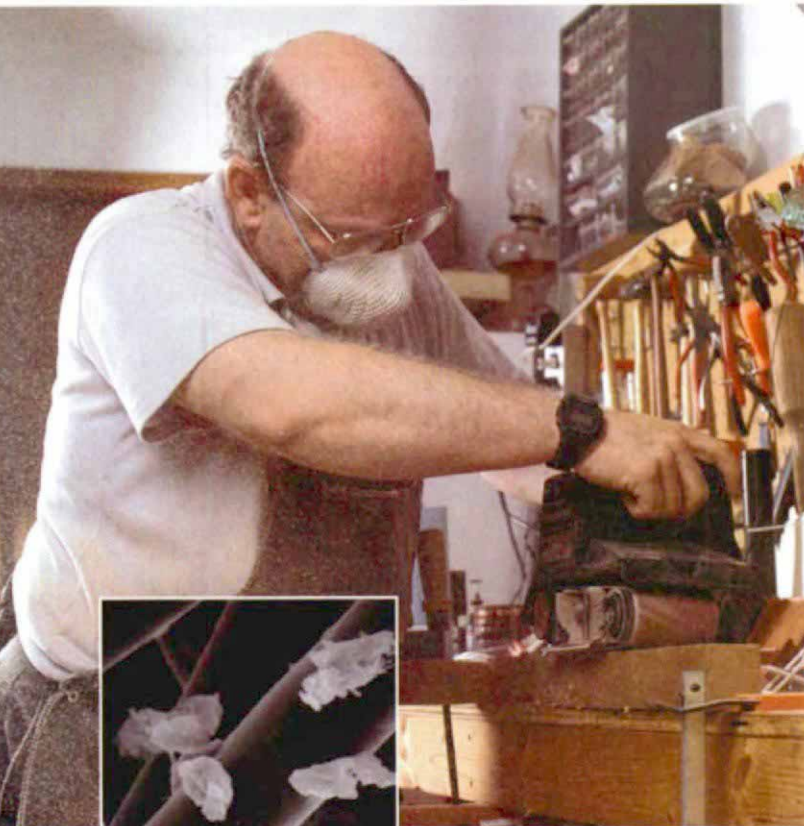


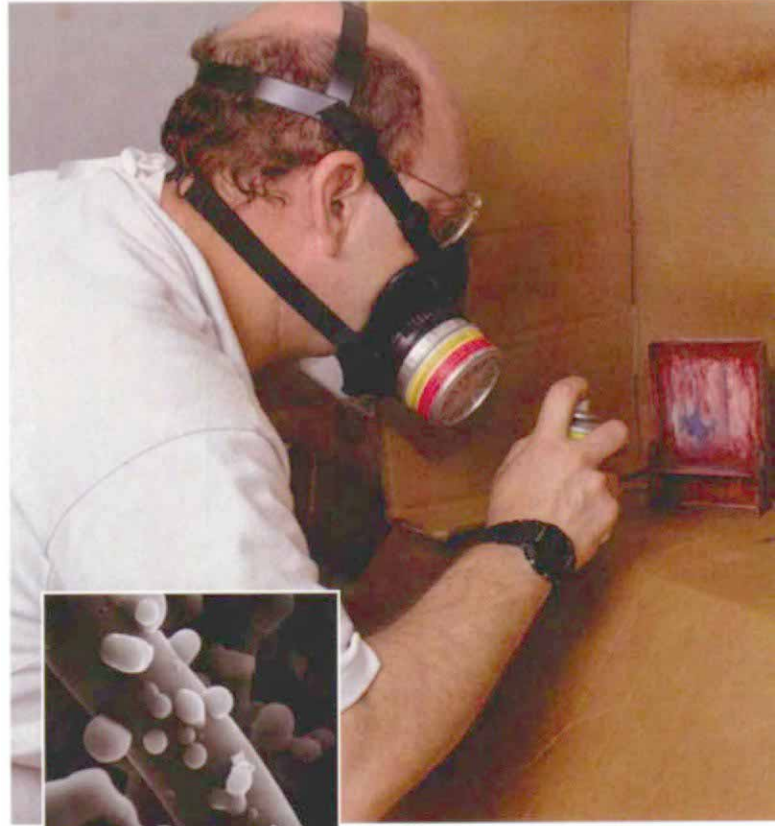
# Protecting Your Lungs from Woodworking

*Dust masks and respirators can capture a variety of workshop hazards*

by Charles W. Calmbacher



**Power sanding** produces a lot of airborne dust. Seen under 1,200x magnification (inset left), wood dust particles are stuck to the strands of a dust mask.



