

**The  
Printmaking  
Guide to 2  
Being Safe**

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*The Printmaking Guide* to Being Safe

## **Basic Preventative Measures:**

1. DO NOT eat, drink, or smoke in the studios.
2. SUBSTITUTE less hazardous materials or techniques when possible. There are many instances where highly toxic chemicals can be replaced by less toxic materials.
3. KNOW the materials and their hazards. If labels do not adequate information regarding contents, hazards, and precautions, use resource books to research the product your health is worth the effort.
4. STORE materials safely. Use clearly labeled, unbreakable containers, and always cover them when not in use to deter their evaporation into the environment. Do not store materials in food containers to avoid accidental ingestion.
5. ENSURE proper ventilation.
6. WEAR appropriate personal protective equipment such respirators, face shields, ear muffs, proper footwear and gloves.
7. ASK if you are unsure about the operation of any equipment. Misuse of tools leads to accidents. No equipment is to be altered or modified unless on manufacturers recommendation. 4

## Protective Clothing and Gear

When the possibility of chemical contamination exists, protective clothing, which resists physical and chemical hazards, should be worn over street clothes. Smocks are appropriate for minor chemical splashes and spills, while plastic or rubber aprons are best for protection from corrosive or irritating liquids.

Loose clothing (such as overlarge smocks or ties), skimpy clothing (such as shorts), torn clothing and unrestrained hair may pose a hazard. Perforated shoes, sandals, or cloth sneakers should not be worn in chemical use areas or where mechanical work is being performed.

Because oil ink and solvents do contain toxins it is important that they be kept away from the skin and therefore from entering the bloodstream. The best way to minimize risks is to reserve a set of clothing solely for studio use, or to wear coveralls or a smock over street clothes.

### Glove Selection And Use

Gloves should be worn whenever the possibility of skin contact with hazardous chemicals exists. Every glove is permeable to a chemical. The permeability varies with the chemical being used, the length of time of the exposure and the thickness of the glove. General use gloves, such as the latex surgical gloves, are appropriate when using small amounts of most chemicals for short periods of time. These gloves should be changed whenever they become contaminated with the chemical.

Otherwise, the glove that offers the best resistance to the chemical should be used. The following guidelines should be used to determine the appropriate glove. In addition to protecting hands and skin from chemical exposures, there are many gloves which offer protection from physical hazards, such as high or low temperatures, electrical shock, skin abrasions, vibration or sharp objects. Always match the glove to the hazard.

### Eye Protection

Safety glasses should be worn for protection from impact of particles. Standard eyeglasses fitted with side shields are generally not sufficient. Goggles should be worn when a potential splash from a hazardous material exists. They may be worn over prescription glasses. **Face shields** are in order when working with large volumes of hazardous materials, either for protection from splash to the eye or flying particles. Face shields may be used in conjunction with goggles for maximum protection from corrosives and hot chemicals. Contact lenses do not offer any protection from chemical contact. The shop spray booth is a good example of airborne particles to avoid if not protected properly.

## Emergency Procedures: Fire, Chemical Exposure

For any emergency, including fire, explosions, accidents, and medical emergencies, notify KCAI campus security immediately at 931-6666. You may then choose to dial 911 from any campus phone. Public Safety personnel will respond, determine whether additional assistance is needed and alert others who can help.

### Fire Emergencies

In the event of a fire, Public Safety should be notified immediately at 911 and the following actions are recommended:

\* If you have been trained in the use of a fire extinguisher, fight the fire from a position where you can escape, only if you are confident that you will be successful. Small fires can often be extinguished.

✓  If your clothing catches fire, drop to the floor and roll to smother the fire, drop to

the floor and roll to smother the fire. If a co-worker's clothing catches fire, knock the person to the floor and roll him or her to smother the flames.

- ✓ If the fire is large or spreading, activate the fire alarm to alert building occupants. Leave the fire area and prevent the fire's spread by closing the doors behind you.
- ✓  Evacuate the building and await the arrival of Public Safety. Be prepared to inform them of the exact location and details of the fire.
- ✓  Do not re-enter the building until you are told to do so by Public Safety or the municipal fire official.

### Chemical Exposures

The following procedures should be followed in the event of chemical exposure. In all cases, the incident should be reported to the department manager, regardless of severity.

#### Chemicals on Skin

1. Immediately flush with water for no less than fifteen minutes. Remove any jewelry or clothing that have become contaminated to facilitate removal of any residual material. For pullover shirts and sweaters, it may be beneficial to cut garments off to prevent contamination of eyes.
2. If immediate medical attention is needed, call Public Safety at 911 for an ambulance or transportation. Explain carefully what chemicals were involved.
3. Review the MSDS to determine if any delayed effects should be expected.

