



ART SAFETY MANUAL

I. Introduction

- a. Artists use a variety of art media including hazardous and industrial chemicals. This program provides basic information on how to work safely with chemicals and how to control hazardous operations while creating and displaying art.
- b. The purpose of Tennessee Tech University’s Art Safety Manual is to establish a program that provides guidance to personnel who are involved in art at Tennessee Tech University including the Appalachian Center for Craft. The manual offers technical support for regulatory compliance as well as information on required training and periodic inspections of health and safety practices. The Art Safety Manual can also be used as a training tool for students.

II. Document History

VERSION	DATE	COMMENTS
1	July 2015	Initial Art Safety Manual
2	September 2017	Addition of Photography (VI. b.)

- a. This Art Safety Manual is reviewed annually and amended as necessary and whenever:
 - New art procedures are introduced.
 - There is a significant change to existing processes or techniques.
 - Applicable regulations are revised.
 - An employee or contractor is exposed or injured while working.
 - A "near miss" accident occurs.
 - Property or the environment is negatively impacted.
- b. Environmental Health and Safety (EHS) will evaluate this Art Safety Manual at least annually and update it as needed to ensure continued program effectiveness and compliance with applicable regulations and industry standards. All revisions to this Art Safety Manual will be shared with the various parties identified in this document.

III. Roles and Responsibilities

- a. All employees in the Art Department are responsible for following the guidance provided within this document.
- b. Environmental Health and Safety:
 - i. EHS is responsible for designing, overseeing, implementing, and updating the Art Safety Manual. EHS works with the Art Department to assist with implementation and enforcement of the Art Safety Manual. Specific responsibilities are to:
 - 1. Identify areas where hazardous chemicals are used and stored in conjunction with the supervisors, staff, and faculty.
 - 2. Design and provide health and safety training to meet Tennessee Occupational Safety and Health Administration (TOSHA) requirements.
 - 3. Maintain training records.
 - 4. Inspect work areas to assist with compliance.
 - 5. Provide safety and health technical support to employees.
 - 6. Assist or conduct a risk assessment (or Job Hazard Analysis) in order to evaluate chemical usage, and recommend appropriate engineering and administrative controls as well as personal protective equipment (PPE).
 - 7. Coordinate inclusion in TTU's Medical Surveillance Program when necessary.
 - 8. Conduct air and noise monitoring to determine exposure levels as needed and upon request.
 - 9. Assist in identifying, accumulating, storing, and reducing hazardous waste.
 - 10. Provide hazardous waste containers and labels.
 - 11. Conduct routine inspection of waste satellite accumulation areas.
 - 12. Coordinate hazardous waste pick up.
 - 13. Conduct annual program review with feedback from participants of the program.
- c. Employees:
 - i. Employees includes faculty (professors, adjunct, and artists in residence), staff (classified, wage, and student wage), and graduate students receiving compensation. This does not refer to students in instructional courses. Specific responsibilities for employees are to:
 - 1. Inform EHS if there is a new piece of equipment that needs to be evaluated to ensure TOSHA compliance.
 - 2. Inform EHS if there is a new piece of equipment that needs to be evaluated to ensure TOSHA compliance.
 - 3. Conduct a risk assessment (or Job Hazard Analysis) in order to evaluate chemical usage, and recommend appropriate engineering and administrative controls as well as personal protective equipment (PPE).
 - 4. Use all required PPE.
 - 5. Maintain training records.
 - 6. Inspect tools and machines prior to use to ensure all guards are in place and functioning.
 - 7. Report missing guards or malfunctioning equipment to supervisor.
 - 8. Defective or damaged tools must be marked with the words "**Out of Service, Do Not Use.**"

9. Review Safety Data Sheet (SDS) and know hazards associated with chemicals being used.
10. Use equipment and chemicals in designated areas only.
11. Provide feedback for annual program evaluation upon request.
12. Report near-misses to EHS and your supervisor.
13. All accidents involving an injury need to be reported to your supervisor. Please review [TTU Human Resources](#) procedures for documentation of accidents involving students, visitor, staff, and faculty.

IV. Identifying Hazardous Materials

- a. It is important to identify and understand the hazards associated with the materials used and stored in the workplace. An evaluation is done to institute controls in order to prevent exposure to these hazards.

When evaluating and assessing hazards it is important to know the following ahead of time:

- How will material be handled?
- Who will be handling the material?
- Where will work be done?
- Who else could be affected by work being done?

This section outlines how hazardous materials are identified and addressed when creating art.

- b. Job Hazard Analysis and [Personal Protective Equipment](#) Assessments.
 - i. Job Hazard Analysis (JHA) is a procedure that focuses on individual job tasks as a way to identify hazards associated with each job task. Hazards can lead to injuries and illnesses and are controlled by evaluating workplace operations and establishing appropriate engineering controls, administrative controls, and personal protective equipment (PPE) for each job task.
 - ii. Jobs tasks which have JHA priority are:
 - Jobs with high injury or illness rates.
 - Jobs with a potential to lead to or cause severe injuries and/or illnesses.
 - Jobs that have undergone changes in procedure and/or processes.
 - Jobs that are new to the operation.
 - Jobs that are complex enough to require written instructions.

PPE is used as a last line of defense against the hazards associated with tasks being performed and can be used alone or in conjunction with engineering and administrative controls.

PPE assessments are conducted to ensure that PPE being used is adequate for hazards associated with each task being performed. EHS works with supervisors and employees to determine the most appropriate PPE including but not limited to respirators, protective clothing, hard hats, safety glasses, and hearing protection.

It is important that EHS is contacted if PPE is not functioning properly, PPE poses a greater hazard, or additional PPE is required.

- c. Hazard Communication
 - i. The Tennessee Tech University [Hazard Communication Program](#) complies with 29 Code of Federal Regulations (CFR) 1910.1200 and covers employees who work with hazardous chemicals. It provides guidance on how to safely manage chemicals and communicate the hazards associated with chemicals and other media used in the studio through the training of employees on safety information, labels, signage, and other forms of warning. Elements of the program include chemical inventories, Safety Data Sheets (SDS), storage and handling of toxic chemicals, container labeling, and waste management.
 - ii. Additional training and documentation is required to work with hazardous chemicals. Review the Art Safety Training Matrix to determine the training needed for work in a studio or shop.
- d. Chemical Inventories
 - i. An inventory of the hazardous chemicals in use and in storage must be maintained for each work area. The chemical inventory must contain at least the following information:
 1. Chemical name and CAS#.
 2. For brand name products, list the product name or common description (e.g. WD-40).
 3. Contact person.
 4. Only hazardous components in a mixture need to be listed.
 5. Amount (volume or mass in English or metric units).
 6. The quantity of substance should be expressed in units that are typical of that physical state. Examples:
 7. Liquid – (gallons, quart, liters, milliliters).
 8. Dry – (pounds, kilograms, milligrams).
 9. Gas – (cubic feet).
 10. Location - building and room number.
 11. Other information that may be helpful includes the concentration (percent by volume).
 - ii. Chemical inventories must be updated annually. Review the [Chemical Inventory SOP](#) for more information.
- e. Safety Data Sheets
 - i. A Safety Data Sheet (SDS) is a document providing both workers and emergency personnel with the proper procedures for handling chemical(s). Additional training and documentation is required for work with hazardous chemicals. Review the Hazard Communication Program and TTU [Chemical Hygiene Plan](#).
- f. Storage and Handling of Chemicals
 - i. The TTU Hazard Communications Program and the SDS will provide information regarding the storage and handling of specific items. The sections below provide additional guidance for the storage and handling of hazardous chemicals.
- g. Handling of Chemicals:
 - i. Cover containers to prevent liquids from evaporating and powders from spilling.
 - ii. Transfer powders carefully to avoid getting large amounts of dust in the air.
 - iii. Pour liquids carefully to avoid splashing. Use a funnel where possible.
 - iv. Wear appropriate PPE.
- h. Storage of Chemicals:

- i. Keep the minimum amount of materials on hand and purchase the smallest practical container size to reduce risk of spills or fire, and to minimize waste.
- ii. Choose appropriate containers. Avoid breakable glass containers whenever possible.
- iii. Dyes and other powdered materials that come in small paper bags should be transferred to solid containers or sealed plastic bags to avoid tears in bags releasing dust into the air.
- iv. Hazardous chemicals should not be stored above eye level.
- v. Do not store chemicals that are incompatible together.
- vi. Never store chemicals in food containers.
- i. Storage of flammable chemicals:
 - i. Flammable chemicals must be stored in flammable storage cabinets that are clearly labeled "Flammable - Keep Fire Away."
 - ii. At least one 10 pound Class ABC fire extinguisher must be located within 50 feet of the point of the job site use of more than 5 gallons of flammable or combustible liquids or 5 pounds of flammable gas.
 - iii. Other combustible materials (e.g., wood, cloth, paper) must not be stored in the same area or on top of flammable or combustible liquids storage areas.
- j. Container Labeling
 - i. Hazardous chemicals should remain in the manufacturer's container throughout their use. However, if this is not feasible and the hazardous chemical must be transferred to another container, or if one or more hazardous chemicals are mixed in a container, the new container must be labeled with the following:
 1. Complete chemical name, trade name, or common name found on the SDS.
 2. The chemical name must be written in English and clearly legible.
 3. Appropriate hazard warning, or alternatively, words, pictures, symbols, or combination thereof which provides at least general information regarding the hazards of the chemicals.

V. Hazardous Waste Management

- i. There are several categories of chemicals used by artists that meet the criteria of hazardous waste. Although the [Resource Conservation and Recovery Act \(RCRA\)](#) designates specific categories of hazardous waste, one can also define hazardous waste as a material that is no longer in use, and cannot be safely returned to the environment, in original form.
- ii. Unwanted chemicals or waste chemicals must be disposed of according to the TTU [Hazardous Waste Management and Satellite Accumulation Area Guide](#).
- iii. Waste Streams
 1. There are several types of wastes that can be generated by the Art department. Some examples include:
 - a. Oily rags
 - b. Solvent wastes (turpentine, paint thinner, etc.)
 - c. Paints
 - d. Baby oil
 - e. Linseed oil
 - f. Ceramic glaze

- g. Acids and bases
 - h. Sharp implements
 - i. Lubricating oils
 - j. Empty chemical containers
2. Oily Rags
 - a. Oily rags must be placed in a red oily rag can. Do not leave oily rags lying around the floor. Linseed oil, in particular, can ignite on its own if left out, causing fire that may spread to other areas. The oily rag can is self-closing to prevent such an occurrence.
 3. Solvents
 - a. Solvents, such as paint thinner, turpentine, toluene, xylene, and alcohols are considered hazardous waste. DO NOT DUMP them down the drain. Solvents must be disposed of according to the TTU Hazardous Waste Management and Satellite Accumulation Area Guide.
 4. Paints
 - a. 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. Oil-based paints must be disposed of according to the TTU Hazardous Waste Management and Satellite Accumulation Area Guide.
 - b. Latex paints should be dried out and placed in regular trash. Water-based paints may be disposed via the regular trash.
 5. Baby Oil
 - a. 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.
 6. Linseed Oil
 - a. Because of its potential for fire, linseed oil should be handled as a hazardous waste, in a similar manner as solvents. Linseed oil can be combined with oil-based paints and solvents for disposal. Linseed oil must be disposed of according to the TTU Hazardous Waste Management and Satellite Accumulation Area Guide.
 7. Ceramic Glaze
 - a. Many ceramic glazes contain metals that are considered hazardous waste. Unused portions of the glazes should be disposed of according to the TTU Hazardous Waste Management and Satellite Accumulation Area Guide.
 8. Acids and Bases
 - a. 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. Acids and bases must be disposed of according to the TTU Hazardous Waste Management and Satellite Accumulation Area Guide.
 9. Lubricating Oils

- a. 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.
- 10. Broken Glass Sharp Implements
 - a. 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.
- 11. Empty Chemical Containers
 - a. Empty chemical containers should be triple-rinsed and recycled or placed in regular trash.

VI. Safe Work Practices

a. Painting and Drawing:

This section will discuss the hazards and precautions of working with paints, pastels, inks, pencils, crayons, and other painting and drawing media. Working safely can involve changes in how art materials are selected and handled.

i. General Requirements

1. Whenever possible replace harmful substances with less toxic substitutes. Obtain and review the SDS for all chemicals used. Contact EHS for JHA and [PPE assessments](#).
2. Wear appropriate gloves, goggles and other protective clothing. A face shield should also be worn where there is a splash hazard or impact hazard to the face.
3. Contact EHS to evaluate the need for inclusion in the [Respiratory Protection Program](#).
4. An emergency shower and eyewash station must be available where hazardous chemicals are used or stored.
5. Do not eat, drink or smoke in the art studio.

ii. Pigments

1. Painters use pigments in oil paints, acrylics, watercolor paints, gouache, encaustic, poster paints, casein paints and tempera. Sometimes commercial paints such as oil enamel, epoxy paints and automobile paints are used. Dry pigments are especially hazardous because they are easily inhaled and ingested if methods such as spraying, heating, or sanding are used.
2. Lead pigments can cause anemia, gastrointestinal problems, peripheral nerve damage, kidney damage and reproductive system damage. Other inorganic pigments may be hazardous, including pigments based on cobalt, cadmium, and manganese. See Appendix B: Known or Probable Carcinogens/Highly Toxic Pigments.
3. In addition to general requirements for Painting and Drawing, the following precautions are required:
 - a. Use the least toxic pigments possible. Do not use lead or carcinogenic pigments.

- b. Avoid mixing dry pigments whenever possible otherwise do so in an exhaust hood. Wet mop and wipe all surfaces when using dry pigments, never dry sweep.
 - c. If any pigments contain any of the above mentioned chemicals, contact EHS an assessment.
 - iii. Water-based paints
 1. Water-based paints include water color, acrylic, gouache, tempera and casein. In addition to pigment hazards, all water-based paints contain a preservative to prevent mold or bacterial growth. Although present in small amounts, certain preservatives may cause allergic reactions in some people.
 2. Acrylic paints contain a small amount of ammonia which can cause eye, nose and throat irritation. Acrylics and some gouaches also contain a very small amount of formaldehyde as a preservative. If a product containing formaldehyde is used, contact EHS immediately to evaluate the use and determine if additional controls need to be put in place.
 3. Casein paints use the protein casein as a binder. While soluble forms are available, casein can be dissolved in ammonium hydroxide which is moderately irritating to the skin and highly irritating by eye contact, ingestion, and inhalation.
 4. If preservative is added, avoid using sodium fluoride, phenol or mercury compounds. For tempera, a small amount of pine oil works for short periods of time.
 - iv. Non water-based paints
 1. Oil paints, encaustic, and egg tempera use linseed oil, wax and egg respectively as vehicles. Solvents are often used as a thinner and for cleanup. Turpentine and mineral spirits (paint thinner), for example, are used in oil painting mediums for thinning, and for cleaning brushes. Alkyd paints use solvents as their vehicle. In addition many commercial paints used by artists also contain solvents.
 2. Most organic solvents become potential fire hazards when they evaporate. Combustible liquids, such as kerosene, mineral spirits, and cellosolves are a fire threat if heated.
 3. Wax should be only heated to the minimum temperature needed for proper flow of the paint. Do not heat with an open flame or hot plate with exposed element. Use a double boiler or electric frying pan.
 4. Acrylic paint can be substituted for underpainting.
 5. Wear neoprene gloves while using epoxy paints and cleaning brushes with mineral spirits or turpentine.
 6. Solvents are flammable and must be stored in a flammable storage cabinet.
 7. During pregnancy and nursing, switch to water-based paints to avoid exposure to solvents.
 - v. Airbrush, Spray Cans, and Spray Guns
 1. Artists use many products in spray form, including fixatives, retouching sprays, paint sprays, varnishes, and adhesive sprays. Spray mists are particularly hazardous because they are easily inhaled and can contain

solvents. In addition pigments are also easily inhaled, creating a greater potential hazard than applying paint by brush. Aerosol spray cans also contain propellants, such as isobutanes and propane, which are extremely flammable.

