Richard Austin (1936-1990) was a metalsmith and author, with several hundred articles to his credit.

After his death I was given custody of an extensive collection of manuscript material-mostly on the technical issues of metalworking.

This text represents the first effort to organize the material—an attempt merely to group the files by topic. None of this is finished, and the text makes reference to illustrations that were never done—illustrations which were stored separately in any case, making it extremely difficult to bring the parts together.

It is unlikely that I will ever be able to spend the time to sort this all out. But it seemed a shame to let these articles languish unread by those who might benefit from them in some small way. So I have decided to release them in their roughly sorted form in the hopes that someone may find them useful.

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VENTILATION

Almost every product that the craftsman picks up has a simple warning label: "Use in a well ventilated area". The issues are just what that means and how do we accomplish the demands of safety.

It might be useful to think of this as a problem of air flow and air changes. Let's begin with air changes. If we were working in a studio which was ten by ten by ten feet, the room would hold one thousand cubic feet of air. If we wanted to replace all of the air in the room with fresh air every minute, we would have to have an exhaust fan with a capacity of one thousand cubic feet per minute. If we wished to replace all of the air in the studio every ten minutes, the exhaust fan capacity would only have to be one hundred cubic feet per minute. Since exhaust fans aren't terribly expensive, the superficial solution seems to be to put a great big fan in the studio and get some fresh air in. I suppose if you lived in a pleasant climate, that might be satisfactory. However, in most places that fresh air will have to be heated or cooled to or even dehumidified before it's introduced into the shop. To the extent that particulate matter is present, you could filter the air rather than exhaust it to the
outside. However, filters do not take care of many toxic fumes such as solvents or very small particulate matter. Although you should have fresh air in your shop, changing all the air in the environment is obviously not the best solution to the air quality problem.

If I have a burn-out furnace for lost wax casting, it is obviously a source of a great deal of air contamination. In order to run that in an open room, you would have to have an enormous number of changes of air. However, if it's placed in a fume hood which controls the fumes, a much smaller volume of air will eliminate the pollution problem. The best way to control air pollution is to deal with it before it moves into the environment. This means picking up the pollution as close to its source as possible. Air pick-up may be done at the soldering station, pickling or plating baths, the burn-out furnace and the area where you do your metal melts.
Even though you may no longer use asbestos directly in the jewelry-making process, it still turns up in your environment from time to time. Perhaps you've moved into a new studio space and the pipes are wrapped in asbestos. You may purchase some old equipment which contains asbestos, or it may come in to your studio in other ways. Prudence suggests that you ought to clean it up and get rid of it. However, cleanup presents its' own hazards. A conventional shop vacuum cleaner will pick up gross amounts of asbestos, but the fibers are small enough to pass completely through the filter bag and become dispersed in the shop environment. The cleanup of asbestos is a very specialized procedure that requires particular equipment and techniques. If the sources are not too highly dispersed, it may be better in the short term to simply glue it down. A good example would be the asbestos paper which is used on heating ducts in many residential and commercial buildings. There are special paints available which can be applied to this insulation to immobilize the asbestos dust. This may be the best way to approach the problem on a short-term basis.
good solvent for silica, it is a suitable cleaning agent. However, hydroflouric acid causes unusually severe burns.

The problems associated with hydroflouric acid need even further discussion. The fundamental issue is that hydroflouric acid burns are somewhat unique. First, the material is a local anesthetic, so you may not have an immediate sense of being burned. Second, the nature of the burn and the tissue damage inhibits healing so that hydroflouric acid burns are more difficult to treat. Third, the specific medical treatment for hydroflouric acid burns is unique. Many doctors, and even emergency room personnel, do not understand the proper treatment for these burns and/or they may not have the appropriate materials available. If you find that you're going to work with these materials, I would highly recommend that you talk to your doctor or the nearest emergency room and make them aware of this. Check to see if they have the proper medication available.

Failing in these first precautions, in at least one case I found that I had to provide a specific textbook reference before an emergency room doctor would use the appropriate procedure. Medical personnel don't like being told how to do their jobs. A little communication will go a long way in easing this problem.
Plating Compounds - There are two fundamentally different classes of plating compounds. These are acid-base systems and cyanide-base systems. There are a number of acid-base systems available which can provide successful results in limited production. These are also acceptable for most electro-forming operations. Unfortunately, high quality production plating generally requires the cyanide system. Obviously, some potential health problems are associated with cyanide plating solutions. However, it should be noted that thousands of workers work with these materials year in and year out with no ill effects. However, this is based on careful control, ventilation and proper disposal of waste materials.