#### Chemicals in Eyes

1. Flush eye(s) with water for at least fifteen minutes. The eyes must be forcibly held open to wash, and the eyeballs must be rotated so all surface area is rinsed. The use of an eye wash fountain is desirable so hands are free to hold the eyes open.
2. Remove contact lenses while rinsing. Do not attempt to rinse and reinsert contact lenses.
3. Seek medical attention regardless of the severity or apparent lack of severity. If an ambulance or transportation is needed, contact Public Safety at 911. Explain carefully what chemicals were involved.
4. Review the MSDS to determine if any delayed effects are expected.

#### Chemical Inhalation

1. Close containers, open windows or otherwise increase ventilation, and move to fresh air.
2. If symptoms, such as headaches, nose or throat irritation, dizziness, or drowsiness persist, seek medical attention by calling Public Safety at 911. Explain carefully what chemicals were involved.
3. Review the MSDS to determine what health effects are expected, including

delayed effects.

#### Accidental Ingestion of Chemicals

1. Immediately contact the Poison Control Center for instructions. Do not induce vomiting unless directed to do so by a health care provider. Explain carefully what chemicals were involved.
2. Review the MSDS to determine what health effects are expected, including delayed effects.

#### Accidental Injection of Chemicals

1. Wash the area with soap and water.
2. Seek medical attention, if necessary. Explain carefully what chemicals were involved.
3. Review the MSDS to determine what health effects are expected, including delayed effects.

## **Emergency Procedures: Spill Response**

In the event of a chemical spill, the individual(s) who caused the spill is responsible for prompt and proper clean-up. It is also their responsibility to have spill control equipment appropriate for the chemicals being handled readily available. There should be a sufficient quantity of absorbents or other types of materials to control any spill that can be reasonably anticipated.

The following are general guidelines to be followed for a chemical spill:

1. Report all spills to Maintenance. Immediately alert room occupants and evacuate the area, if necessary.
2. If there is a fire or medical attention is needed, contact Public Safety at 911.
3. Attend to any people who may be contaminated. Contaminated clothing must be removed immediately and the skin flushed with water for no less than fifteen minutes. Clothing must be laundered before reuse.
4. If a volatile, flammable material is spilled, immediately warn everyone, control sources of ignition and ventilate the area.
5. Don personal protective equipment, as appropriate to the hazards. Refer to the Material Safety Data Sheet or other references for information.
6. If the spill is large (more than 5 liters), if there has been a release to the environment or if there is no one knowledgeable about spill clean-up available, contact Public Safety at 911.
7. Consider the need for respiratory protection. The use of a respirator or self-contained breathing apparatus requires specialized training and medical surveillance. Never enter a contaminated atmosphere without protection or use a respirator without training. If respiratory protection is needed and no trained personnel are available, call Public Safety at 911. If respiratory protection is available, be sure there is another person outside the spill area in communication, in case of an emergency. If no one is available, contact Public Safety.

8. Protect floor drains or other means for environmental release. Spill socks and absorbents may be placed around drains, as needed.
9. When spilled materials have been absorbed, use brush and scoop to place materials in an appropriate container. Polyethylene bags may be used for small spills. Five gallon pails or 20 gallon drums with polyethylene liners may be appropriate for larger quantities.
10. Place the container in a flammable liquid storage cabinet until the next hazardous waste pickup.
11. Decontaminate the surface where the spill occurred using a mild detergent and water, when appropriate.

## **Summary of Types of Wastes**

There are several types of wastes that can be generated in Visual Arts. Many of these wastes are considered hazardous waste by the US Environmental Protection Agency and require special handling. These materials may not be poured down the drain.

### **Oily Rags**

Oily rags must be placed in an oily rag can. The rags are emptied out by the studio technicians. Do not leave oily rags lying around the floor.

### **Solvents**

Solvents, such as paint thinner, turpentine, toluene, xylene, and alcohols are considered hazardous waste. **DO NOT DUMP** them down the drain. Follow the instructions for handling hazardous waste.

### **Spray painting**

Spray painting or aerosol spraying is to be done outdoors and only in the studios if done in the spray booth located by the etching acids. This is the only indoor area in the studio with ventilation adequate enough for spray paints. A respirator and suitable clothing should be worn and drop sheets used.

### **Paints**

Oil-based paints are considered hazardous waste. **DO NOT DUMP** oil-based paint down the drain or place in regular trash. Oil-based paints may be combined with solvents and linseed oil for disposal. Follow the instructions for handling hazardous wastes. Latex paints should be dried out and placed in regular trash. Water-based paints may be disposed via the regular trash.

### **Baby Oil**

Baby oil is not considered hazardous waste. Baby oil can be used to clean brushes and can be washed down the drain. Excess baby oil can be disposed in the regular trash.