2. All light fixtures within 20 feet of the spray booth should be enclosed and shatter-proof. There should be no sources of ignition (electric switches, motors, flames etc.) within 10 feet of the spray booth opening.
3. Contact EHS to evaluate the need for inclusion in the Respiratory Protection Program.
4. Use spray cans or an airbrush in a spray booth.
5. Use water-based airbrushing paints and inks rather than solvent-based paints. Try to brush items rather than spraying if possible.
6. Never try to spray paint by blowing air from your mouth through a tube. This can lead to accidental ingestion of the paint.

vi. Dry Drawing Media

1. Dry drawing media includes dust-creating media such as charcoal and pastels which are often fixed with aerosol spray fixatives, and media such as crayons and oil pastels which do not create dust. Although charcoal is only considered a nuisance dust, inhalation of large amounts of charcoal dust can create chronic lung problems through a mechanical irritation and clogging effect. A major source of charcoal inhalation is from the habit of blowing excess charcoal dust off the drawing.
2. Pastels can contain toxic pigments such as chrome yellow (lead chromate) which can cause lung cancer, and cadmium pigments (which can cause kidney and lung damage and are suspect human carcinogens). Like charcoal, blowing excess pastel dust off the drawing is one major source of inhalation of pastel pigments. Pastel artists have often complained of blowing their nose different colors for days after using pastels, a clear indication of inhalation.
3. Use the least dusty types of pastels, chalks, etc. Asthmatics in particular might want to switch to oil pastels or similar non-dusty media.
4. Spray fixatives should be used in a spray booth. If use of spray fixatives is occasional, they can be used outdoors.
5. Never try to spray fixative by blowing air from your mouth through a tube. This can lead to accidental ingestion of the fixatives.
6. Do not blow off excess pastel or charcoal dust with your mouth. Instead tap off the built up dust so it falls onto paper on floor.
7. Wet-mop and wet-wipe all surfaces clean of dusts.

vii. Liquid Drawing Media

1. This includes both water-based and solvent-based pen and ink, and felt tip markers. Although drawing inks are usually water-based, there are some solvent-based drawing inks. These usually contain solvents like xylene. Permanent felt tip markers used in design or graphic arts contain solvents also contain xylene. Newer brands often contain the less toxic propyl alcohol (although it is an eye, nose and throat irritant). The inhalation hazard from using permanent markers increases when

using a number of them at the same time in close proximity to each other.

2. Use water-based markers and drawing inks if possible.
3. Alcohol-based markers are less toxic than aromatic solvent-based markers.
4. Make sure to recap markers when not in use. If there is more than one user, spread out and make sure there is enough dilution ventilation to disperse the vapors. Never paint on the body with markers or drawing inks. Body painting should be done with cosmetic materials.

b. Photography

i. General requirements:

1. Local exhaust ventilation is required when working with hazardous substances.
2. Whenever possible replace harmful substances with less toxic substitutes.
3. Obtain and review the SDS for all chemicals used.
4. Obtain and review the SDS for all chemicals used. Contact EHS for JHA and PPE assessments.
5. Contact EHS to evaluate the need for inclusion in the Respiratory Protection Program.
6. Chemical splash goggles should be worn when mixing and dispensing photochemical solutions and in all darkrooms where hazardous chemicals can splash into the eyes.
7. Nitrile gloves should also be worn when mixing photochemicals.
8. Wear appropriate gloves, goggles and other protective clothing. A face shield should also be worn when there is a splash hazard or impact hazard to the face.
9. An emergency shower and eyewash station must be available where chemicals are used or stored.
10. Do not eat, drink or smoke in the art studio.

ii. Black and White Photographic Processing

1. A wide variety of chemicals are used in black and white photographic processing. Print processing uses tray processing with successive developing baths, stop baths, fixing baths, and rinse steps. Other treatments include use of hardeners, intensifiers, reducers, toners, and hypo eliminators. Premixed ready-to-use photochemicals are recommended in order to avoid hazards associated with mixing concentrated chemicals.

iii. Mixing Photochemicals

1. Photochemicals can be bought in liquid form, which only need to be diluted, or powder form, which need to be dissolved and diluted. Developer solutions and powders are often highly alkaline (corrosive). Glacial acetic acid, used in making the stop bath, is also corrosive by skin contact, inhalation and ingestion.
 - a. Always add any acid to water, never the reverse.
 - b. Use liquid products instead of powder products due to the higher risk of inhalation of powders.

- c. Store concentrated acids and other corrosive chemicals on low shelves so as to reduce the chance of face or eye damage in case of breakage and splashing.
 - d. Do not store photographic solutions in glass containers.
 - e. Label all solutions according to Hazard Communication Program requirements.
 - f. Pregnant women, in particular, should not be exposed to powdered developer.
- iv. Developing Baths
 - 1. The most commonly used developers are hydroquinone, monomethyl para-aminophenol sulfate, and phenidone. Several other developers are used for special purposes. Other common components of developing baths include an accelerator, often sodium carbonate or borax, sodium sulfite as a preservative, and potassium bromide as a restrainer or antifogging agent. Developers are skin and eye irritants, and in many cases strong sensitizers. Most are moderately to highly toxic by ingestion, with ingestion of less than one tablespoon of some compounds being possibly fatal. In addition to general requirements for Photography, the following precautions are required:
 - a. Never place hands in developer baths, ALWAYS use tongs.
 - b. If developer solution splashes on your skin or eyes immediately rinse with water for 15 –20 minutes and seek medical attention immediately.
 - c. Do not use para-phenylene diamine or its derivatives. If products are found to contain para-phenylene diamine, contact EHS immediately for proper disposal.
- v. Stop Baths and Fixer
 - 1. Stop baths are usually weak solutions of acetic acid. Acetic acid is commonly available as pure glacial acetic acid or 28% acetic acid. Some stop baths contain potassium chrome alum as a hardener. Fixing baths contain sodium thiosulfate ("hypo") as the fixing agent, and sodium sulfite and sodium bisulfite as a preservative. Fixing baths also may also contain alum (potassium aluminum sulfate) as a hardener and boric acid as a buffer. In addition to general requirements for Photography, the following precautions are required:
 - a. Chemical use in darkrooms must be done in front of a slot hood to control the level of acetic acid vapors and sulfur dioxide gas produced in photography.
 - b. Cover all baths when not in use to prevent evaporation or release of vapors and gases.
- vi. Intensifiers and Reducers
 - 1. A common after-treatment of negatives (and occasionally prints) is either intensification or reduction. Common intensifiers include hydrochloric acid and potassium dichromate, or potassium chlorochromate. Reduction of negatives is usually done with Farmer's reducer, consisting of potassium ferricyanide and hypo. These chemicals are highly toxic and have adverse effects on the body. In addition to

general requirements for Photography, the following precautions are required:

- a. The safest reducer to use is Farmer's reducer. Do not expose Farmer's reducer to acid, ultraviolet light, or heat.
- b. Do not use mercury, cyanide or uranium intensifiers, or cyanide reducers because of their high or extreme toxicity.
- c. Do not expose potassium chlorochromate to acid or heat.

vii. Toners

1. Toning a print usually involves replacement of silver by another metal such as gold, selenium, uranium, platinum, or iron. In some cases, the toning involves replacement of silver metal by brown silver sulfide which releases a highly toxic hydrogen sulfide gas during toning, or when treated with acid. A variety of other chemicals are also used in the toning solutions. In addition to general requirements for Photography, the following precautions are required:
 - a. Take precautions to make sure that sulfide or selenium toners are not contaminated with acids. For example, with two bath sulfide toners, rinse the print well after bleaching in acid solution before dipping it in the sulfide developer.

viii. Other Hazards

1. Many other chemicals are also used in black and white processing, including formaldehyde, a variety of oxidizing agents (e.g., hydrogen peroxide and ammonia, potassium permanganate, bleaches, and potassium persulfate), sodium sulfide, silver nitrate, and concentrated acids. If a product containing formaldehyde is used, contact EHS immediately to evaluate the use and determine if additional controls need to be put in place.

ix. Color Processing

1. Color processing is much more complicated than black and white processing, and can either be done in trays or in automatic processors. In some old processes, the film emulsion was hardened during the process, typically before the bleach. Such a hardening bath often used aldehydes, such as formaldehyde and gluteraldehyde. In modern processing, these hardening steps are unnecessary because the film emulsion is sufficiently hardened to withstand the processing chemicals.

x. Developing Baths

1. The first developer of color transparency processing usually contains monomethyl-paminophenol sulfate, hydroquinone, and other standard black and white developer components. Color developers contain a wide variety of chemicals including color coupling agents, penetrating solvents (i.e., benzyl alcohol, ethylene glycol, and ethoxydiglycol), amines, and others. In general, color developers are more hazardous than black and white developers. Recent color developing agents are supposed to be less hazardous, but still can cause skin irritation and an allergic reaction.

xi. Bleaching, Fixing, and Other Steps

1. Many of the chemicals used in other steps of color processing are essentially the same as those used for black and white processing. Examples include the stop bath and fixing bath. Bleaching uses a number of chemicals, including potassium ferricyanide, potassium bromide, ammonium thiocyanate, and acids. Chemicals found in prehardeners and stabilizers include succinaldehyde and formaldehyde. Neutralizers can contain hydroxylamine sulfate, acetic acid, and other acids. In addition to general requirements for Photography, the following precautions are required:
 - a. Use premixed solutions whenever possible.
 - b. Do not add acid to solutions containing potassium ferrocyanide or thiocyanate salts because this releases cyanide gas.
 - c. When diluting solutions containing concentrated acids, always add the acid to the water, never the reverse.
 - d. A water rinse step is recommended between acid bleach steps and fixing steps to reduce the production of sulfur dioxide gas.
 - e. Control the temperature carefully according to manufacturer's recommendations to reduce emissions of toxic gases and vapors.
- xii. Disposal of Photochemicals
 1. Old or unused concentrated photographic chemical solutions, toning solutions, ferricyanide solutions, chromium solutions, color processing solutions containing high concentrations of solvents, and non-silver solutions should be treated as hazardous waste.
 2. Disposal of photochemicals must be disposed of according to the [TTU Hazardous Waste Management and Satellite Accumulation Area Guide](#).
- c. Sculpture
 - i. Many artists work with traditional sculptural materials including plaster, stone, lapidary, clay, wax, and modeling materials. This section will provide hazards and safety information for certain traditional processes.
 1. Whenever possible replace harmful substances with less toxic substitutes. Obtain and review the SDS for all chemicals used.
 2. Contact EHS to evaluate the need for inclusion in the Respiratory Protection Program.
 3. Wear appropriate gloves, goggles and other protective clothing. A face shield should also be worn where there is a splash hazard or impact hazard to the face.
 4. Wear appropriate clothing that fits correctly and is free of loose material. Confine loose clothing, ties, long hair, or jewelry that can become caught in moving parts.
 5. An [emergency shower and eyewash station](#) must be available where hazardous chemicals are used or stored.
 6. Do not eat, drink or smoke in the art studio.
 - ii. Plaster
 1. Plaster can be carved, modeled, and casted. Varieties of plaster include: Plaster of Paris, casting plaster, white art plaster, molding plaster, and

Hydrocal. These are all varieties of calcined gypsum, composed of calcium sulfate.

2. Plaster dust (calcium sulfate) is slightly irritating to the eyes and respiratory system. Many of the additives used such as silica and vermiculite dust are highly toxic. Potassium sulfate, potassium alum, borax are also toxic. Concentrated acetic acid and burnt lime (calcium oxide) are corrosive.
3. Always carve or cut in a direction away from you, and keep hands behind the tool. If the tool falls, do not try to catch it.
4. When adding materials to plaster, use an N-95 National Institute for Occupational Safety and Health (NIOSH)- approved filtering facepiece respirator (see Appendix D) and clean up dust carefully.
5. Store plaster in sealed containers or plastic sealed bags rather than paper bags which can rip open.
6. HEPA Vacuum or wet mop to keep plaster dust levels low.
7. Do not dry sweep.

iii. Plaster Molds

1. When plaster molds are used, methods need to be put in place to release the molds. Mold releases used with plaster include vaseline, tincture of green soap, auto paste wax-benzine, silicone-grease-benzine, and mineral oil-petroleum jelly. In waste molding, the plaster mold is chipped away.
2. Making plaster casts of hands, legs, and other body parts can be very hazardous due to the heat released during the setting process.
3. Do not use plaster for body part casts. Instead, use a plaster-impregnated bandage (such as Johnson and Johnson's Pariscraft), along with petroleum jelly or similar mold release as protection.

iv. Plaster Finishing

1. Paints, powdered pigments, and dyes that are used to finish plasters are often hazardous by inhalation or ingestion, and in some cases by skin contact. Alcohol, shellac, and solvents used in lacquers are moderately toxic. These solvents are also flammable.
2. Use an N-99 NIOSH- approved filtering facepiece when using powdered pigments or dyes (see Appendix D). Contact EHS to evaluate the need for inclusion in the Respiratory Protection Program.
3. Brush or dip dyes or paints rather than spraying.
4. Store solvents safely, and keep them away from open flames.
5. Solvent-soaked rags should be kept to a minimum and placed in an approved, metal, self-closing waste disposal. This should be disposed of as hazardous waste or recycled by professional laundering.

d. Modeling Materials

i. Clay

1. Modeling materials used in sculpture include traditional moist clays, non-hardening modeling clays, self-hardening clays, oven-hardening clays, wax, and paper mache type products.
2. Modeling clays of the plasticine type usually contain China clay in an oil and petrolatum base. Additive, including dyes, sulfur dioxide, vegetable

oils, aluminum silicate, preservatives, and turpentine are often present. There are also a variety of polymer clays that are self-hardening, or oven-hardening (e.g., FIMO, Sculpey), which are not really clays at all. These are often based on polyvinyl chloride.