There is an unfortunate tendency for small shops to dispose of waste plating materials by putting them in the sewage system. This is a very bad practice which should be discouraged. If you're going to engage in any kind of plating, find out what the local restrictions are and find out what provision has been made for disposing of these materials. Many municipalities and/or individual companies provide disposal service for small quantities for individual craftsmen at relatively modest prices. Even if significant cost and aggravation is incurred, you should treat this as part of the
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I've never seen a study directly relating poor ventilation during burnout with any specific medical problem, but some combustion products are known to increase the risk of cancer. At the very least, the fumes are an irritant when you are trying to work. A fume hood is inexpensive to build and easy to install. I've seen every sort of set-up in the trade; some are very effective, others practically useless. A few simple rules will define the system requirements:

. The system should be fire resistant.
. It should require a minimum volume of make-up air.
. It should have a vacuum rather than pressure exhaust system.
Casting Safely - For many years, centrifugal casting units were sold without any kind of safety shield. I've seen many units mounted in wash tubs, garbage cans, wooden boxes and cut-off oil drums. All these worked to varying degrees, but they were mostly clumsy and inelegant solutions. Today, equipment manufacturers have made the shields an integral part of the unit or provide them as an accessory. There are still thousands of units in operation with inadequate shielding. I want to share a simple shield design with you. It can be made with very simple tools. It also stores in a very small amount of space for shipping or storage. You can complete this project with very few tools.

The basic form used is an octagon. It has an octagonal base and eight identical wall segments. The sketch in Figure 1 illustrates the general pattern.
TOXICITY

One of the difficulties in convincing people to apply safe working practices is the fact that the consequences of exposure to toxic materials often occur a long time after the exposure. Perhaps even more subtle is the fact that many types of exposure to the artist craftsman occur over a very long period of time. For example, a single brief exposure to fairly concentrated acetone fumes probably wouldn't be too significant, but repeated exposure over a long period of time can cause a real problem. It's important to remember that this chronic type of exposure is the primary area where small shops fail to exercise proper procedures. Everybody knows that cyanide fumes are fatal, so we take the proper precautions. It's the more subtle things that we need to be concerned about.
SAFETY

The liquid sold as an additive for Phosphate based investments may be phosphoric acid. This is an acid of intermediate strength which should be treated with due respect. In addition phosphoric acid or its vapors will corrode steel and is very hard on steel files and highly polished metal.

Hydrofliouric acid has wide application in the metal ceramic and glass arts. Unfortunately, the hazards of this material are not widely publicized. You will note that no reference has been made to the application of the acid. I would strongly recommend that you avoid this material if any reasonable alternative process is available.

If you do receive a hydrofliouric acid burn you will find that many doctors are not aware of the unique problems involved. Be absolutely certain that the doctor understands the nature of the burn. Flushing with water and neutralization are the classic methods of treading acid burns. This may not be sufficient treatment for larger burns or if the burn has gone unnoticed for an extensive period of time.
HAZARDOUS MATERIAL

ASBESTOS

I'm very disturbed to observe the casual safety practices in small shops. Many of the materials used constitute serious health hazards. Some hazards are immediate and others take years. In fairness to the metalsmiths many of the hazards or problems of toxic materials have only been recognized recently. A good example is the problem of asbestos.

For many years, asbestos was considered to be a safe material, that is, it could be handled without any serious precautions against ingesting or inhaling the five particles. Recently, it has been recognized that this material represents a serious health hazard. Both the ingestion and inhalation of asbestos fiber dust can cause long term health problems. For this reason, you should make every effort to minimize your exposure to asbestos in the shop. I no longer use an asbestos soldering block or asbestos crucible or flask liners.
Silica - There is a strong tendency for metal casters to underestimate the possibility of developing silicosis from handling the investment. It is important to understand that there already are identified instances of silicosis associated with workers in the manufacturing environment exposed to investment. Good personal hygiene and shop habits are an important part of any preventative health program.