT (Student Report)	Type of school activity________________________________ General description of how injury occurred (use reverse side if necessary) ________________________________ ________________________________ ________________________________ ________________________________
(Staff Witness	Student Signature ________________________________ ________________________________ ________________________________ ________________________________
Adult ☐ Adult ☐	Staff Name____________________Phone Number __________ Witnessed accident? Yes ☐ No ☐ Other Witnesses: Name____________________Student ☐ Name____________________Student ☐ If no witnesses – state so Attach reports of additional witnesses.
THE INJURY *	Describe injury and First Aid given:____________________ **(Hea** ________________________________ ________________________________ ________________________________ Student Dismissed To: Home ☐ Doctor ☐ Dental ☐ Hospital ☐ Via Ambulance ☐ Classroom ☐ Other ☐ Was a parent or other adult notified? Yes ☐ No ☐ Date/Time____________ Name of person notified____________________

FOLLOW-UP * (Health Service)	Number of school days missed due to injury__________ Name of Doctor or Clinic/Hospital__________ Diagnosis __________ What special care or treatment needed after return to school (crutches, modified P.E., etc.)?__________

For students with disabilities where a critical incident report has been completed only fill out sections of this report marked with a * and attach to the critical incident report.

Date________________________Signed: Principal________________________

Staff________________________Nurse/Health Para________________________

Distribution: White: If follow-up needed, send to Health Service Co-ordinator (maintained for 30 years plus graduation date)
Yellow: Building copy (maintained for 5 years)
Fax to Administrative Services (763-506-1133)
SHS Form No. 1852 (Rev. 10/02)

ACCIDENT REPORT SUMMARY

Date	Nature of Injury	Source of Injury		Hazardous Condition or Unsafe Act
		Category	Part	

FREE INFORMATION AND SERVICES

- **Safety Magazine – FREE**
  - *Construction and Engineering* – safety magazine (refer to www.cesmag.com for details)

- **Labor and Industries Safety Consultant – FREE**
  - WISHA provides a free consultation by either a safety or health professional at the request of the employer, such as a school. The consultation would be for the employee since the employee is required to follow all WISHA regulations at all times, but it would clearly benefit the students as well.
  - An employee can file a complaint that prompts an inspection. It could be kept confidential if they feel a hazard exists.
  - A basic description of both a consultation and inspection can be found at: http://www.lni.wa.gov/wisha/concerns.htm or by calling 1-800-4BE-SAFE.

- **1-800 Numbers**
  - To get a list of other 1-800 numbers, go to www.lni.gov/home/direct.htm. For safety questions or complaints you can call 1-800-4BE-SAFE.

Pediatrics
July, 2000

Injuries Sustained by Students in Shop Class.
Author: Stacey Knight

ABBREVIATIONS. ED, emergency department; SIR, Student Injury Report.

Injuries in the school environment are a serious public health problem. It is estimated that 20% of injuries to school-aged children occur on school premises.[l] School injuries result in an estimated $3.2 billion in medical spending and $115 billion in good health lost each year.[2] Although injuries occurring on school playgrounds and during sporting events have been studied, injuries occurring within the classroom have received little to no attention, especially injuries occurring in shop classes.[3-11] The seriousness of injuries in a shop class is illustrated in the following account. An llth-grade female shop student sustained a hand injury attributable to a table saw. After the machine was turned off, the free-spinning blade drew her fingers across the blade as she reached for the wood scrap. She partially severed 2 fingers. These injuries required surgery and a hospital stay. She missed 4 days of school and was restricted from activity on return to school.

Federal policies carefully regulate the workplace regarding safety issues involving minors. As part of these regulations, children [is less than] 18 years of age are prohibited from working with equipment such as power-driven woodworking tools, metal-forming or punching machines, circular saws, and band saws.[12] Often these same tools are used by students in shop class, where there are few or no restrictions for use of the equipment. This equipment is not only designed for adults but also has great potential for serious injury.

The purpose of our study was to describe the epidermiology of shop class injuries in Utah public schools for the years 1992-1996. To assess the medical and financial outcome of shop class injuries, we used a statewide school injury database linked to emergency department (ED) records and hospital inpatient records. The findings from this study may help school administrators, teachers, and students develop and improve safety policies and practices in school shop classes. In addition, the findings may provide useful information to pediatricians and enable them to better inform patients of risks in school shop classes.

METHODS

Data collected by the Utah Department of Health Violence and Injury Prevention Program from 1992-1996 were used. The data were generated from a standardized Student Injury Report (SIR) form completed by school personnel (ie, secretary, school nurse, counselor, coach, teacher, etc) immediately after the occurrence of an injury on school premises that: 1) caused loss of at least one half of a day of school; and/or 2) warranted medical attention and treatment (ie, school nurse, physician, other health care provider, or evaluation in a health care facility). The SIR forms are used in all school districts in Utah. A technician reviews each form before it is entered into the database, communicates with schools regarding the
consistency of reporting, and provides training to improve the accuracy of reporting. Use of these forms is voluntary; however, compliance has been consistent from year to year, and this form is the only means used to report student injuries to the health department. Items on the form include: student demographics, time and date of injury, place (school and district), number of missed days, action taken (ie, first aid, called 911, taken to a physician), nature of injury, body area affected, contributing factor, school setting, location (ie, athletic event, classroom, gymnasium, shop class, laboratory, etc.), activity during which injury occurred, equipment

involved, malfunction of equipment, and equipment misuse. We analyzed injuries that occurred to students in grades 7 through 12. A shop injury was defined as an injury where shop was coded for the location. Shop is recorded for industrial art classes, vocational educational classes, or automotive classes.