3. Use gloves if skin irritation results from using plasticine modeling clays.
4. Wash hands with soap and water after contact.
5. Never bake any art material in an oven which is also used for food.
6. Use a separate oven, that has reliable temperature control and only bake these products to their particular hardening temperature.
7. Do not use hardening modeling clays that have di(2-ethylhexyl) phthalate (DEHP) as a plasticizer. At this time, the long-term hazards of replacement plasticizers have not been adequately researched.

ii. Wax

1. Waxes used for modeling, carving, and casting include beeswax, ceresin, carnauba, tallow, paraffin, and micro-crystalline wax. In addition there are the synthetic chlorinated waxes. Solvents used to dissolve various waxes include alcohol, acetone, benzene, turpentine, ether, and carbon tetrachloride.
2. Waxes are often softened for carving or modeling by heating in a double boiler or with a light bulb, by sculpting with tools warmed over an alcohol lamp, or by the use of soldering irons, alcohol lamps, and blowpipes. Wax can be melted for casting in a double boiler. Additives used with waxes include rosin, dyes, petroleum jelly, mineral oil, and many solvents.
3. Do not overheat waxes.
4. Do not use an open flame to melt waxes.
5. Use a double boiler and a temperature-controlled hot plate, or a crock pot.
6. Use the least hazardous solvent to dissolve wax. Do not use carbon tetrachloride under any circumstances.
7. Store solvents safely, do not smoke or have open flames near solvents.
8. Solvent-soaked rags should be placed in an approved, metal self-closing waste disposal and disposed of as hazardous waste or recycled by professional laundering.
9. Do not use chlorinated synthetic waxes.

e. Wood Work

- i. Different types of hard and soft woods are used to make sculptures, including many exotic tropical woods. Many of these woods are hazardous themselves and sometimes, woods are treated with hazardous preservatives or pesticides.
- ii. Hardwood and Softwood
 1. Many hardwood dusts, especially those from exotic woods, are common sensitizers and can cause allergic skin reactions, conjunctivitis (eye inflammation), hay fever, asthma, coughing, and other respiratory diseases. Some hardwoods also contain chemicals that are toxic.
 2. Softwoods do not cause as high a frequency of skin and respiratory problems as do hardwoods. A few individuals can develop allergic reactions to some softwoods.

3. Whenever possible, use common hardwoods rather than rare tropical hardwoods.
 4. If allergies are of concern to individuals using hardwoods, avoid common sensitizing woods e.g. western red cedar.
 5. Wash hands carefully after work.
 6. Avoid inhalation of wood dusts by using a dust collector.
- iii. Plywood and Composition boards
1. Plywood is made by gluing thin sheets of wood together with either urea-formaldehyde glues (for indoor use) or phenol-formaldehyde glues (for outdoor use). Composition board, for example particle board, is made by gluing wood dust, chips, etc. together with urea-formaldehyde resins. These materials can emit formaldehyde for some years after manufacture, with composition board emitting more formaldehyde. In addition, heating these materials or machining them can cause decomposition of the glue to release formaldehyde which is a respiratory sensitizer.
 2. Contact EHS to conduct baseline formaldehyde monitoring.
 3. Do not store large amounts of plywood or composition board in the shop since it will emit formaldehyde.
 4. Dust collectors connected to woodworking machines should be exhausted to the outside since emitted formaldehyde will not be captured by dust collectors.
- iv. Carving and Machining Wood
1. There are several hazards associated with carving and machining wood. Many wood dusts are hazardous by skin contact or inhalation and are also fire hazards.
 2. Woodworking machinery accidents are often due to missing machine guards, faulty equipment, or using the wrong type of machine for a particular operation. Woodworking machines may be noisy and can cause permanent hearing loss with long-term exposure. Contact EHS to evaluate the need for inclusion in the [Hearing Conservation Program](#).
 3. Tool accidents are often caused by dull tools or improper use of the tool. Vibrating tools such as chainsaws can cause Raynaud's phenomenon ("whitefingers") involving numbness of the fingers and hands.
 4. Wear appropriate clothing that fits correctly and is free of loose material. Confine loose clothing, ties, long hair, or jewelry that can become caught in moving parts.
 5. There are also electrical and fire hazards from faulty or inadequate wiring of electrical equipment.
 6. Keep hand tools sharpened, and cut away from your body. Do not place hands in front of the tool.
 7. Keep all electrical equipment and wiring in good repair and avoid extension cords which can be tripped over and are electrical hazards.
 8. Make sure that all woodworking machines are equipped with proper guards to prevent accidents.

9. Shield noisy machines whenever possible. Mount the machinery with vibration isolators (like shock absorbers), and keep all machinery in good working condition.
 10. Replace old, noisy machinery whenever possible. Contact EHS to evaluate the need for inclusion in the Hearing Conservation Program.
 11. Use the proper machine for particular operations and repair defective machines immediately, or tag out of service (Lock out Tag Out, LOTO).
 12. Clean wood dust from around and inside machines to avoid fire hazards.
 13. HEPA Vacuum or wet mop to keep sawdust levels low.
 14. Do not dry sweep.
- v. Paint Stripping
1. Paint and varnish removers contain a wide variety of solvents. "Nonflammable" paint strippers contain methylene chloride. They may also contain many other solvents, including acetone, glycol ethers, methyl alcohol, and acetates. Caustic soda, acids, blowtorches and heat guns are also used to remove old paint. Old stains on wood are often removed with bleaches, which can contain caustic soda, hydrogen peroxide, oxalic acid, or hypochlorite.
 2. Do not use methylene chloride containing strippers.
 3. Do not use lead containing paint.
 4. Use dimethyl adipate paint strippers which are safer than other solvent types.
 5. Volatile, solvent-based paint strippers should preferably be used outside.
 6. Do not have open flames or other sources of ignition (e.g., pilot light) in the room when using flammable solvents.
 7. Avoid using torches to remove paint.
 8. Solvent-soaked rags should be placed in an approved, metal self-closing waste disposal can and disposed of as hazardous waste or recycled by professional laundering.
- vi. Painting and Finishing
1. Wood can be painted, stained, lacquered, or varnished. It can be oiled with linseed oil, tung oil, or other types of oil. Other materials used in finishing include shellacs, polyurethane coatings, and waxes. Some woodworkers mix their own paints from dry pigments.
 2. Avoid open flames, and other sources of ignition when applying flammable finishes, or when spraying.
 3. Use water-based paints rather than solvent-based paints if possible.
 4. Use latex paints containing ethylene glycol or propylene glycol rather than glycol ethers.
 5. Use ready-made paints rather than mixing your own.
 6. Use shellacs containing denatured (ethyl) alcohol rather than ones containing methyl alcohol.
 7. Brush on materials whenever possible, to avoid the hazards of spraying.
 8. Finishes should be sprayed inside an explosion-proof spray booth.
 9. Touchup with spray cans should be done outdoors.