## Photographic Chemicals

Photographic chemicals generally fit into four categories: fixers, developers, rinses, and specialized chemicals. Standard developers and rinses can be rinsed down the drain during processing. Most fixers contain silver in quantities above the amount allowed for sewer disposal. Specialized chemicals, such as special acids and bases, should be assumed to be hazardous waste and collected accordingly.

### Acids and Bases

Materials with a pH of less than 2 or more than 12.5 are considered hazardous waste. Do not mix these wastes with the solvent or oil wastes. Use care when handling acids and bases and follow the instructions for handling hazardous waste. Be sure to utilize the storage cabinet intended for acids in the etching area and approved containers ONLY.

### Lubricating Oils

Oils such as pump oil, motor oil and other machine oils are recyclable. These materials should be placed in a plastic container, sealed and labeled as *Used Oil*. Do not label them as hazardous waste or as waste oil. The used oil should be disposed properly.

### Broken Glass Sharp Implements

Sharp objects, such as razor blades, knives, and broken glass should be packaged in a puncture-proof jar or box and placed in the regular trash. Pre-packaging helps to avoid injury to janitors or others handling the trash.

### Empty Chemical Containers

Empty chemical containers should be triple-rinsed and recycled or placed in regular trash.

#### General Recommendations

- \* Don't purchase more of a material than you expect to use in the foreseeable future. The costs of disposal often exceed the purchase cost by a considerable margin.
- \* Substitute with a less hazardous material whenever possible.
- \* Consistent with safe practice, bulk compatible waste in containers up to five gallons in capacity to reduce disposal costs (consult with EHS first).
- \* Keep all chemical containers clearly and unambiguously labeled.
- \* Dispose of your wastes at the completion of a project - don't abandon them for someone else to deal with later.

\*

## Handling Hazardous Waste

Materials that are to be disposed of as hazardous waste must be placed in sealable containers. Containers should be filled, leaving a headspace for expansion of the contents. Often the original container is perfectly acceptable. If you routinely generate significant quantities of compatible solvents, bulking of waste in five-gallon carboys provided by EHS may be practical. Similar wastes may be mixed if they are compatible (e.g solvents, linseed oil and oil-based paint).

Containers must be **kept closed** except during actual transfers. Do not leave a hazardous waste container with a funnel in it. Waste containers must be labeled as hazardous waste as soon as the material is first put into the container. Notify KCAI maintenance for pickup and disposal.

### Procedure

1. Place the waste materials in an appropriate waste container.
2. Seal the container. Do not leave a funnel in an open container.
3. Once the container is full, inform maintenance to ensure that it is included with the next scheduled waste pickup.

### **Storage Containers**

Flammable and combustible liquids should be stored in only certain types of approved containers. Containers used by the manufacturers of flammable and combustible liquids generally meet these specifications.

The type of container needed depends on the quantity and class of flammable or combustible liquid. A safety can is an approved container of not more than 5 gallons capacity that has a spring closing lid and spout cover. Safety cans are designed to safely relieve internal pressure when exposed to fire conditions.

A flammable liquid storage cabinet is an approved cabinet that has been designed and constructed to protect the contents from external fires.

## **How Chemicals Enter the Body**

**Inhalation:** This is the major route of entry for airborne chemicals. The chemicals can have a direct effect on the nose, upper respiratory tract and the lungs or they can enter the blood stream and thus affect the blood, bone, heart, brain, liver, kidneys or bladder.

**Ingestion:** This is not normally a direct route of entry from exposure except by willful or accidental ingestion. Materials can also enter the stomach through indirect means. For example, the lung has a cleaning mechanism which pushes material out of the lung where it can be swallowed. This can result in an exposure to most of the internal organs or even in a local action on the stomach wall.

**Skin Contact:** Some materials are absorbed through the skin and therefore when they enter the bloodstream they can be transported throughout the body and accumulate in, or affect, the most sensitive areas of the body. Skin contact can also result in allergic reaction, the removal of the protective skin oil, or dermatitis. In some cases, the chemical contact may result in a cancerous lesion. Note: More detailed information on the hazards of chemicals found in art materials can be found in the Reading Room.

### **Arts and Reproduction**

Many chemicals used in art can also affect the reproductive system. Some chemicals have specific effects on the male reproductive system, e.g., cadmium, manganese, and lead. Others have specific effects on the female reproductive system, e.g., toluene and xylene, which cause menstrual irregularities. All of these chemicals are common in art materials.