To determine the medical outcome and hospital charges associated with shop class injuries, we linked the SIR database to Utah statewide ED records (available for 1996 only), and to Utah statewide hospital inpatient discharge records (1992-1996). These records were acquired from the Utah Health Data Committee, Office of Health Data Analysis. Reporting by hospitals is mandated by Utah law. Both databases contain International Classification of Disease, Ninth Revision codes, E-codes, demographic information (birth date, sex, and grade), billing information, and charges (excluding physician fees). ED records contain patients seen only in the ED, and not admitted as inpatients; thus, there is no overlap between the databases.

The methodology of probabilistic linkage has been previously validated and described.[13,14] Briefly, probabilistic record linkage uses statistical properties of variables that are common in 2 databases to determine whether a pair of records refers to the same person and event. We used Automatch 4.1 (Matchware Techologies, Inc, Silver Spring, MD) to probabilistically link the SIR database to the ED and inpatient files.

RESULTS

SIR Database

From 1992 to 1996, 14 133 students in grades 7 through 12 were injured at school. Of these, 1008 (7.1%) were injured during a shop class. Nearly one half of the shop injuries (42.10/o) occurred to students in grades 8 and 9, and 87.3% were male. The predominant hour for shop injuries was 10:00 AM. Teachers completed 62.5% of the injury reports. The average missed school time for a shop injury was one half of a day (range: 0-36 days).

Equipment use accounted for 88.4% of the shop injuries. Nonequipment injuries included collision with an object or person and foreign body/object. Band saws (11.9%), table saws (11.6%), and sander/ buffers (7.4%) were involved in nearly one third of the equipment-related injuries. Other types of equipment included other saws (7.2%), cutting equipment (6.4%). drills (3.8%), welders (3.7%), and routers (2.8%). Improper use of equipment was reported in 37.9% of the equipment-related incidents, and malfunction of equipment was reported for 3.5% of the equipment-related incidents. The type of injury and primary injured area, reported on the SIR form, varied for equipment and nonequipment injuries. Lacerations (70.90/o), bums (6.0%), and abrasions (4.6%) were reported for equipment injuries, whereas lacerations (45.4%), fractures (9.2%), and pain/tenderness (6.70/o) were reported for nonequipment injuries. The primary injured areas reported for equipment injuries were finger/thumb (64.0%), hand/wrist (12.8%), and eye (5.6%), whereas the primary injured areas reported for nonequipment injuries were eye (19.3%), finger/thumb (17.60/o), and hand/wrist 0.9%).

In 1996, 2951 students in grades 7 through 12 were injured at school and 713 ,.2%) visited an ED as a result of the injury. That same year 167 students were injured in a shop class and 45 (26.9%) visited an ED as a result of the shop class injury. Over one half (57.7%) of the students who visited the ED for a shop injury were in grades 11 and 12, and 91.1% were male. The average missed school time for the students admitted to ED was 1 day (range: 0-10 days). Three students were restricted from activity for 4, 10, and 20 days. Equipment was a factor in 88.9% of the shop injuries admitted to the ED. Table saws (15.0%), other saws (15.0%), and band saws

(12.5%) were involved in nearly one half of the equipment injuries seen in the ED. Equipment was used improperly in 44.7% of the equipment-related incidents and malfunctioned in 10.5% of the equipment-related incidents. The majority (68.9%) of the students experienced a hand/wrist injury. The leading injuries sustained were open wounds (64.4%), followed by contusions (13.3%), fractures (8.9%), and 2 students sustained traumatic amputation of a finger. The total ED charges for shop injuries were $16 571 or -$368 per injury.

Inpatient Linkage

For 1992-1996, 14 133 students were injured at school and 146 (1.0%) required inpatient hospital care as a result of the injury. Of the 1008 students injured in a shop class, 7 (.7%) required inpatient hospital care. All of these students were in grades 9 to 12, and 4 (57.1%) were male. The students missed an average of 6 days of school, with I student missing 36 days. Six of the students were injured using a table saw and 1 sustained injuries attributable to automotive cleaning fluid'. Equipment was used improperly in 4 of the table saw injuries, whereas equipment malfunction was not reported as contributing to any of the injuries. Two students sustained an open-wound hand injury involving a tendon, 2 sustained traumatic amputation of a finger, 1 suffered a traumatic amputation of a thumb, 1 suffered open fracture to a finger sustaining nerve and tendon damage, and 1 sustained second degree burns on face and upper limb. The total inpatient hospital charges for shop injuries were $26 767 with an average charge of $3821, and the average length of stay was 1.4 days. All 7 patients were discharged to home from the hospital.

DISCUSSION

While using a sander, a 12th-grade male shop student sustained a deep finger laceration. The injury required 8 stitches and resulted in an ED charge of $150. This incident is typical for most shop class injuries. In fact, we found the vast majority of shop injuries involved equipment use. In addition, equipment misuse or malfunction was a significant contributor to shop injuries. The morbidity associated with shop injuries can be Devastating and life lasting; for example, some students partially or completely severed fingers or thumbs. Other studies have shown equipment like those used in shop classes have the potential to cause serious injuries.[15-17] These tools may be particularly dangerous for school-aged children because of the children's musculoskeletal development. Adolescents commonly experience disproportional growth patterns, causing limited and uncoordinated range of motion, and resulting in an increased risk for injury. Furthermore, shop equipment designed for adults may be unsuitable in size and dimension for school-aged children, which may put them at increased risk for injury.[12] These findings stress the need for school administrators, teachers, and students to develop and improve safety policies and practices in school shop classes. In addition, pediatricians need to be cognizant of these hazards and inform patients of risks in school shop classes.