**Overspray from finishing**—Under 1,200x magnification (inset), droplets of finish are shown captured by the fibers of a respirator.

**M**y great-grandfather emigrated to this country from the Black Forest of Germany at the end of the 19th century and found work as a finisher for a piano company. That would have been unremarkable except he had only one arm. He was a hard worker and wasn't cut any slack.

The company occasionally held demonstrations that displayed his speed and ability to keep up with other workers. He became so well known for his talent that Mark Twain, who had an eye for unusual characters, hired him to repair some furniture the author had singed with cigars.

In my great-grandfather's day, safety took a back seat to getting the job done. He never wore a dust mask or respirator when he

worked. That attitude has prevailed for many generations of woodworkers. I approach woodworking with more caution. For many years, I worked in the pesticide and herbicide industry where a respirator was mandatory. I got used to wearing one, and I've carried that habit over to my workshop.

## Fine dust particles are the most dangerous

Wood dust particles created in woodworking come in all sizes, some so small you can't even see them. Sanding machines produce very fine particles; even dull cutting tools will create fine dusts as well as larger chips. Very fine particles cause the most damage to your lungs. Wood dusts are considered a potential carcinogen by

**Not all masks are rated for wood dust.** You might find these low-cost masks near the lumber racks at the home center, but read the label carefully. Some aren't rated for wood dust.



the National Institute of Occupational Safety and Health (NIOSH). Some woods, such as Western red cedar, contain resins that are considered toxic. Studies have found that people in the wood-working industry suffer a higher incidence of respiratory system problems, including lung cancer, than the general population.

The nose and bronchial tubes are the body's first line of defense against air-borne invaders. There, fine hair-like fibers, called cilia, snag particles. The irritants get trapped in mucus and are expelled through coughing or sneezing. Excessive exposure, however, can irritate the tissues in the nose and bronchial tubes, causing difficulty in breathing and other allergic reactions.