## High Risk Groups

**Pregnant and Breast-feeding Women:** Chemicals and other factors which are thought to cross the placental barrier and possibly cause damage and birth defects, include lead, cadmium, mercury, copper, carbon monoxide, dyes, noise, vibration, and many organic solvents. The amount of material necessary to damage the fetus or embryo is much smaller than the amount which can injure the adult. The most sensitive time for chemical interference with normal development is from the 18th to the 60th day after conception. Other hazards include materials that can affect the respiratory and circulatory systems. Examples include solvents, dyes, metals, toxic dusts and gases, as well as strenuous activity and other stresses.

Many chemicals, especially heavy metals and solvents, can be found in a woman's milk several hours after exposure and can affect the infant. **AVOID USE OF SOLVENTS AND AEROSOLS.** Children: Children are more susceptible to the effects of hazardous chemicals than adults are and they should be closely supervised in the studio environment.

**Smokers and Heavy Drinkers:** These individuals are at a higher risk of damage to their lungs and liver respectively. Nicotine and/or alcohol mixed with toxic chemicals in art materials can cause synergistic and multiplicative reactions.

**Individuals on Medications:** Medications also create a greater risk. Consult your physician to ensure that any medication will not interact with substances in art materials to cause illness.

Note: Also within the high-risk group are the physically disabled, the elderly, and those with allergies or illnesses.

## Inks

*Intaglio, lithography and relief* inks consist of pigments suspended in either linseed oil or water as a vehicle. There can be additional hazardous binders or preservatives, etc.

### Hazards

1. Oil-based inks contain treated linseed oils. While linseed oil is not considered a hazard by skin contact or inhalation, ingestion of large amounts of some treated linseed oils might be hazardous due to presence of small amounts of toxic heavy metals. Oil vehicles are flammable when heated, and rags soaked in these may ignite by spontaneous combustion.

### Precautions

1. Know what materials are used. Obtain the material safety data sheets (MSDSs) on all products used. Use the least toxic inks possible.
2. Do not use an open flame to heat linseed oil, linseed oil, varnishes, or burnt plate oil. Take normal fire prevention measures (e.g. no smoking or open flames in work area).
3. Place oil-soaked rags in self-closing disposal cans and remove from the studio each day. An alternative is to place the oil-soaked rags in a pail of water.

## Pigments

Pigments are the colorants used in lithography, intaglio, and relief printing inks. There are two types of pigments: inorganic pigments, and organic pigments.

### Hazards

1. Pigment poisoning can occur if pigments are inhaled or ingested. For normal printing with prepared inks, the main hazard is accidental ingestion of pigments due to eating, drinking or smoking while working, or inadvertent hand to mouth contact.
2. The classic example of a toxic inorganic pigment in printmaking is lead chromate (chrome yellow). Lead pigments can cause anemia, gastrointestinal problems, peripheral nerve damage (and brain damage in children), kidney damage and reproductive system damage. Other inorganic pigments may be hazardous also, including pigments based on cobalt, cadmium, and manganese.
3. Some of the inorganic pigments, in particular cadmium pigments, chrome yellow and zinc yellow (zinc chromate) may cause lung cancer if inhaled. In addition, lamp black and carbon black may contain impurities that can cause skin cancer.
4. Chromate pigments (chrome yellow and zinc yellow) may cause skin ulceration and allergic skin reactions.
5. The long-term hazards of the modern synthetic organic pigments have not been well studied.

### Precautions

1. Obtain MSDSs on all pigments. This is especially important because the name

that appears on label of the color may or may not truly represent the pigments present.

2. Use the safest pigments possible. Avoid lead pigments.
3. Avoid mixing dry pigments whenever possible. If dry pigments are mixed, wear a NIOSH-approved toxic dust respirator.

## Solvents

Organic solvents are used in printmaking to dissolve and mix with oils, resins, varnishes, and inks; and to clean plates, rollers, tools, and even hands. Solvents and paint thinners are moderately toxic by skin contact and inhalation and highly toxic by ingestion. This applies to odorless solvents as well. When using solvents and thinners have good general or local ventilation. The use of turpentine is not permitted in the studios. Lithotine, is an acceptable substitute.

## Hazards

1. Repeated or prolonged skin contact with solvents can cause defatting of the skin and resultant dermatitis. Many solvents can also be harmful through skin absorption.
2. Inhalation of solvent vapors is the major way in which solvents are harmful. High concentrations of most solvents can cause dizziness, nausea, fatigue, loss of coordination, or coma. This can also increase the chances for mistakes and accidents.
3. Many solvents are toxic if ingested. Swallowing an ounce of turpentine can be fatal.
4. Most solvents, except chlorinated hydrocarbons, are also either flammable or combustible.