We found that power saws accounted for approximately one quarter of the equipment-related injuries. This finding is particularly troubling because the use of power saws by minors is regulated in the workplace. No such regulations exist for students in the shop class environment. A study of amateur and professional woodworkers found that although the largest percentage of serious equipment-related injuries involved a table saw, the table saw had the lowest rate per hour of use for a first time injury incident (.7 incidence per 1000 person hours).[16] Although this particular study was not restricted to students in shop classes, it may indicate that although shop equipment-injuries often involve table saws, other shop equipment may be more dangerous per hour of use. In our study, we were unable to obtain usage rates of shop equipment, thus preventing us from determining the risk of an injury for specific shop equipment. However, by identifying which equipment contributed to shop injuries, we were able to better determine which equipment may need increased attention. Shop class instructors and school administrators should ensure that shop class power saws and other equipment are well-maintained and include all available safety features. In addition, it is important that individual students are not allowed to use power saws inappropriate for their stature.

Another important finding was that many of the equipment-related injuries were coded as equipment misuse. Shop class curriculum in Utah public schools includes equipment training and instructions on shop safety practices and procedures, yet students continue to be injured by improper use of equipment. This may indicate that safety instructions need greater emphasis or perhaps that safety policy enforcement is lacking. In the occupational literature, proper training on the safe use of equipment and improved supervision of workers have been shown to reduce injuries and decrease inappropriate behaviors.[12,18] The use of occupational training material and supervision techniques may help increase safety practices in shop classes.

A 12th-grade male shop student cut the end of his thumb while using a malfunctioning paper cutter. He sustained a laceration when the slicing arm of the apparatus failed to remain in an upright position. The injury did not result in stitches, but resulted in an ED visit and $105 in ED charges. Injuries resulting from the malfunction of equipment are costly and unnecessary. These injuries are costly because they may result in litigation for the school (not to mention the medical cost of the injury), and are also unnecessary because most are preventable. Injuries resulting from malfunction of equipment indicate a need for school administrators and shop instructors to ensure that equipment is maintained properly and old equipment is updated or replaced. One suggestion for decreasing shop injuries is to take a workplace approach. For example, Padham [19] suggests that schools invite outside agencies, such as the Occupational Safety and Health Administration, into shop facilities to conduct safety audits.

While reaching for a wood scrap, a female in grade 10 severed 3 fingers, when she came in contact with the table saw blade. She missed 36 days of school, required several surgeries, and incurred over. $6100 in inpatient hospital charges. The morbidity associated with shop injuries can be devastating and life lasting, as evidenced by the previous example. In our study, one quarter of students injured in shop class required an ED evaluation or hospital inpatient care. The majority of the hospital and ED injuries were to the hand. In fact, 5 students sustained traumatic amputations to a finger or thumb. Other studies have documented that hand injuries cause serious morbidity. A study of injuries among carpenters found equipment-related hand injuries cost an average of $12 000 and resulted in an average of 20 days of total or partial disability.[17] Another study, which examined hand injuries treated in a hospital, reported that 6 weeks after treatment 26% of outpatients and 44% of inpatients reported pain and discomfort, and 18% had problems writing or typing.[20] Hand injuries to shop class students, especially those that sustain traumatic amputations, impact the students and their families in terms of financial burdens because of rehabilitation cost, missed school days, and loss of productivity.

Our study has several strengths. First, to our knowledge, this is the largest school shop injury study to date. The use of the Utah SIR database enabled us to conduct a population-based study of shop injuries. Second, the SIR database contained useful equipment-related injury information that is important in determining possible areas for prevention of shop injuries. Third, the use of probabilistic linkage allowed us to determine the severity of injuries and determine hospital charges that enabled us to associate the injuries with actual financial impact without using estimates.

Limitations of our study include possibly underestimating of school injuries because of the voluntary nature of the reporting. The SIR form has been in place for [is greater than] 10 years. Although it is voluntary, it is the only form schools use to report injuries to the health department, and compliance has been consistent from year to year. A second limitation is the fact that forms are completed by shop teachers and other school personnel, not by safety professionals trained in accident investigation. Another limitation is our data contain hospital charges, which do not include physician fees or rehabilitation charges and do not accurately contain cost or payment information. In addition, our data lacked cost associated with litigation. Thus, the financial impact of shop injuries is probably underestimated. Further limitations include the lack of student enrollment rates for shop classes, the lack of specific shop equipment usage rates, the inability to determine maintenance of specific equipment, and the lack of information regarding supervision. These limitations should be addressed as part of future studies.

Despite these limitations, we have shown that shop injuries are an important component of school health. In our study, we found that shop injuries were most often equipment-related, were a result of equipment misuse or malfunction, and can cause serious injury. These injuries have a great impact on students, their families, and schools because of the loss of productivity of the student and the financial impact. Many of the injuries are preventable. These findings stress the need for school administrators, teachers, and students to develop and improve safety policies and practices in school shop classes and in school health in general. Pediatricians and other physicians need to ask teen-aged patients whether they are enrolled in shop class and to caution them about equipment use, especially power saws.

