

## FINISHING SAFETY

In addition to understanding how a finish forms a film on wood, you should also understand what happens when these chemicals come in contact with you. For the most part, finishes are toxic to the user. If you limit your exposure to them by following the precautions listed on the sides of containers and in Material Safety Data Sheets, they are relatively safe. But like many of the tools in your shop, if they are used recklessly they can be dangerous.

### CHEMICAL HAZARDS

Most finishes are made with organic solvents, so called because they will break down organic hydrocarbons like resins, oils — and you, if you're exposed to them long enough. There are six categories of organic solvents:

- **Alcohols** — ethanol, methanol, isopropanol
- **Aliphatic hydrocarbons** — petroleum naphtha, VM&P naphtha, h-Hexane, kerosene
- **Aromatic hydrocarbons** — toluol, xylene
- **Chlorinated hydrocarbons** — methylene chloride
- **Ketones** — acetone, methyl-ethyl ketone, methyl-isobutyl ketone
- **Others** — turpentine, glycol ether, diglycidyl ether

Most of these toxic materials attack the central nervous system, but some can damage the lungs, liver, kidneys, and blood as well. They will also irritate the skin, eyes, nasal membranes, and throat lining. They can produce both acute and chronic deleterious physical effects.

The acute effects generally last only a short time. An overexposure to high concentrations of finishing chemicals may cause dizziness, shortness of breath, headache, nausea, confusion, loss of coordination, and irrational behavior. These pass quickly after you remove yourself from the danger. Don't think you can risk an occasional overexposure, however. If the chemicals invade your body in sufficient concentration, the damage can be permanent — or lethal.

The chronic effects can be much more dangerous for two reasons — they sneak up on you, and the damage cannot be reversed. They're usually caused by frequent exposure to low concentrations of chemicals. The effect of each exposure is minor, but it's cumulative. The damage mounts slowly and steadily over the years until the symptoms listed above become a daily ritual. Frequent exposure to high concentrations can cause dementia — loss of memory, impaired judgment, and disorientation.

All organic solvents are volatile to one degree or another. They will evaporate and fill the air. This volatility is determined by the vapor pressure (VP) generated as the solvents evaporate. It's measured by how many millimeters the pressure will cause a column of mercury to rise (mm HG). The higher the vapor pressure, the faster the fumes fill the air.

Solvents also have different degrees of toxicity. Some have to be present in larger quantities than others to pose a health risk. Toxicity is determined by the threshold limit value (TLV) — how much of the solvent must be present in a given volume of air for it to have a toxic effect. This is generally measured in parts per million (PPM). The lower the threshold PPM, the more toxic the solvent.

The health risk posed by a specific solvent is determined by both its toxicity and its volatility. A highly toxic solvent may be relatively safe if its volatility is low enough. If it

doesn't evaporate into the air, and you take care not to ingest it or let it touch your skin, then you won't be exposed to high enough quantities to suffer a harmful effect. By the same token, a solvent with low toxicity and high volatility can be extremely dangerous. If it quickly fills the air with fumes, you may be overexposed in a very short time. The most dangerous solvents are those that are highly toxic and highly volatile; the safest have low toxicity and low volatility.

In addition to posing health risks, most finishing chemicals are also flammable. Their flammability varies, but all of the organic solvents listed here can be ignited by a careless spark. Furthermore, linseed oil and some oil-derived products may spontaneously combust at room temperature if the vapors are sufficiently concentrated in the air.

### HOW TO PROTECT YOURSELF

Use the finish that provides the protection and enhancement that you want and has the less dangerous solvents. For example, if you determine that either a shellac finish or a lacquer finish will work well for you, choose shellac. The alcohol in shellac is decidedly less dangerous than the aromatic hydrocarbons and ketones present in lacquer. To help you decide, the "Hazardous Finishing Chemicals" chart on page 20 ranks common solvents from the most dangerous to the least dangerous.