10. Oil-soaked rags should be placed in an approved, metal self-closing waste disposal can and disposed of as hazardous waste or recycled by professional laundering.

f. Metal Work

- i. This section covers the precautions of the various types of metal sculpture and metalworking techniques to include metal casting, welding, brazing, soldering, forging, metal fabrication, and surface treatment of metals.
 1. Whenever possible replace harmful substances with less toxic substitutes.
 2. Obtain and review the SDS for all chemicals used.
 3. Contact EHS to evaluate the need for inclusion in the Respiratory Protection Program.
 4. Wear appropriate gloves, goggles and other protective clothing. A face shield should also be worn to protect eyes against flying metal pieces or filings.
 5. Wear appropriate clothing that fits correctly and is free of loose material.
 6. Confine loose clothing, ties, long hair, or jewelry that can become caught in moving parts.
 7. An emergency shower and eyewash station must be available where chemicals are used or stored.
 8. Do not eat, drink or smoke in the art studio.
- ii. Welding and Cutting
 1. Appropriate personal protective equipment (PPE) must be used whenever hot work is conducted. Eye, face, and hand protection is required at a minimum. Other PPE such as boots, hard hat, and protective welding apparel must be used as necessary.
 2. Screens must be used and arranged in a manner that provides protection for surrounding persons. Screens may not obstruct or prevent ventilation or egress.
 3. Welding cables and other equipment must not obstruct egress and kept clear of passageways, ladders, and stairways.
- iii. Polishing and Finishing
 1. Filing, sand blasting, grinding, wire brushing, and buffing are examples of the various types of polishing and finishing treatments used with metals.
 2. Grinding, wire-brushing, buffing wheels, sanding, and other similar techniques using powered equipment can produce flying metal particles, dust, and, in some cases, particles from abrasives and the grinding wheel. Hand-operated sanding and polishing using abrasives such as rouge, tripoli (silica), and pumice can also produce dust. Filing can produce flying metal particles.

g. Ceramics

- i. General Requirements
 1. Whenever possible replace harmful substances with less toxic substitutes.
 2. Obtain and review the SDS for all chemicals used.

3. Contact EHS a PPE assessment.
4. Contact EHS to evaluate the need for inclusion to the Respiratory Protection Program.
5. Wear appropriate gloves, goggles and other protective clothing.
6. Wear appropriate clothing that fits correctly and is free of loose material. Confine loose clothing, ties, long hair, or jewelry that can become caught in moving parts.
7. An emergency shower and eyewash station must be available where hazardous chemicals are used or stored.
8. Do not eat, drink or smoke in the art studio.

h. Clay

- i. Clays are minerals composed of hydrated aluminum silicates, often containing large amounts of crystalline silica. Other impurities may include organic matter or sulfur compounds. Sometimes, grog (ground firebrick), sand, talc, vermiculite, perlite, and small amounts of minerals such as barium carbonate and metal oxides, are added to modify clay properties.
 1. Use premixed clay whenever possible to avoid exposure to large quantities of clay dust.
 2. Do not use asbestos or asbestos-contaminated talcs.
 3. Clay mixers should be equipped with proper machine guards so that they cannot be opened to add clay or water while the mixer blades are turning.
 4. Avoid contact of clay with broken skin.
 5. To prevent back problems, always lift with knees bent. Also, use a standup wheel, or elevate electric wheels to a height that does not require bending over.
 6. Keep wrists in an unflexed position as much as possible to prevent carpal tunnel syndrome. Take frequent work breaks.
 7. Recondition clay by cutting still-wet clay into small pieces, letting them air-dry, and soak in water.
 8. Finish greenware while still wet or damp with a fine sponge instead of sanding when dry.
 9. Do not sand greenware containing fibrous talc.
 10. Clay storage and mixing should take place in a separate room.
 11. Bags of clay (and other pottery materials) should be stacked on palettes or grids off the floor for easier clean-up.
 12. Wear separate work clothes while in the studio. Choose clothes of material and design that do not trap dust and wash these clothes separately from other laundry.
 13. Floors should be sealed or made of easy-cleaning material.
 14. HEPA Vacuum or wet mop to keep dust levels low and prevent dry scraps from becoming pulverized.
 15. Do not dry sweep.

i. Glazes

- i. Glazes used to color or finish clay pieces are a mixture of silica, fluxes and colorants. Common fluxes include lead, barium, lithium, calcium and sodium, and are used to lower the melting point of silica. Glaze components are

weighed, sorted and mixed with water. These materials are often in fine powdered form, and result in high dust exposures.

1. Wash hands after work.
2. Use lead-free glazes whenever possible. If the glaze does not state "lead-free" or "leadless" on the label, assume it contains lead until proven otherwise.
 - a. Contact EHS to conduct air and surface monitoring to determine lead exposure levels.
3. If possible, do not use colorants that are known human carcinogens and avoid probable human carcinogens such as lead, chromium, etc.
4. Lead-glazed pottery should be labeled as lead-containing.
5. Good housekeeping procedures and cleanup of spills reduce the risk of inhalation or ingestion of dusts.
6. Wet mop spilled powders.

j. Kilns

- i. Electric kilns and fuel-fired kilns are used to heat pottery to the desired firing temperature. The fuels in fuels-fired kilns produce carbon monoxide and other combustion gases.
 1. Electric or fuel-fired kilns should be kept in a separate room to reduce excess heat in the working studio.
 2. Do not use lead compounds at stoneware temperatures this will cause the lead to vaporize.
 3. Chimneys should have a high enough stack to prevent exhaust from re-entering the building. High-velocity stack fans may be necessary.
 4. Lumber, paper, solvents, or other combustible and flammable materials should not be stored in kiln areas.
 5. Raise electric kilns at least a foot off the floor and place at least two feet from any wall, allowing air circulation.
 6. Wooden floors should be protected with non-asbestos containing fireproof materials (e.g. firebrick).
 7. Always check that the kiln has shut off.
 8. Regulators, to automatically shut off kilns if the air flow stops or if a negative pressure develops are needed.
 9. ANSI approved infrared goggles or hand-held welding shields should be worn when looking into the operating kiln. Shade number from 1.7 to 3.0 is recommended, but a darker shade may be required if spots appear in front of one's eyes after looking away from the kiln.

k. Glass

1. Safety glasses are required at all time. Didymium glassblowing glasses are preferred as they filter the bright sodium glare produced when glass is heated.
2. Welder's goggles are required when working quartz or Vycor glass. These goggles filter harmful ultraviolet light produced as the quartz is heated.
3. Sandals are not recommended footwear.
4. Long hair should be tied back when working around open flames.

5. Avoid wearing synthetic clothing that will burn and melt when exposed to flames or hot glass.
6. Roll up long sleeves so they won't catch on fire.
7. Heat only clean, solvent free glassware.
8. Never heat glass with volatile or toxic materials inside.
9. After rinsing glassware with solvents, air dry the apparatus to make certain that no solvent remains. (Explosion could result.)
10. Metal vapors must never be present in glass to be heated. The most common metal encountered in glassware is mercury. Remove all traces of mercury before heating and blowing on this glassware.
11. Silicone stopcock grease is another source of contamination in heated glassware. A fine white powder (silica) is produced when heated to high temperatures. This silica will fire into the glass and, in turn, weaken it.
12. No eating or drinking in the studio.

I. Blacksmithing

1. Safety glasses or goggles must be worn when smithing, or observing.
 - a. An approved face shield may be used in addition to eye protection for added protection from flying particles. The use of face shield will always include the use of safety glasses under the face shield.
2. Heavy duty, high topped closed shoes are required.
3. The need for hand protection is a matter of choice. Some smiths use no hand protection. Some smiths use a glove on the tong/tool or hot metal holding hand and no glove on the hammer hand. The tong /tool or hot metal holding hand is usually closer to the hot work and protection is helpful. However a glove on the hammer hand results in a loss of grip on the hammer handle. If a glove or gloves are used it is recommended that:
 - a. The gloves are made of cotton, or Kevlar.
 - b. If a leather gloves are used the glove on the tong hand be loose fitting so it can be removed quickly. The fit shall be loose enough that it can be shaken off the hand.
 - c. Gloves made of synthetic materials, except for kevlar, not be used. Synthetic materials can melt onto the skin if exposed to hot sparks or flame. If a glove becomes hot it shall not be soaked in water to cool the glove.
 - d. Cooling a glove in water can produce steam in the glove. A glove that is soaked with sweat can also produce steam. Therefore it is necessary to have dry gloves available.
4. Cotton is the best all-around material to wear. Synthetic materials are not recommended because they melt easily and some may burn rapidly when exposed to flame. Synthetics will not be allowed when working or in close proximity to the forging area.