ACKNOWLEDGMENT

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REFERENCES

[I.] Scheidt P, Harel Y, Trumble A, -Jones D, Overpeck M, Bijur P. The epidemiology of nonfatal injuries among US children and youth. Am i Public Health. 1995;85:932-938

[2.] LI-I Miller T, Spicer R. How safe are our schools? Am 3 Public Health. 1998;88:413-418

[3.] Boyce WT, Sprunger LW, Sobolewski S, Schaefer C. Epidemiology of injuries in a large, urban school district. Pediatrics. 1984;74:342-349

[4.] Dale M, Smith MEM, Weil]W, Parrish HM. Are schools safe? Analysis of 409 student accidents in elementary schools. Clin Pediatr. 1969;8: 294-296

[5.] Gratz RR. School injuries: what we know, what we need. I Pediatr Health Care. 1992;6:256-262

[6.] Laflamme L, Eilert-Petersson E. School-injury patterns: a tool for safety planning at the school and community levels. Accid Anal Prev. 1998;30: 277-283

[7.] Langley ID, Silva PA, Williams SM. Primary school accidents. N Z Med J. 1981;94:336-339

[8.] Langley ID, Chalmers D, Collins B. Unintentional injuries to students at school. 3 Pediatr Child Health. 1990;26:323-328

[9.] Lenaway DD, Ambler AG, Beaudoin DE. The epidemiology of school-related -@-rf injuries: new perspectives. Am I Prev Med. 1992;8:193-198

[10.] Sheps SB, Evans GD. Epidemiology of school injuries: a 2-year experience in a municipal health department. Pediatrics. 1987;79:69-75

11.] Di Scala C, Gallagher S, Schneps S. Causes and outcomes of pediatric injuries occurring at school. I Sch Health. 1997;67:384-389

[12.] National Research Council', In@@itute of Medicine. Protecting Youth at Work. Washington, DC: National Academy Press; 1998

[13.] Jaro M. Advances in record-linkage methodology as applied to matching the 1985 census of Tampa, Florida. I Am Stat Assoc. 1989;84:414-419

[14.] Jaro M. Probabilistic linkage of large public health data tiles. Stat Med. 1995;14:491-498

[15.] Justis El, Moore SV, LaVelle DG. Woodworking injuries: an epidemiologic survey of injuries sustained using woodworking machinery and hand tools. I Hand Surg. 1987;12:890-895

[16.] Becker TM, Trinkaus KM, Buckley DI. Tool-related injuries among amateur and professional woodworkers. 3 Occup Environ Med. 1996;38: 1032-1035

[17.] Waller]A, Payne SR, Skelly JM. Injuries to carpenters. I Occup Med. 1989;31:687-692

[18.] Waller 1. Injury Control: A Guide to the Causes and Prevention of Trauma. Boston, MA: Lexington Books; 1985

[19.] Padham E. Safety: your first responsibility. Vocational Educ 3. 1990;65: 16-17

[20.] Smith M, Auchincloss 3, Ali M. Causes and consequences of hand injury. I Hand Surg. 1985;10:288-292

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COMPRESSED AIR - - C A U T I 0 N

BE CAREFUL WITH COMPRESSED AIR!! SO CAUTIONS DR. G.C. THOSTESON, M.D., IN HIS COLUMN, "YOUR HEALTH." COMPRESSED AIR CAN BE DANGEROUS, EVEN FATAL. AT 40 PSI A BLAST OF AIR FROM A DISTANCE OF 4 INCHES CAN RUPTURE AN EARDRUM AND POSSIBLY CAUSE A FATAL BRAIN HEMORRHAGE. AT 40 PSI METAL CHIPS AND OTHER DEBRIS CAN BE DRIVEN 70 MPH. DIRECTED INTO THE MOUTH, AIR AT THIS PRESSURE CAN RUPTURE LUNGS AND INTESTINES. AIMED AT THE EYES, IT CAN PRODUCE BLINDNESS. AIR AT PRESSURES AS LOW AS 4 PSI CAN RUPTURE THE BOWEL. COMPRESSED AIR DIRECTED AGAINST THE SKIN CAN CAUSE TISSUE -DAMAGE SIMILAR TO BURNS, IN ADDITION TO DRIVING DIRT AND
CHIPS DEEP INTO THE FLESH. SAFETY GLASSES SHOULDALWAYS BE WORN WHEN WORKING WITH COMPRESSED AIR. COMPRESSED AIR SHOULD NEVER BE USED TO BLOW DUST OUT OF HAIR OR CLOTHING. ASIDE FROM THE DANGERS MENTIONED ABOVE, AIR CAN BE DRIVEN INTO A SLIGHT SCRATCH OR PUNCTURE IN THE SKIN CAUSING AGONIZING PAIN AND SWELLING, AND PERHAPS EVEN BUBBLES OF AIR IN THE BLOOD. THE UTMOST CAUTION SHOULD ACCOMPANY THE USE OF COMPRESSED AIR IN CLEANING MACHINES, ENGINE PARTS, ETC. THE MOST INEXCUSABLE, AND OFTEN THE WORST DAMAGE, RESULTS FROM *HORSEPLAY*, WHICH CAN NEVER BE TOLERATED. AS DR. THOSTESON POINTS OUT, IT'S JUST AIR, BUT SO IS A HURRICANE. AND IF AIR AT 40 PSI CAN DO SO MUCH DAMAGE, IMAGINE AIR AT 70, 80, OR 100 PSI OR EVEN 160 PSI! CHECK THE AIR PRESSURE AND SAFETY PROGRAM IN YOUR SHOP.