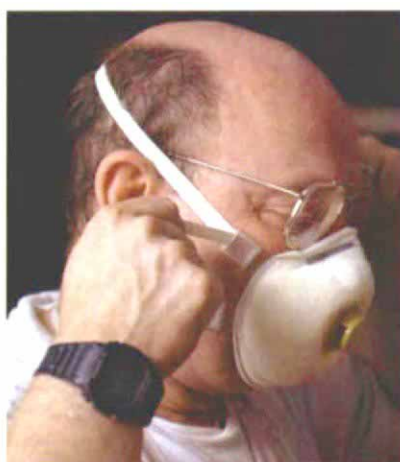
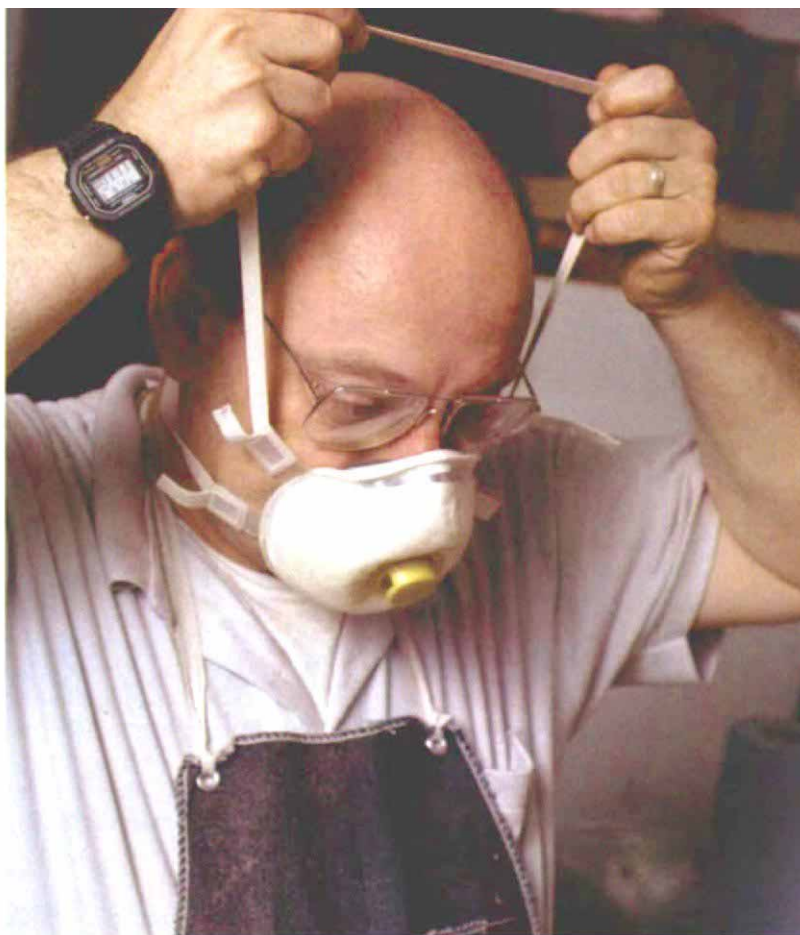
Dusts and mists are most harmful when they enter the lungs, which act like a freeway interchange to other parts of the body, including the bloodstream, kidneys and central nervous system. Small particles, those ranging in size from 0.5 microns to 5 microns (a sheet of typing paper is about 25 microns thick), are most likely to do this. When dust particles enter the lungs, the body's immune system springs into action and tries to destroy and expel the invaders. Our bodies are quite successful at this. But lung cells can get battle-weary and mutate into cancerous cells when they're overwhelmed by toxins.

NIOSH has revised its standards for respirators because it has been determined that respirator filters are less efficient at filtering dust and mist particles about 0.1 to 0.3 microns in diameter than at filtering smaller or larger particles (see the box on p. 67). New respirators are very efficient at capturing all sizes of fine particles. Because you never know exactly what size particles you might face in the workshop if you're running machine tools, it pays to wear some sort of dust mask or respirator. When spray finishing, it's even more important to protect your lungs because you will be faced with fine mist particles as well as potentially hazardous vapors from the chemicals.

### Disposable masks have improved

Disposable masks are designed for specific hazards. Some are only designed for pollen and other large particles (see the top left photo above). It's a safe bet to pick a mask that's been certified by NIOSH. Then you'll know it meets certain standards.

Though often referred to as paper dust masks, these disposables are made of a variety of materials including finely woven paper, plastics and polymers. These filters come in many styles: from the basic mask with an elastic headband to more elaborate, molded units with exhalation valves, silicon seals and adjustable headbands. Prices for these respirators range from about 15 cents to several dollars each. The most inexpensive masks, made of thin



**Getting a good fit from a respirator**—Masks with two adjustable straps (top and center) usually fit well. A mask that doesn't seal flat against the face (bottom) will allow dust or mist to escape past the filter.







**Quarter-face mask**—This mask seals well because of its soft body and fabric covering. The filter is replaceable.



**Half-face mask**—These respirators are usually made of soft rubber or silicone and have replaceable filter cartridges.



**Full-face protection**—Powered air-purifying respirators deliver a constant supply of filtered air.

materials and a flimsy bendable metal strap over the nose bridge, often don't seal well. Fiber masks, made of thicker materials molded to conform to the shape of the face, provide a better fit and improved seal. Some come with one-way valves, which make breathing easier and help prevent fogging of glasses. Masks equipped with two adjustable straps offer a more secure fit than those with a single elastic band. People who have beards, however, won't get a good seal with any of these masks.

Replace a disposable mask when breathing through it becomes difficult. Don't try to extend the life of a mask by vacuuming or washing it. Doing so will only break down the material and make the mask ineffective.

### Air-purifying cartridge respirators

Air-purifying cartridge respirators come in three basic styles: quarter-, half- and full-face designs. These make you look like a serious

toxic avenger. The quarter- and half-face models cover the nose and mouth; the full-face models offer eye protection as well. Again, many of these will not seal well if the wearer has a beard. To be effective, respirators must seal against bare skin.