## Precautions

1. Obtain the MSDS on all solvent products used. Use the least toxic solvent possible. For example, replace the more toxic methyl alcohol with denatured alcohol or isopropyl alcohol.
2. Use adequate ventilation.
3. Keep minimum amounts of solvents on hand and purchase in smallest practical container size. Large amounts of solvents or solvent-containing materials should be stored in a flammable storage cabinet.
4. Never store solvents or solvent-containing materials in food or drink containers. Always label containers.
5. Do not allow smoking, open flames or other sources of ignition near solvents.
6. Have a class B fire extinguisher in the area. (If ordinary combustible materials are present, you may need a Class ABC fire extinguisher).
7. Wear gloves when handling solvents to avoid skin contact In particular do not use

solvents to clean ink off hands. Baby oil is a good substitute.

### Acids

Although the KCAI print department no longer uses acid etching solutions, this information is relevant when one goes to a shop where acid is still used.

*Acids are used in intaglio (acid etching) and in lithography. Strong acids commonly used include nitric acid, hydrochloric acid, and phosphoric acid, and less commonly carbolic acid (phenol), chromic acid, hydrofluoric and sulfuric acids.*

#### *Hazards*

- *Concentrated acids are corrosive to the skin, eyes, respiratory system and gastrointestinal system. Dilute acids can cause skin irritation on repeated or prolonged contact.*
- *Chromic acid is a skin sensitizer, suspect carcinogen, and oxidizer.*
- *Phenol is highly toxic by skin absorption and ingestion. It may cause severe kidney damage, central nervous system effects and even death if absorbed in large amounts.*
- *Hydrofluoric acid is highly toxic and can cause severe, deep burns which require medical attention. There is no immediate pain warning from contact with hydrofluoric acid.*
- *Concentrated nitric acid is a strong oxidizing agent and can react explosively with other concentrated acids, solvents, etc. Nitric acid gives off various nitrogen oxide gases, including nitrogen dioxide which is a strong lung irritant and can cause emphysema.*

#### *Precautions*

- *Know what is used. Obtain the MSDS for all acids. 2. Whenever possible avoid concentrated acids.*
- *Doing acid etching requires working in a enclosed hood, or in front of a slot exhaust hood or window exhaust fan at work level. 4. Store concentrated nitric and chromic acids away from organic materials. Concentrated nitric acid should always be stored separately even from other acids.*
- *An important safety rule when diluting concentrated acids is to add the acid to the water, never the reverse.*
- *Wear appropriate gloves, goggles and protective apron or lab coat when handling acids.*
- *If adequate ventilation is not available, wear a NIOSH- approved respirator with acid gas cartridges.*
- *If acid is spilled on your skin, wash with lots of water. In case of eye contact, rinse the eyes with water for at least 15-20 minutes and seek medical attention.*

## **Lithography**

Lithography uses either aluminum metal plates or stones for printing. It involves use of a variety of chemicals to make the image ink-receptive and non-image areas receptive to water and ink-repellent.

#### **Hazards**

1. Acids used include phosphoric, nitric, acetic, citric, hydrochloric, hydrofluoric and tannic acids. The concentrated acids are corrosive and even dilute acid solutions can cause skin irritation from prolonged or repeated contact. Hydrofluoric acid and phenol are the most dangerous to use. These are NEVER permitted for use in the KCAI studio.

2. Lithotine, kerosene, and mineral spirits are skin and eye irritants and inhalation can cause intoxication and respiratory irritation.
3. The solvents contained in vinyl lacquers can include highly toxic isophorone and cyclohexanone. Methyl ethyl ketone (MEK), which is moderately toxic, is often used as a thinner.
4. Dichromate salts may cause skin and nasal ulceration and allergic reactions, and are suspect cancer-causing agents.
5. Rosin dust may cause asthma and allergic dermatitis. There is the hazard of explosion from the buildup of rosin dust, in enclosed rosin boxes, around an ignition source.
6. Talcs may be contaminated with asbestos and silica.
7. Airbrushing drawing materials or using spray enamel paints is more hazardous than drawing with a brush because the inhalation hazard is higher.

### **Precautions**

1. Obtain the MSDS for all materials used.
2. See Acids and Solvents sections for the precautions with acids and solvents.
3. Use the least toxic solvents. Gasoline should never be used. Lithotine and mineral spirits are less toxic than the more irritating kerosene.
4. Use asbestos-free talcs such as French Chalk, or baby powder.
5. Avoid dichromate-containing counteretches and fountain solutions if possible. Do not use hydrofluoric acid or phenol.
6. Appropriate gloves, goggles and a protective apron should be worn when mixing or using concentrated acids.