WOOD DUST
First Listed in the ***Tenth Report on Carcinogens***

CARCINOGENICITY

Wood dust is *known to be a human carcinogen,* based on sufficient evidence of carcinogenicity from studies in humans. An association between wood dust exposure and cancer of the nose has been observed in many case reports, cohort studies, and case-control studies that specifically addressed nasal cancer. Strong and consistent associations with cancer of the nasal cavities and paranasal sinuses were observed both in studies of people whose occupations are associated with wood dust exposure and in studies that directly estimated wood dust exposure. Risks were highest for adenocarcinoma, particularly among European populations. Studies of U.S. populations showed similar significant positive associations. A pooled analysis of 12 case-control studies showed that the estimated relative risk of adenocarcinoma was very high (45.5) among men with the greatest exposure, and that the risk increased with duration of exposure (Demers *et al.* 1995). The association between wood dust exposure and elevated nasal cancer risk in a large number of independent studies and with many different occupations in many countries strongly supports the conclusion that the increased risk is caused by wood dust rather than by simultaneous exposure(s) to other substances, such as formaldehyde or wood preservatives. Other types of nasal cancer (squamous-cell carcinoma of the nasal cavity) and cancer at other sites, including cancer ofnasopharynx and larynx and Hodgkin's disease, have been associated with exposure to wood dust in several epidemiologic studies. However, these findings were positive in some, but not all, studies and the overall epidemiologic evidence is not strong enough or consistent enough to allow firm conclusions about the role of wood dust exposure in the development of cancer at these other sites.

There is inadequate evidence for the carcinogenicity of wood dust from studies in experimental animals. No tumors attributable to beech wood dust exposure were found in inhalation studies in female Sprague-Dawley rats, female Wistar rats, or male Syrian golden hamsters or in intraperitoneal injection studies in female Wistar rats. Similarly, inhalation exposure to wood dust did not significantly affect the incidence of tumors induced by simultaneous exposure to other compounds, including formaldehyde in female Sprague-Dawley rats, sidestream cigarette smoke in female Wistar rats, or *N*-nitrosodiethylamine in male Syrian golden hamsters. However, each of these studies suffers from various limitations, such as small numbers of animals or dose groups, short study duration, or inadequate data reporting.

ADDITIONAL INFORMATION RELEVANT TO CARCINOGENESIS OR POSSIBLE MECHANISMS OF CARCINOGENESIS

Dermal exposure to a methanol extract of beech wood dust resulted in a significant dose-related increase in the incidence of skin tumors (squamous-cell carcinoma and papilloma) and mammary tumors (adenocarcinoma, adenoacanthoma, and mixed tumors) in female NMRI mice.

Studies using polar organic solvent extracts of some hardwood dusts have reported weak positive results for reverse mutations in *Salmonella typhimurium.* In addition, two chemicals found in wood, A carene and quercetin, were found to be mutagenic in *Salmonella. In vitro* and *in vivo* tests in mammals, using polar organic solvent extracts of some wood dusts (beech and oak) have shown positive results for DNA damage, micronucleus induction, and chromosomal aberrations (primarily chromatid breaks). A higher rate of DNA damage (primarily single-strand breaks and DNA repair) and micronucleus induction has been observed in peripheral blood lymphocytes from people who are occupationally exposed to wood dust.

The roles of specific chemicals found in wood dust (either naturally in the wood or added to it in processing) in inducing cancer are not clear. The particulate nature of wood dust also may contribute to wood dust-associated carcinogenesis, because dust generated by woodworking typically consists of a high proportion of particles that are deposited in the nasal cavity. Some studies of people with long-term exposure to wood dust have found decreased mucociliary clearance and enhanced inflammatory reactions in the nasal cavity. Also, cellular changes (metaplasia and dysplasia) observed in the nasal mucosa of woodworkers and of laboratory animals may be precancerous.

PROPERTIES

Wood is an important worldwide renewable natural resource. Forests extend over approximately one-third of the earth's total landmass (about 3.4 million km^2). There are an estimated 12,000 species of trees, each producing a characteristic type of wood;
therefore, the species of trees harvested vary considerably among different countries and even among different parts of a single country. However, even in countries with high domestic production of wood, some wood may be imported for specific uses, such as furniture production (IARC 1995).
In the plant kingdom, trees belong to the division of spermatophytes and are subdivided into two classes based on seed type: gymnosperms (which have exposed seeds) and angiosperms (which have encapsulated seeds). Most of the 12,000 tree species are broad-leaved deciduous trees, or hardwoods, principally angiosperms. Only approximately 800 species are pines, firs, and other coniferous trees, or softwoods, principally gymnosperms (IARC 1995). . :
The terms "hardwood" and "softwood" refer to the species, and not necessarily the hardness of the wood. Although hardwoods generally are denser than softwoods, the density varies greatly within each group, and the hardness of the two groups overlaps somewhat (IARC 1995). Although most trees harvested worldwide are hardwoods (58% of volume), much of the hardwood is used for fuel. For industrial purposes, softwood is the major wood used (69%), although this varies from region to. region (IARC 1995).
Wood dust is a complex mixture generated when timber is processed, such as when it is chipped, sawed, turned, drilled, or sanded. Its chemical composition depends on the species of tree and consists mainly of cellulose, polyoses, and lignin, with a large and variable number of substances with lower relative molecular mass. Cellulose is the major component of both softwood and hardwood. Polyoses (hemicelluloses) are present in larger amounts in hardwood than in softwood. They contain five neutral sugar units:
three hexoses (glucose, mannose, and galactose) and two pentoses (xylose and arabinose). The lignin content of softwood is higher than that of hardwood. The monomers of lignin are phenylpropane units joined by various linkages.