VII. Training

- a. Faculty/Supervisor:
 - i. All faculty/supervisor members will complete a risk assessment of the work being conducted within room/area.
 - ii. Review the [Art Safety Training Matrix](#) and the Art Safety Manual to determine the appropriate trainings for work in the studio/shop.
 - iii. [Site specific training documentation](#) is required once, and must be updated each time a new hazard is present.
 - iv. Appropriate training shall be completed annually.
 - v. All faculty/supervisor members are ultimately responsible for ensuring all staff and/or students within their room/area are appropriately trained on the hazards.
 1. Please refer to your departmental procedures for keeping copies of training records. These records must be available for regulatory review.
- b. Artists in residence and paid students workers within the room:
 - i. Based upon the findings of the risk assessment by the faculty/supervisor member, the artist in residence and paid student employees will be required to take training.
 - ii. Site specific training documentation is required once, and must be updated each time a new hazard is present.
 - iii. Appropriate training shall be completed annually.
- c. Students in class:
 - i. All students will be given basic safety instructions at the initial meeting of their respective class sections. These instructions should be pertinent to each respective class.
 - ii. It is recommended to have written safety procedures incorporated into the written procedures.
 - iii. No documentation is required.
- d. There are physical hazards involved in creating art. Standard Operating Procedure (SOP) provide information on engineering controls, administrative controls, and appropriate PPE that should be used when faced with hazards addressed in each guide. These SOPs are referenced throughout the manual and are available on the EHS website. SOPs include the following:
 - i. Chemical Inventory SOP
 - ii. Emergency Eyewash and Safety Shower SOP
 - iii. Hazard Communication Program SOP
 - iv. TTU Chemical Hygiene Plan
 - v. TTU Respiratory Protection Program
 - vi. Accident Reporting Procedure
 - vii. Personnel Protective Equipment
 - viii. Soldering Safety Guidelines
 - ix. Hazardous Waste Management and Satellite Accumulation Area Guide
 - x. Hearing Conservation Program

VIII. Engineering Controls

- a. Engineering controls are used to remove a hazard or place a barrier between the worker and the hazard. Well-designed engineering controls can be highly effective in protecting

workers and will typically be independent of worker interactions to provide this high level of protection. This can be achieved by elimination, or minimization of the hazard. The hazard could also be isolated, enclosed, or redirected.

b. Chemical Substitution

- i. One of the major ways to reduce the hazards associated with chemical substances is the substitution of the hazardous chemical by less hazardous alternatives and using the safest materials and processes possible. When deciding if substitution is a viable alternative:
 1. Use the least toxic solvents possible. Examples include denatured alcohol, isopropyl alcohol, acetone, and odorless mineral spirits.
 2. Eliminate toxic metals such as lead and cadmium. Use cadmium-free silver solders and lead-free glazes and enamels.
 3. Use water-based materials instead of solvent-based ones.
 4. Use liquid materials to replace powders, e.g. wet clay or water-based dyes instead of dry clay or powdered dyes.
 5. Use wet techniques such as wet sanding and wet grinding instead of dry techniques.
 6. Apply coatings by brushing or dipping instead of spraying.
 7. Eliminate cancer-causing agents such as asbestos, cadmium, lead and zinc chromate, benzene, and chromate copper arsenate.

c. Ventilation

- i. Maintaining a clean indoor air environment in the studio and during art procedures is an important way to prevent chemical exposures. This can be accomplished through the use of air cleaning and pollution control systems such as HEPA filters, dust collection systems, paint booths, welding fume collectors, etc.
- ii. There are two types of ventilation for toxic substances: dilution ventilation and local exhaust ventilation. Dilution ventilation involves bringing in clean air to dilute the contaminated air, and then exhausting the diluted air to the outside via exhaust fans. Dilution Ventilation should not be used to exhaust highly toxic solvent vapors or particulates. The exhausted air should be completely exhausted to the outside and not re-circulated.
- iii. Local Exhaust Ventilation utilizes a hood, slots, or a down draft to capture the contaminants at the source, ducts to transport them to the outside, an exhaust fan to move the air, and sometimes air cleaners to remove particulates from the air. Examples of typical local exhaust systems for art operations include slot exhaust hoods for cleaning etching plates, enclosed hoods for acid etching, spray booths for spray painting and spray glazes, movable exhaust hoods for welding, and dust-collecting hoods for woodshops. A canopy hood should never be used for the control of hazardous exhaust.
 1. When using local exhaust ventilation, enclose the process as much as possible and place the hood as close to the operation as possible. Make sure to have the system evaluated by EHS as proper air flow is important and may require annual certification.

IX. Administrative Controls

- a. Administrative controls work with engineering controls and PPE to reduce exposure to hazards in the work place. They include implementing safe work practices such as written standard operating procedures (SOP), monitoring the use of highly hazardous materials and the use of alarms, warning signs, and a buddy system where necessary. Training is also an administrative control.

X. Personal Protective Equipment

- a. Personal protective equipment (PPE) is used whenever engineering and/or administrative controls are not viable or do not adequately protect employees from hazards. PPE serves to prevent or minimize the exposure to hazards including hazardous chemicals. Examples of PPE are; gloves, eye protection, face protection, respiratory protection, aprons, hearing protection, and uniforms. Any employee expected to work with hazardous chemicals must review the SDS to determine what PPE is required to be worn. Supervisors must review non-routine and routine work tasks and contact EHS to conduct PPE assessment in order to provide employees with appropriate PPE.
- b. Selection of PPE should be centralized to ensure that proper equipment is chosen, and that training is given on its proper use and maintenance. A variety of sizes should be made available as one size will not fit everyone. It is essential to choose PPE that is specific to the hazard and type of work to be performed. PPE must be compatible, provide proper dexterity, limit interference, fit properly, and be comfortable.
- c. Employees who are required to wear PPE must be trained in the following:
 - i. When PPE is necessary.
 - ii. What PPE is necessary.
 - iii. How to wear the PPE.
 - iv. How to adjust the PPE.
 - v. How to store and dispose of PPE.
- d. Employees must demonstrate an understanding of the training and an ability to use PPE before being allowed to perform work requiring its use. Retraining is necessary if an employee doesn't show this understanding or skill, or if changes in the workplace or types of PPE make previous training obsolete. Please contact EHS for assistance in assessing proper PPE and to assist with training on PPE use.
- e. Review the Personal Protection Equipment Standard Operating Procedure.

XI. Respiratory Protection

- a. Harmful chemical vapors and particulates may be release into the atmosphere while sanding, welding and grinding, working with organic solvents thinners or degreasing, painting or using epoxies, abrasive blasting, and scraping or sanding surfaces that are coated with lead-based paints.
- b. Prior to wearing or selecting any respirator, you must first contact EHS to be enrolled in the TTU Respiratory Protection Program.

XII. Hearing Protection

- a. Noise can be caused by vibration, forging, machinery, power tools, exhaust fans, and old or improperly maintained equipment. TTU's Hearing Conservation Program has been developed to protect employees from exposure to excessive noise and complies with OSHA standard 29 CFR 1910.95.

- b. EHS administers the Hearing Conservation Program and conducts noise monitoring to evaluate occupational noise exposure and determine inclusion in the Program as well as to evaluate the noise output from a source.