The quarter-face air-purifying respirator is usually made of rubber, silicones or plastic (see the photo at left above). It is designed to fit over the nose and mouth, and it rests on the chin. It comes with a replaceable filter that will block out dusts and nontoxic mists. These respirators cost about \$5 and replacement filters are usually available for about \$1 or less.

The half-face respirator covers the nose and mouth and fits under the chin. Outfitted with the appropriate cartridges, it can protect against very fine particles, toxic vapors, mists and some gasses (see the top photo on the facing page). A respirator body with a pair of filters costs \$25 to \$40. Cartridges cost \$8 to \$20 per pair.

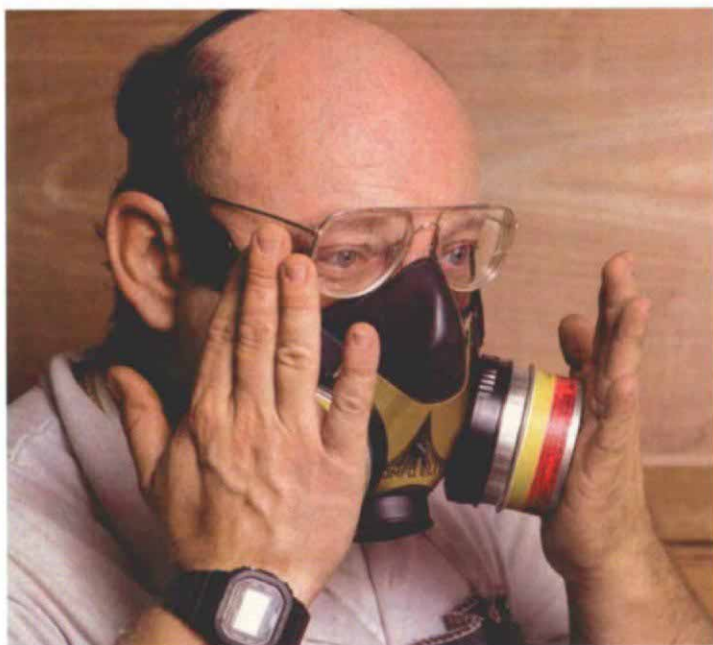
These are a good choice for woodworking because they have soft rubber or silicone seals and adjustable straps. A good fit is important with a respirator, and except for those with beards, half-face respirators will fit almost anyone (see the photo at left).

Although half-face respirators serve most woodworkers well, there is a mask that provides even more protection: the full-face respirator, available from industrial equipment suppliers. It seals along the forehead, temples, cheeks and under the chin. A full-face respirator has the additional advantage of built-in eye and face protection. The body of these devices costs from \$150 to \$250. Cartridges are \$8 to \$20 per pair.

### Powered air-purifying respirators are comfortable

Powered air-purifying respirators (PAPRs) come in several styles: half-face, full-face, with a hood or with a face-shield and a seal around the face. These respirators (see the photo at right above) have battery-powered fans that draw air through replaceable filters. Depending on the model, they can filter dusts, mists and other hazards. (NIOSH is still developing new standards for these.) Like full-face respirators, these offer excellent protection. If you wear glasses or have a beard, a full-face, hooded PAPR may give you the best fit and, therefore, the best protection. I prefer PAPRs for woodworking because they reduce the strain of breathing through a filter.

PAPRs are available through professional tool stores, woodworking equipment suppliers, safety equipment companies and directly from some manufacturers. The cost of these respirators



**Testing the fit of a cartridge-style respirator**—Cover the cartridges with your hands and inhale. The vacuum pressure created should collapse the mask against your face.

varies based on the design—the more hazards they guard against, the higher the cost. Prices range from approximately \$150 to \$500. Cartridges range in price from \$8 to more than \$20.

PAPRs pump filtered fresh air toward your face, which makes them very comfortable to wear, even in warm weather. But pay attention to the sound of the fan; if it sounds like it's beginning to strain, it probably means that it's time to change the filter.