## **Plate and Stone Preparation**

A variety of drawing materials with high wax and fatty acid content are used to make the image, including tusche and lithographic crayons. Airbrushing liquid drawing materials or using spray enamel or lacquer is also common. Other materials used in stone or plate processing include etch solution containing acids and gum arabic, counteretch solutions containing acids and sometimes dichromate salts, and fountain solutions containing dichromate salts. First use acetone, and second, use lacquer thinner. Phenol (carbolic acid) has been used for removing grease from stones, and a variety of solvents including lithotine, gasoline, kerosene, and mineral spirits, which are used for diluting drawing materials, washing out images and correction of images. Talc and rosin mixtures are also used. Metal plates are prepared with solvent-based vinyl lacquers.

### Printing and Cleanup- Litho

For all types of lithographic inks, solvents are used to make image corrections on the press, to remove images, and to clean the press bed and rollers.

### Hazards

Some roller cleaners and glaze cleaners can contain chlorinated hydrocarbons such as perchloroethylene and methylene chloride. Most chlorinated solvents (except 1,1,1-trichloroethane) have been shown to cause liver cancer in animals and are therefore suspect human carcinogens. In addition, perchloroethylene can cause liver damage, and methylene chloride heart attacks.

### Precautions

1. Know materials used. Obtain the MSDS for all solvents. See Solvents section for the precautions with solvents.
2. Choose products that do not contain chlorinated solvents whenever possible.
3. For small scale solvent use in correcting images or cleaning the press bed using lithotine or mineral spirits, dilution ventilation (e.g. window exhaust fan) is sufficient.

## Intaglio

Intaglio is a printmaking process in which ink is pressed into depressed areas of the plate and then transferred to paper. These depressed areas can be produced by a variety of techniques, including acid etching, drypoint, engraving and mezzotint.

### Hazards

1. See Solvents section for the hazards of solvents. 1,1,1-trichloroethane found in some soft grounds is moderately toxic by inhalation under normal conditions but may cause fatalities at very high concentrations.
2. See Acids section for the hazards of acids. In particular nitric acid etching releases the respiratory irritant nitrogen dioxide which has poor odor warning properties. During the etching process, flammable hydrogen gas is also produced.
3. Concentrated nitric acid is a strong oxidizing agent and can react with many other chemicals, especially solvents or other organic compounds, to cause a fire.
4. Mixing hydrochloric acid with potassium chlorate to make Dutch mordant produces highly toxic chlorine gas. Potassium chlorate is a key ingredient in many pyrotechnics, and is a potent oxidizing agent. It can react explosively with organic compounds, sulfur compounds, sulfuric acid or even dirt or clothing. On heating it can violently decompose to oxygen and potassium chloride. Storage and use are very dangerous require special precautions especially when mixing.
5. Rosin dust (and asphaltum dust which is also sometimes used) is combustible. Sparks or static electricity have caused explosions in enclosed rosin and aquatint boxes. Rosin dust may also cause asthma and dermatitis in some individuals.
6. Inhalation of solvents and pigments can result from use of aerosol spray paints.



### Precautions

1. Obtain the MSDS for all materials used.
2. See Solvents and Acids sections for specific precautions.
3. Use Dutch mordant with extreme caution. A safer substitute for etching copper plates is ferric chloride (iron perchloride). This forms acidic solutions so should be handled accordingly, but does not have the dangers of handling concentrated acids. Ferric chloride solution might cause minor skin irritation from prolonged contact.
4. Application of grounds or stopouts should be done with local exhaust ventilation, (e.g. slot or enclosed hood).
5. Acid etching should be done with local exhaust ventilation. See section on precautions for Acids for more information. Rosin (or asphaltum) boxes should be explosion-proof. Use sparkproof metal cranks, explosion-proof motors, or compressed air. Don't use hair dryers to stir up rosin dust.

### Etching

Etching involves use of Dutch mordant (hydrochloric acid plus potassium chlorate) or ferric chloride to etch the zinc or copper (respectively) metal plate. Un-etched parts the plate are protected with resists such as stop-out varnishes containing ethyl alcohol, grounds containing asphaltum or gilsonite and mineral spirits, rubber cement, and rosin or spray paints for aquatinting. Sometimes, soft grounds contain more toxic solvents.

#### *Other Techniques*

*Drypoint, mezzotint and engraving* use sharp tools to incise lines in metal plates.

### Hazards

1. One major hazard associated with these types of processes involves accidents with sharp tools.
2. Long-term use of these tools can cause carpal tunnel syndrome, which can cause numbness and pain in the first three fingers. Severe cases can be incapacitating.

### Precautions

1. Keep tools sharp, store them safely and always cut away from yourself.
2. When possible, clamp down plates to avoid slippage.
3. Minimize the chance of carpal tunnel syndrome by choosing tools with wide handles, avoiding tight grips, and doing hand flexing exercises during regular rest periods. Set work table height so wrist flexing motions are minimal.
4. Utilize the grinding booth to prevent metal debris from contaminating the studio.
5. Wearing a mask and gloves will also provide added safety.