**Safety Reminder:** *Pregnant and breast-feeding women should avoid all organic solvents. Exposure may be especially dangerous to the fetus during the first three months of a pregnancy.*

However, it's not enough to choose a relatively safe finish. The chemicals in even the least dangerous products still pose some health risk and fire hazard.

You must take additional steps to protect yourself.

Perhaps the most important is to ventilate the finishing area. Open the windows; use a fan to keep the air moving. This will help to clear the area of fumes before they have a chance to reach a toxic or combustible concentration. Ventilation is especially important in small shops, or if you have set aside a small room for finishing. Fumes become quickly concentrated in small spaces. Also, some fumes are heavier than air and fall to the floor. For this reason, set the fan on the floor or direct air downward.

If you can, work outdoors when using highly volatile chemicals such as acetone or methylene chloride, or when working with large quantities of organic solvents. An open window and a fan may not ventilate the area quickly enough. The fumes might fill an area faster than the air can be evacuated. If you spray finishes with volatile organic solvents, such as varnish or lacquer, you must use an explosion-proof spray booth. As you spray, microscopic droplets of finish — the overspray — fill the air. Not only is a spray booth ventilated to carry the fumes outside, the fan motors, lights, and switches are also shielded to prevent an electric spark from igniting the overspray.

**Safety Reminder:** *It's impossible to overestimate the dangers of spraying a flammable finish, or the importance of explosion-proof wiring in a spray booth. One-half cup of lacquer, when vaporized and mixed with the proper amount of air, has the explosive force of one stick of dynamite.*

In addition to providing ventilation, you should also wear a respirator, particularly if you are spraying finishes or will be exposed to the fumes for over an hour. Don't try to get by with a dust mask; it will not screen out the harmful chemicals from the air you breathe.

Use a close-fitting mask with filter cartridges rated for organic vapors and a pre-filter for dusts and mists. Make sure both the mask and cartridges are jointly approved by the National Institute for Occupational Safety and Health (NIOSH) and the Mine Safety and Health Administration (MSHA). Replace the cartridges after their useful working time has expired. Keep them in an airtight container such as a plastic bag when not in use. This will help extend their useful life.

*Tip: Because respirator cartridges wear out after a specific amount of time in use, they must be replaced periodically. However, when you use a respirator only once in a while, it's easy to lose track of the time you've logged. To aid your memory, put a piece of masking tape on the outside of the mask and tick off the hours on the tape. When you replace the cartridges, replace the tape too.*

Sometimes a respirator isn't enough. As the chart of "Hazardous Finishing Chemicals" on page 20 shows, many organic solvents can irritate the skin and eyes. When there is danger of splashing or when exposed to these chemicals for long stretches, wear a full face shield and rubber gloves in addition to a respirator. You may also wish to apply a barrier cream to your skin, especially when working with finishes that contain glycol ether and diglycidyl ether. This skin lotion, which is available from most industrial suppliers, protects flesh from casual contact with harmful chemicals.

Be careful how you store these chemicals. Keep both unused and used finishes and related products in sealed metal containers. The containers, of course, should have labels. The same precaution applies to rags and paper towels saturated with volatile chemicals, although you don't need to label them. Vapor easily accumulates in the folds of the material and may be ignited by a stray spark. Or, if rags are saturated with linseed oil, they may ignite spontaneously. A sealed metal container insulates rags from sparks, and any spontaneous fire will quickly use up all the oxygen and die before it can spread.

In addition to being careful how you store these chemicals, also be careful how you dispose of them. Depending on the toxicity of the solvent, a single cup — no more than you'd use to clean a brush — can pollute over a thousand gallons of water! Save slightly used solvents, let the solids settle out of them, and use them again.

When they really are used up, take them to an appropriate agency for safe disposal. Call the United States Environmental Protection Agency, Resource Conservation and Recovery Hotline at 1-800-424-9346 to find out who handles chemical disposal in your area. And once again, always choose the least dangerous chemical for the job. The finish that poses the least risk to you will also pose the least risk to the environment.

*From "Finishing" by Nick Engler*