The lower-molecular-mass substances significantly affect the properties of wood;
these include substances extracted with nonpolar organic solvents (fatty acids, resin acids, waxes, alcohols, terpenes, sterols, steryl esters, and glycerols), substances extracted with polar organic solvents (tannins, flavonoids, quinones, and lignans), and water-soluble substances (carbohydrates, alkaloids, proteins, and inorganic material). Hardwood tends to have a higher percentage of polar-soluble substances than does softwood.
Wood dust is a light brown or tan fibrous powder. Its specific gravity is reported as 0.56 by the National Toxicology Program (NTP) (2001), but it also is described as variable and dependent on wood species and moisture content. The composition of softwood tissue is simpler than that of hardwood. The bulk of softwood consists of just one type of cell, tracheids. Tracheids are elongated fiber-like cells with a square or polygonal cross-section. Less than 10% of softwood consists of short, brick-like parenchymal cells arranged radially. Softwoods also contain epithelial cells that secrete resin into canals, which run horizontally and radially through the wood.
In hardwoods, there is more detailed differentiation between stabilizing, conducting, and storage tissue. Stabilizing tissues contain libriform fibers and fiber tracheids, which are elongated cells

with thick polygonal walls and small lumina. The conducting system is composed of vessel elements fitted together to form long tubes of up to several meters. Hardwoods that contain resin canals also have a secretory system of epithelial cells (IARC 1995).
The walls of wood cells consist of various layers that differ in structure and chemical composition. The individual cells of wood tissue are glued together in the middle lamella (which consists mainly of lignin, polyoses, and pectins). The outer cell wall layer (the primary wall) is formed by a net-like arrangement of cellulose fibrils embedded in a matrix of lignin and polyoses. The next layer is the secondary wall, which is further subdivided into secondary walls 1 (SI) and 2 (S2). SI and S2 contain densely packed cellulose fibrils arranged in parallel. At the inner border of the cell wall, there is a final layer (the tertiary wall). The lignin content decreases from the compounded middle lamella through S2, and the cellulose content increases in the same direction. The organic matter of wood (extractives) is found in the resin canals and parenchymal cells (IARC 1995).

No flash-point data are available for wood dust; however, wood dust is flammable and will ignite in the environment. It may present a strong to severe explosion hazard if a dust cloud contacts an ignition source. Wood dust is stable under normal laboratory conditions. No information about decomposition in the environment was found in the literature (NTP 2001).

USE

Wood dust has limited commercial uses, but wood is one of the world's most important renewable resources. Forests are estimated to cover more than one-third of the world's total land area, with a total biomass of one trillion cubic meters, of which approximately 3.5 billion cubic meters are harvested annually. "Industrial roundwood" refers to categories of wood not used for fuel, which include sawn wood (54%), pulpwood (21%), poles and pit props (14%), and wood used for other purposes, such as particle board and fiberboard (11 %) (IARC 1995).
Wood dust is used to prepare charcoal, as an absorbent for nitroglycerin, as a filler in plastics, and in linoleum and paperboard (NTP 2001). Another commercial use for wood dust is in wood composts (Weber *et al.* 1993).

PRODUCTION

Wood dust is created when machines or tools are used to cut or shape wood materials. Industries in which large amounts of wood dust are produced include sawmills, dimension mills, furniture industries, cabinetmaking, and carpentry (IARC 1995).
Total estimated production values for wood used in industry in the United States for 1990 was 311.9 million cubic meters of softwood and 115 million cubic meters of hardwood (Demerse/a/. 1997).

EXPOSURE

The National Occupational Exposure Survey, conducted from 1981 to 1983 by NIOSH, estimated that approximately 600,000 workers were exposed to wood dust in the United States (NIOSH 1990). Wood dust usually is measured as airborne dust concentrations, by particle size distribution, by type of wood, and by other characteristics of wood (IARC 1995). Backlighting with a dust lamp, or Tyndall beam, is useful for identifying sources of dust emission (Hamill *et al.* 1991).
Exposure to wood dust occurs when individuals use machinery or tools to cut or shape wood. Breathing in the dust causes it to deposit in the nose, throat, and other airways. The amount of dust deposited within the airways depends on the size, shape, and density of the dust particles and the strength (turbulence and velocity) of the airflow (IARC 1981). Particles with a diameter

