

# nontoxicprint

Health in the Arts

LASER-CUTTING-SAFETY 3D PRINTING

## Substitution: Overview

**Substitution of a hazardous art material or process by one that is safer should be the first precaution that is tried.**

For children under the age of 12, it is mandatory to use non-toxic art materials. However, substitution will also work for older students and professional artists.

One of the basic types of substitution is to use water-based materials instead of solvent-based ones. For example, silk screen printing with solvent-based inks is one of the most hazardous art processes and requires expensive ventilation systems to work safely. Switching to water-based silk screen printing minimizes the health risks.

Similarly acrylic and water color painting are safer than oil painting which requires mineral spirits or turpentine. This is particularly a consideration in high school painting classes where exposures in a class of twenty students doing oil painting could be very hazardous because of the large amounts of solvents used. A fan exhausting 3000 cubic feet of air per minute would be required for every cup of turpentine or paint thinner evaporated in a one hour class period. Instead, use acrylic, water color, or similar water-based paints.

If switching to water-based materials is not possible, then try less toxic solvents. The least toxic solvents are ethyl alcohol (sold as denatured alcohol), isopropyl alcohol, rubbing alcohol, acetone, and odorless mineral spirits or paint thinner. You can often use these solvents to replace more toxic solvents like methyl alcohol, lacquer thinners, toluene, xylene, and turpentine. Note that flammability should also be considered when making substitutions. Acetone, for example, is one of the least toxic solvents, but is extremely flammable.

Other examples of less toxic substitutes are cadmium-free silver solders, fluoride-free fluxes, asbestos-free materials, crushed walnut shells, or glass beads instead of sand for abrasive blasting, and lead-free glazes and enamels.

Changing a process can sometimes reduce exposure. For example, brushing or dipping materials is safer than spraying them since this eliminates inhalation of the particulates. Wet working methods also reduce the risk of inhaling dusts. Other examples of process substitution include the use of moist clay, liquid dyes, and wet grinding techniques.

Avoid cancer-causing materials because there is no known safe level of exposure to these substances. Of course, the lower the exposure, the lower the risk.

Finally, remember that substitution takes time to work. I have had many artists tell me that they tried substitutes such as water-based silk screen inks, but the substitutes do not produce good results. Usually, artists have tried the water-based inks a few times in the same way that they used the solvent-based inks. Using the same techniques will not necessarily give good results.

Substitutes often have very different properties from the original material, particularly if you are switching from solvent-based to water-based materials. For example, no painter would try to use acrylics or watercolors with the same technique used for oil painting. Therefore, allow time to experiment to find the proper way of using the substitute.

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### Substitute Products

### Lead-free solder

The Englehard Corporation has recently formulated Silvabrite 100, which is free of lead, zinc, and antimony. It is comprised of 95.625% tin, 4% copper, and 0.375% silver. This combination reportedly produces a wide melting range and excellent capillary flow and wetting action. It seems to be stronger and more professional looking than the standard 95/5 (tin/antimony) and 50/50 (tin/lead) solders without being much more expensive. Skin and eye contact with the fumes, as well as inhalation of fumes, may cause irritation, nausea, and metal fume fever. Contact with molten silver can produce argyria, a gray discoloration. Chronic exposure to copper fumes can result in capillary damage, discoloration of the skin, and liver and kidney damage. Prolonged overexposure to tin may result in a benign pneumoconiosis called stannosis. While local exhaust ventilation is recommended for all types of soldering, solders that do not contain cadmium or lead are preferred. For more information, contact the specialty metals division at the Englehard Corporation, 603 West Main Street, Mansfield, MA 02048. Tel: (800) 225-2130 or in MA, (617) 339-0589.

### Vegetable Oils

The May 1991 issue of The Daily Hazard, the newsletter produced by the London Hazards Centre, reported on the International Hazards Conference that was held in Copenhagen in September of 1990. Of note were reports that 600 (3.5% of the total) Danish printers have been compensated for brain damage due to organic solvent exposure, occurring primarily during cleanup.

In efforts to find safer substitutes for the organic solvents, printers in Denmark have experimented with soya bean oil, vegetable oil, and coconut oil. While the oils had to be used in different ways, often in smaller quantities, to be effective, there was surprising success. The printers worked with a company to formulate "NatuRen" made up of soya and coconut oil which is being tested in 27 printing works. Laboratory workers have followed the printers' example, and are experimenting with olive oil and coconut oil as substitutes. CSA encourages these substitutions, and also acknowledges that work processes and methods must be often changed in accordance with new products.

### Citrus-Based Solvents

There are several citrus-based solvents on the market, some claiming to be composed of all natural, non-toxic ingredients. Leinos-thinner, orange solvent, and other citrus-scented solvent products use a chemical called d-limonene, a highly fragrant chemical present in many plants, especially citrus fruits. This is the same chemical present in Lithotine and dipentene. Because its chemical properties are similar to those of odorless paint thinners and mineral spirits, d-limonene has become a popular ingredient in many solvent and degreasing products.

The long-term health effects of d-limonene were investigated by the National Toxicology Program (NTP) because of the widespread use of this substance in food, cosmetics, and commercial products. NTP's recent study of d-limonene (Toxicology Report 347) found evidence of carcinogenic activity in male rats fed with d-limonene. Since researchers do not have complete information about the long-term effects of d-limonene on humans, those who use citrus products should exercise caution.

The attractive citrus smell can lead to accidental ingestion of large amounts. Other health effects include dermatitis and eye irritation. Skin contact should be minimized and inhalation of large quantities should also be avoided. We have had reports that the use of citrus thinners can be extremely irritating, especially in people who are already sensitive to solvents such as turpentine, or those used directly on the skin for the removal of special effects make-up.

Because the labeling of non-food products is not strictly regulated by the government, the phrases "all natural" and "non-toxic" can be misleading. Although d-limonene, like many other chemicals, is a "naturally occurring chemical," it should not be assumed that it is harmless.

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