## Monoprints

Monoprints involve standard intaglio, lithographic and other printmaking techniques, but only one print is made. Monoprints have the same hazards involved in plate preparation and printing as the parent techniques.

### Printing and Cleanup- Intaglio

Intaglio inks contain pigments, treated linseed oil and modifiers. Printing involves placing the ink on the inking slab, inking the plate by hand, and then printing. Cleanup of inking slab, press bed, and cleaning the plate is done preferably with vegetable oil and diluted simple green, other options are a variety of solvents including mineral spirits, alcohol, lithotine, turpentine, etc. Ask your instructor under what circumstances solvents may be used.

### **Hazards**

1. Preparing your own inks from dry pigments can involve inhalation of toxic pigments. See Pigments section for the hazards of pigments.
2. See Solvents section for the hazards of solvents. Plate cleaning is more hazardous than cleaning inking slabs or press beds because larger amounts of solvents are used.
3. Lithotine, turpentine, or oil-soaked rags can be a spontaneous combustion hazard if improperly stored.

### **Precautions**

1. See Pigments and Solvents sections for the specific precautions for pigments and solvents.
2. NIOSH-approved respirators with organic vapor cartridges can be used if ventilation is not adequate.

## Relief and Other Printing Processes

Other printing processes include relief printing, collagraphs, monoprints, and plastic prints.

### Relief Printing

Relief printing techniques include woodcuts, linoleum cuts and acrylic plates for plaster relief. These techniques involve the cutting away of plate areas that are not to be printed. Relief inks can be oil-based or water-based.

### **Hazards**

1. Some woods used for woodcuts can cause skin irritation and/or allergies. This is particularly true of tropical hardwoods.

2. Accidents involving sharp tools can result in cuts.
3. Wood carving and cutting tools can cause carpal tunnel syndrome. This was discussed earlier in the section that included drypoint and mezzotint.
4. Caustic soda (sodium hydroxide) is sometimes used for etching linoleum. It can cause skin burns and severe eye damage if splashed in the eyes.
5. Eating, drinking or smoking while printing can result in accidental ingestion of pigments.
6. Hazardous solvents are used in stopouts and resists in linoleum etching, and for cleaning up after printing with oil-based inks. See Solvents section for more information on the hazards of solvents.

### **Precautions**

1. Obtain the MSDS for all materials used.
2. See Acids and Solvents sections for precautions with acids and solvents.
3. Water-based inks are preferable to oil-based inks since solvents are not needed.
4. Wear appropriate gloves, goggles and protective apron when handling caustic soda.
5. If the chemical is spilled on your skin, wash with lots of water. In case of eye contact, rinse the eyes with water for at least 15-20 minutes and contact a physician.
6. Always cut in a direction away from you, with your free hand on the side or behind the hand with the tool.
7. Carpal tunnel syndrome can be minimized or avoided by using tools with wide handles, avoiding tight grips, and rest periods with hand flexing exercises. Linoleum cutting is softer to work, and thus can reduce musculoskeletal injury.

## **Collagraphs**

Collagraphs are prints produced by using a collage of different materials glued onto a rigid support. A wide variety of materials and adhesives can be used in making collagraphs.

### **Hazards**

1. Rubber cement, a common adhesive used with collagraphs, is extremely flammable and most rubber cements and their thinners contain the solvent n-hexane which can cause damage to the peripheral nervous system (hands, arms, legs, feet) from chronic inhalation.
2. Epoxy glues can cause skin and eye irritation and allergies.
3. Spraying fixatives on the back of collagraph plates to seal them can involve risk of inhalation of the solvent-containing spray mist.

4. Sanding collagraph plates which have been treated with acrylic modeling compounds or similar materials can involve inhalation of irritating dusts.

### **Precautions**

1. Know the hazards of materials used. Obtain the MSDSs from the manufacturer.
2. Use the least toxic materials available. In particular use water-based glues and mediums (e.g. acrylic medium) whenever possible. Some rubber cements are made with the solvent heptane, which is less toxic than n-hexane, primarily because peripheral neuropathy is not associated with its use.
3. Wear gloves when using epoxy glues.
4. Wear a NIOSH-approved toxic dust respirator when sanding collagraph plates.

## **Plastic Prints**

Plastic prints can involve making prints from a wide variety of plastic materials and resins.

### **Hazards**

Plastic prints can involve hazards from inhalation of plastic resin vapors (e.g. epoxy resins) and also from inhalation of decomposition fumes from drilling, machining, sawing, etc. of finished plastics.

### **Precautions**

1. Obtain the MSDS for all materials used.
2. See Solvent section for the precautions with solvents.
3. Use the least toxic material available, such as a diluted fountain solution.
- 4.