larger than 5 um ("inspirable" particles) are deposited almost completely in the nose. Particles 0.5 u.m to 5 u.m ("respirable" particles) are deposited in the lower airways (IARC 1981, 1995).
Total airborne dust concentrations are described as mass per unit volume (usually milligrams per cubic meter). Wood dust generally is collected by a standard gravimetric method that involves using a sampling pump to collect 9 known volume of air through a special membrane filter contained in a plastic cassette. The detection limit for personal sampling of wood dust is approximately 0.1 mg/m^3. Polyvinyl chloride (PVC) filters are preferred, because of the highly variable moisture content of wood dusts (IARC 1995).
Inspirable dust includes large particles that may deposit in the respiratory system. Finer, respirable dust is sampled through a 10-mm nylon cyclone (centrifugal separator) that is designed to accept 50% of unit density spherical particles of3.5-nm aerodynamic diameter. Samplers that measure inspirable wood dust concentrations must maintain a sampling efficiency of greater than 50% for particles up to 100 |j,m in aerodynamic diameter (IARC 1995, Weber *et al.* 1993).
The National Institute for Occupational Safety and Health (NIOSH) sampling method (NIOSH Method 0500) for total airborne dust consists of collecting dusts on tared 37-mm hydrophobic filters (PVC, *2-[im* to 5-^m pore size or equivalent). Sampling rates of 1 to 2 L/min are recommended, with a recommended filter maximum dust loading of 2 mg of total dusts. Dust weights are determined with a microbalance capable of weighing to 0.001 mg, and dust concentrations are expressed as milligrams per cubic meter of total dust (NIOSH 1994).

Some studies reported that the particle size distribution varied according to the woodworking operation, with sanding producing smaller particles than sawing, but others found no consistent differences (IARC 1995). The majority of the wood dust mass was reported to be contributed by particles larger than 10 pm in aerodynamic diameter, and between 61% and 65% of the particles measured between 1 and 5 um in diameter (IARC 1995).

Several organizations, including the American Conference of Governmental Industrial Hygienists (ACGIH) and the International Standards Organization, have proposed particle-size-selective sampling methods. For wood dusts, the appropriate exposure measure is the inspirable or inhalable mass, which is defined as those materials that are deposited anywhere in the respiratory tract. The ACGIH has defined the sampling characteristics of inhalable mass samplers to have a sampling efficiency of 50% for particles of 100-u.m aerodynamic diameter. Sampling devices that meet these criteria have been developed and used for sampling wood dusts (Hinds 1988, IARC 1995, Weber *etal.* 1993).
Particle size distribution is determined with a multistage cascade impactor device. The impactor separates the particles by mass, allowing dust collected at various stages to be weighed and a particle size (mass) distribution to be determined. Wood dust samples also can be analyzed by optical microscopy that classifies particles by equivalent circular diameters. A particle-size frequency distribution can then be determined (IARC 1995).

Several other characteristics of wood may be reported. Irregular shapes of wood dust particles can be recorded in photomicrographs or by scanning electron microscopy. Chemical substances that occur naturally or have been added, to wood sometimes are described. There is no standard procedure, however, for measuring the extractable fraction in wood dust (IARC 1995).
Use of hand-held electric sanders has been identified as a particularly dusty process that will lead to dust exposure. Wood dust concentrations vary with type of dust extraction, amount of wood removed, and type ofsander (Thorpe and Brown 1994). For electric belt sanders used to sand dowels, total dust concentrations ranged from 0.22 mg/m^3 with external dust extraction to 3.740 mg/m^3 without, and concentrations of respirable dust (0.5 to 5 am) ranged from 0.003 to 0.936 mg/m^3 .under the same conditions. Rotary sanders tested with flat wood samples produced total dust concentrations ranging from 0.002 (with extraction) to 0.699 mg/m (without extraction) and concentrations of respirable dust from 0.001 (with) to 0.088 mg/m^3 (without). Comparable

decreases in dust concentrations were observed for electrical orbital sanders used with dust extraction.
Environmental exposure to wood dust also occurs through handling of compost containing wood dust. Wood compost materials consist of successive layers of chopped leaves, bark, and wood stored outdoors during spring where high rainfall is expected. Visible clouds of fine particulates are easily generated when the compost materials are agitated. Inspirable and respirable dust concentrations during compost handling were measured with portable sampling pumps. Background concentrations of 0.32 mg/m^3 of respirable dust were obtained from samplers upwind from the compost pile (Weber *et al.* 1993). Routine exposures of 0.74 mg/m^3 of inspirable dust (>5 um) and 0.42 mg/m^3 of respirable dust (0.5 to 5 u,m) were determined with samplers at breathing zone level during loading and unloading of compost. The worst-case exposures were collected directly from the visible clouds generated by compost agitation and contained 149 mg/m^3 of inspirable and 83 mg/m^3 of respirable dust.

Teschke *et al.* (1999) analyzed 1,632 measurements of personal time-weighted-average airborne wood dust concentrations in 609 establishments on 634 inspection visits that were reported to the Occupational Safety and Health Administration (OSHA) Integrated Management Information System between 1979 and 1997. Exposures ranged from less than 0.03 to 604 mg/m^3, with an arithmetic mean of 7.93 mg/m^3 and a geometric mean of 1.86 mg/m^3. Exposure levels have decreased significantly over time (the unadjusted geometric mean was 4.59 mg/m^3 in 1979 and 0.14 mg/m^3 in 1997).
Jobs with high exposure to wood dust include sanders in the transportation equipment industry (unadjusted geometric mean = 17.5 mg/m^3), press operators in the wood products industry (12.3 mg/m^3), lathe operators in the furniture industry (7.46 mg/m^3), and sanders in the wood cabinet industry (5.83 mg/m^3). Industries with high geometric means include chemical and petroleum products and rubber and plastics products, in which exposures occur in sanding, pattern making, and mill and saw operation. Industries with the lowest exposures include industrial patterns, paper and paperboard mills, schools and institutional training facilities, and veneer and plywood mills. Teschke *et al.* (1999) used a multiple regression model to predict wood dust exposure levels by such factors as year, state, job, and industry. Values predicted by the model fell in the range of 0.015 to 36.0 mg/m^3, with a geometric mean of 1.85 ± 2.95 mg/m^3.