### Filters are made for a variety of applications

It's important to pick the right filter for the job. When spraying lacquer, for example, be sure to get cartridges rated for organic vapors. Those come with charcoal filters that capture toxic vapors, which even the best dust mask won't. You shouldn't be able to detect the smell of a finishing product when breathing through a respirator fitted with the proper cartridges. If you can, it's time to replace the cartridges. They cannot be cleaned.

There's not a cartridge available for every chemical you might use in the workshop. If you're working with methanol or products containing isocyanates, such as urethanes and polyurethanes, have plenty of fresh air circulation—there isn't a NIOSH-approved filter cartridge to trap those vapors. A respirator, however, will help somewhat by capturing mists from overspray.

It's possible to fill an enclosed room, such as a spray booth, with a high concentration of mists and vapors, which will overwhelm an air-purifying respirator. Air-purifying respirators do not supply oxygen, they only filter contaminants. If you suspect you are creating high concentrations of chemical contaminants, you should have a professional test for oxygen levels.

Because NIOSH has issued new standards for respirators, and old and new models are still on the market, it's confusing sorting through all the numbers and alphabet soup printed on the labels.

On old-style disposable respirators rated for dusts and mists, the label or packaging will have the code TC-21C, followed by some numbers. The 21C tells you it's an old-style mask, and possibly less effective than the newer models. New masks are coded different-

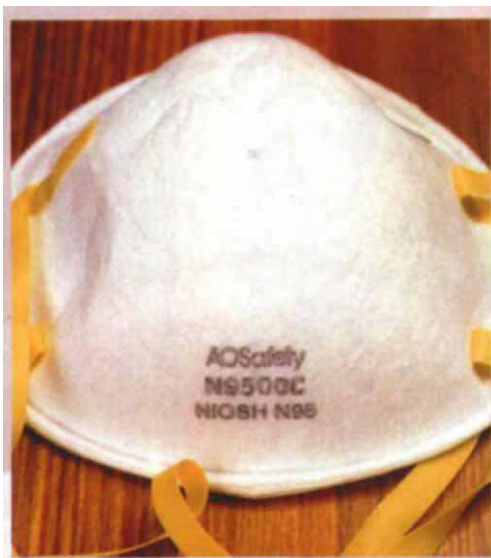


**Use the proper cartridge for the chemical hazard.** For spraying lacquer, organic vapor cartridges, which contain carbon filters, will trap hazardous fumes.

ly, and even the most basic NIOSH-approved dust mask will capture 95% of the particles at 0.3 microns, the most penetrating size.

If you have a cartridge-style mask, there are many specialty filters available. For capturing fine dusts, high-efficiency particulate air (HEPA) filters are a good choice. Most of the HEPA filters manufactured under the old standards will meet the highest level of the new guidelines, which require filters to capture 99.97% of dusts in the 0.3 micron size. □

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**Dust mask that complies with new standards—**This NIOSH-approved dust mask is rated N95. That means it's not oil resistant, and it's 95% efficient at capturing dust particles as small as 0.3 microns.

## New standards for respirators

The National Institute for Occupational Safety and Health (NIOSH) has issued new standards for respirators that went into effect July 10, 1995 and allowed a 3-year grandfather period. Dust masks and cartridges for respirators manufactured after July 10, 1998 must meet the new standards. Consumers will continue to see older products sold after that date because retailers will be allowed to deplete their stocks. Respirators that meet the new guidelines are already on the market.

The new regulations require approved filters to be at least 95% efficient at capturing particles 0.3 microns in size, the most penetrating. Disposable masks that meet the new standards are rated with a letter designation followed by a

number, such as N95. Masks beginning with an N are for use where there is no oil present in the air, masks labeled with an R are resistant to oil mists and P is for masks that are even more resistant to oils. The numbers refer to the efficiency of the respirators: 95%, 99% and 100% (actually 99.97%) efficient. Cartridge-style filters must meet the same standards. Because cartridges are available for a host of hazards, they are labeled with additional information.

Manufacturers are making new cartridges to fit all or most masks on the market. The new standards apply to all particulate filters for non-powered air-purifying respirators. NIOSH may work on new standards for powered respirators in the future. —C.W.C.