## **Photolithography/ Alt.Photo Processes**

Photolithography involves transferring graphic images to stones or metal plates that are coated with a light-sensitive emulsion. One can coat the stone or metal plate, or use presensitized metal plates. Light-sensitive emulsions used on stone consist of a mixture of powdered albumin, ammonium dichromate, water, and ammonia; commercial emulsions are usually based on diazo compounds. Developing solutions for these mixtures often contain highly toxic solvents. Diazo-sensitizing solutions, developers with highly toxic solvents, plate conditioners containing strong alkali, and other brand name mixtures are used for metal plates.

### **Hazards**

1. Diazo photoemulsions are the least hazardous although they can cause eye irritation.
2. Ammonium dichromate used for stone is a probable human carcinogen, is moderately toxic by skin contact, and may cause allergies, irritation, and external

ulcers; it is highly flammable and a strong oxidizer.

3. Ammonia is a skin irritant and highly toxic by inhalation. Ammonia is highly corrosive to the eyes. It has good odor-warning properties.
4. Light exposure sources include photoflood lamps, vacuum Poly- Lite units, and carbon arcs. Carbon arcs produce large amounts of ultraviolet radiation which can cause skin and eye damage and possible skin cancer. Carbon arcs also produce hazardous metal fumes, and ozone and nitrogen dioxide (which can cause emphysema), and toxic carbon monoxide.
5. Screen cleaning solutions include strong caustic solutions, enzyme detergents which can cause asthma, and chlorine bleach. These are skin and respiratory irritants.
6. Many solvents used in developing solutions are highly toxic both by inhalation and skin absorption.

#### **Precautions**

1. Obtain a MSDS for all materials used.
2. See Solvents section for more precautions with solvents.
3. Avoid ammonium dichromate and use presensitized plates if possible. If you cannot substitute, wear gloves and goggles. Store it away from heat, solvents and other organic materials.
4. Use ammonia solutions or solvent-containing photolithographic solutions inside a laboratory hood, or in front of a slot exhaust hood. Wear gloves, goggles, and if ventilation is inadequate, a respirator.
5. Do not use carbon arcs unless they are equipped with local exhaust ventilation exhausted to the outside. Quartz mercury or metal halide lamps are safer.
6. Wear gloves, goggles and plastic apron or laboratory coat when mixing hazardous chemicals.

## **Photoetching**

Photoetching is usually done using the KPR products. Photoresist dyes often contain a variety of highly toxic solvents, including ethylene glycol monomethyl ether acetate (2-ethoxyethyl acetate, cellosolve acetate), ethylene glycol monoethyl ether, and xylene, and benzaldehyde. The developers contain xylene and ethylene glycol monomethyl ether acetate (2-methoxyethyl acetate or methyl cellosolve acetate).

Developers used for safer presensitized plates also contain solvents. Exposure of the plate is done with ultraviolet sources such as carbon arcs, mercury lamps, or metal halide lamps.

#### **Hazards**

1. See the Solvents section for the hazards of various solvents. In particular, methyl and ethyl ether acetates of ethylene glycol are highly toxic by skin absorption and inhalation and can cause anemia, kidney damage, testicular atrophy and sterility in

men, and miscarriages and birth defects in pregnant women.

2. Xylene is moderately toxic by skin absorption, and highly toxic by inhalation and ingestion. It is a strong narcotic.
3. The Photolithography section discusses carbon arc hazards.

### **Precautions**

1. See Solvents section for precautions with solvents.
2. Pregnant or nursing women, children, and men trying to conceive should not work with these materials.
3. Use photofloods or other light sources instead of carbon arcs. Precautions with carbon arcs is discussed in the Photolithography section.
4. Use presensitized plates if possible.
5. Use photoresist solutions with local exhaust ventilation, or wear an organic vapor respirator. Wear butyl rubber gloves when handling KPR solutions.

## **Screenprinting**

Screenprinting involves creating an image onto a mesh screen using a light exposure unit. Screens can be reused by removing used emulsion with chemicals and a power washer.

### **Hazards**

1. Silkscreen emulsion is a photosensitive chemical, and contact with the skin should be avoided. Screen reclaimer and haze remover are toxic chemicals and must be handled as such.
2. The exposure unit uses a powerful light that can harm the eyes upon direct contact.

### **Precautions**

1. Always keep the area as clean and neat as possible, to avoid chemical interaction.
2. Wash your hands immediately after contact with emulsion, use gloves when applying if necessary.
3. Never look directly at the exposure light when in use.
4. Always utilize the designated reclaiming area for emulsion application and removal.
5. Be aware of the nature of the power washer, as it is an electric device used in conjunction with water. If any electrical hazards seem apparent, discontinue use and notify KCAI maintenance immediately.