REGULATIONS

The ACGIH assigned threshold limit values of 1 mg/m^3 for certain hardwoods, such as beech and oak, and 5 mg/m^3 for softwoods except western red cedar, as time-weighted averages (TWAs) for a normal 8-hour workday and a 40-hour workweek. It also established a short-term exposure limit (STEL) of 10 mg/m^3 for softwood, for periods not to exceed 15 minutes. Exposures at the STEL concentration should not be repeated more than four times a day and should be separated by intervals of at least 60 minutes. NIOSH recommends that wood dust (soft, hard, and western red cedar) be considered a potential occupational carcinogen and that exposure be limited to 1 mg/m3 as a TWA exposure up to a 10-hour workday during a 40-hour workweek. OSHA regulations that apply to workplaces where wood dust is present primarily control safety hazards of the environment (e.g., in sawmills). OSHA also established a permissible exposure limit of 15 mg/m^3 for the total dust and 5 mg/m^3 for the respirable fraction of wood dust. OSHA also regulates wood dust under the Hazard Communication Standard and as a chemical hazard in laboratories. Regulations are summarized in Volume II, Table 189.1

1 No separate CAS registry number assigned to wood dust.

REFERENCES

Demers, P.A., P. Boffetta, M. Kogevinas, A. Blair, B.A. Miller, C.F. Robinson, R.J. Roscoe, P.D. Winter, D. Colin, E. Matos, and H. Vainio. Pooled reanalysis of cancer mortality among five cohorts of workers in wood-related industries. Scand. J. Work Environ. Health, Vol. 21, 1995, pp. 179-190.

Demers, P.A., K. Teschke, and S.M. Kennedy. What to do about softwood? A review of respiratory effects and recommendations regarding exposure limits. Am. J. md. Med., Vol.4,1997,pp.385-398.

Hamill, A., J. Ingle, S. Searle, and K. Williams. Levels of exposure to wood dust. Ann. Occup. Hyg., Vol. 35, 1991, pp. 397-403.

Hinds, W.C. Basis for particle size-selective sampling for wood dust. Appl. Ind. Hyg., Vol.3, 1988, pp. 67-72.

IARC. International Agency for Research on Cancer. Wood, Leather, and Some Associated Industries. IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Humans. Vol. 25. Lyon, France: IARC, 1981.

IARC. International Agency for Research on Cancer. Wood Dust. IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Humans. Vol. 62. Lyon France: IARC, 1995, pp. 35-215.

NIOSH. National Institute for Occupational Safety and Health. NIOSH Manual of Analytical Methods (NMAM), Fourth Edition, http://www.cdc.gov/niosh/nmam/nmammenu.html. August 15, 1994.

NIOSH. National Institute for Occupational Safety and Health. National Occupational Exposure Survey (NOES) (1981-1983). Unpublished provisional data as of July 1, 1990, Cincinnati OH.

Noertjojo, H.K., H. Dimich-Ward, S. Peelen, M. Dittrick, S.M. Kennedy, and M. Chan-Yeung. Western red cedar dust exposure and lung function: a dose-response relationship. Am. J. Respir. Crit. Care Med., Vol. 154, 1996, pp. 968-973.

NTP. National Toxicology Program. NTP Chemical Repository. Wood Dust. Last updated August 13, 2001. (http://ntp-server.niehs.nih.gov and search wood dust).

Teschke, K., S.A. Marion, T.L. Vaughan, M.S. Morgan, and J. Camp. Exposures to wood dust in U.S. industries and occupations, 1979 to 1997. Am. J. md. Med., Vol. 35, 1999,pp.581-589.

Thorpe, A., and R.C. Brown. Measurements of the effectiveness of dust extraction systems of hand sanders used on wood. Ann. Occup. Hyg., Vol. 38, 1994, pp. 279-302.

Weber, S., G. Kullman, E. Petsonk, W.G. Jones, S. Olenchock, W. Sorenson, J. Parker, R. Marcelo-Baciu, D. Frazer, and V. Castranova. Organic dust exposures from compost handling: case presentation and respiratory exposure assessment. Am. J. Ind. Med., Vol. 24, 1993,pp.365-374.

General Rules

1. IF YOU OPEN IT, CLOSE IT.
2. IF YOU TURN IT ON, TURN IT OFF.
3. IF YOU UNLOCK IT, LOCK IT.
4. IF YOU BREAK IT, REPAIR IT.
5. IF YOU CAN'T FIX IT, REPORT IT.
6. IF YOU BORROW IT, RETURN IT.
7. IF YOU USE IT, DON'T ABUSE IT.
8. IF YOU MAKE A MESS, CLEAN IT UP.
9. IF YOU MOVE IT, PUT IT BACK.
10. IF YOU DON'T KNOW HOW TO OPERATE IT, LEAVE IT ALONE.
11. IF IT BELONGS TO SOMEONE ELSE AND YOU WANT TO USE IT, GET PERMISSION BEFORE YOU TAKE IT.
12. IF IT DOESN'T CONCERN YOU, DON'T MESS WITH IT.