XIII. Displaying Art

- a. Art is displayed throughout campus and the Appalachian Center for Crafts. Safety precautions should be observed when mounting and displaying art work including sculptures. General safety considerations include:
 - i. Safe clearance should be maintained around sharp edges, protruding pieces, or other trip hazards.
 - ii. Extension cords are only to be used as a temporary means of providing electricity where needed. Using extension cords is not appropriate for displaying art.
 - iii. Art work must be compatible with display lighting and corresponding heat load.
 - iv. Unsecure hazardous materials may not be displayed as part of an art exhibit.
 - v. Art work should not be displayed where they would pose a hazard to others.
 - vi. Art work should be secured to limit vandalism and theft.
- b. The EHS office also offers Ladder Safety training to employees as needed.

XIV. References and Standards

OSHA 29 CFR 1910.95 (Hearing Protection)
ANSI S12.6 (Hearing Protection)
OSHA 29 CFR 1910.120 (Hazardous Waste)
EPA 40 CFR Parts 260-279 (RCRA)
Tennessee Code Annotated (1200-01-11; 0400-12-01)
OSHA 29 CFR 1910.134 (Respiratory Protection)
OSHA 29 CFR 1910.120 (HAZWOPER)
OSHA 29 CFR 1910.132 (PPE)
TOSHA CPL-TN 02-00-054 (Respiratory Protection)
OSHA: 29 CFR 1910.1200 (Hazard Communication)
OSHA 29 CFR 1910.1450 (Lab Standard)
TDL Rule 0800-1-9 (Right to Know)
NFPA: 45, 49, 306, 654 (Fire Protection/Hazard Communication)
EPA: 40 CFR 302, 302.4, 303, 311, 355, 383, 392, 395, 397, 761
TOSHA: Act of 1972 50-3-101: 50-3-919
George Mason University Art Safety Manual

XV. Appendix A: Definitions

CENTRAL ACCUMULATION AREA (CAA): The CAA is the point of central or bulk accumulation of hazardous wastes prior to shipment to an offsite disposal facility and has been registered with the state.

CHEMICAL FUME HOOD: (as defined by OSHA in 29 CFR 1910.1450) Device located in a laboratory, enclosed on five sides with a movable sash or fixed partial enclosed on the remaining side; constructed and maintained to draw air from the laboratory and to prevent or minimize the escape of air contaminants into the laboratory; and allows chemical manipulations to be conducted in the enclosure without insertion of any portion of the individual's body other than hands and arms.

CHEMICAL WASTE: Solid or liquid laboratory waste containing chemicals that must be disposed of through George Mason University's chemical waste management program.

CORROSIVE: A substance that causes visible destruction or permanent changes in human skin tissue at the site of contact; having a pH less than 2 or greater than 11.5.

DILUTION VENTILATION: Is usually accomplished with the use of large exhaust fans in the walls or roof of a building or room.

DUST COLLECTOR: Designed to handle heavy dust loads, consists of a blower, dust filter, a filter-cleaning system, and a dust receptacle or dust removal system.

EGRESS: A means or place of exit; especially from an enclosed space.

ENCLOSED HOOD: Provides adequate local exhaust ventilation. An enclosed hood requires a lower exhaust rate and therefore less makeup air.

ENERGIZED ELECTRICAL EQUIPMENT: Examples of energized electrical equipment are transformers, substations, and electric vaults to name a few. Electricity will travel any conductive path it can as it seeks a ground. A direct path to ground can occur when contact is made between something energized and a portion of your body such as your hand, arm, head, or other body part. An indirect path to ground occurs when you are holding something or touching an object that is in contact with something energized. This could include tools or other equipment you may be holding or when touching a fence, vehicle, or other object that may be in contact with something energized.

ERGONOMIC EVALUATIONS: Assessment of the workplace and tasks performed, specifically paying attention to safety, comfort, ease of use, productivity/performance, and aesthetics in order to improve working conditions and reduce or prevent injuries on the job.

FUME HOODS - These specialized, fixed cabinets contain and draw in contaminants and vent the contaminated air remotely (usually through a stack on the roof of the building). A good supply of properly conditioned makeup air is required so these systems require professional

GALVANIZED DUCTS: Air path to lead out of an enclosed area.

GROUND FAULT INTERRUPTERS (GFCIs): Are designed to protect people from severe or fatal electric shocks. Since a GFCI detects ground faults, it can also prevent some electrical fires and reduce the severity of others by interrupting the flow of electric current.

HAZARDOUS CHEMICAL: A chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees. The term "health hazard" includes chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic systems, and agents which damage the lungs, skin, eyes, or mucous membranes.

HAZARDOUS MATERIALS: A substance, natural or man-made, which is intrinsically dangerous or otherwise poses a safety hazard. Examples are materials which are explosive, poisonous, chemically active (including acids and other corrosives), radioactive, or biologically active (including human blood and other medical waste).

HAZARDOUS SUBSTANCE: Any material that may present a danger to human health and welfare or the environment. This includes hazardous chemicals biohazardous materials, and sources of ionizing radiation.

HAZARDOUS WASTE: A waste with properties that make it dangerous or potentially harmful to human health or the environment and exhibits at least one of the four characteristics: ignitability, corrosivity, reactivity, or toxicity.

HEARING PROTECTION: Devices designed to prevent Noise-Induced Hearing Loss (NIHL), a type of post-lingual hearing impairment.

HEPA FILTER (High Efficiency Particulate Air Filter): A disposable, extended medium, dry type filter with a particle removal efficiency of no less than 99.97 percent for 0.3m particles.

HEPA VACUUM: Contains a special filter that is able to trap very fine dust particles that are too small to see. This type of filter is called a High Efficiency Particulate Air (HEPA) filter.

HIGH VELOCITY STACK FANS: Are ideally suited to exhausting contaminants from ventilation systems where corrosion is also a concern.

HIGHLY TOXIC: Referring to a chemical that

- Has a median lethal dose-LD50 of 50 mg/kg when administered orally to 200-300 g albino rats
- Has an LD50 of 200 mg/kg when administered by continuous contact for 24 hrs on the shaved skin of 2.0-3.0 kg albino rabbits
- Has an LD50 of 200 ppm of volume of gas or vapor, or 2 mg/L of mist or dust, when administered by continuous inhalation to 200-300 g albino rats.

LOCAL EXHAUST VENTILATION: Is a form of engineering control that encloses the material, equipment or process as much as possible and ensures that air flow is into the enclosure at necessary rates.

LOCAL EXHAUST: Protects workers from contaminants as well as excessive heat exposure.

SAFETY DATA SHEET (SDS): A standard formatted information sheet prepared by a material manufacturer, describing the potential hazards, physical properties, and procedures for safe use of a material.

MEDICAL SURVEILLANCE PROGRAM: The process of evaluating the health of employees as it relates to their potential occupational exposures to hazardous agents.

N-95, N-99 NIOSH: National Institute of Occupational Safety and Health, filtering facepieces (N95 or N-99 respirator). Please refer to the Respirator Protection Program for more information.

NOISE ASSESSMENT: EHS will conduct representative noise exposure monitoring according to the Exposure Monitoring Standard Operating Procedures to identify employees in similar exposure groups for inclusion in the Hearing Conservation Program and to enable proper selection of hearing protection devices.

PERSONAL PROTECTIVE EQUIPMENT (PPE): Clothing and other work accessories designed to create a barrier against workplace hazards. Examples include safety goggles, blast shields, hard hats, hearing protectors, gloves, respirators, aprons, and work boots.

SATELLITE ACCUMULATION AREAS: A satellite accumulation area is space within the work area designated for the temporary accumulation and storage of hazardous waste. EHS will collect hazardous wastes from satellite accumulation areas on a routine basis.

XVI. Appendix B: Known or Probable Carcinogens/Highly Toxic Pigments

- antimony white (antimony trioxide) barium yellow (barium chromate)
- burnt umber or raw umber (iron oxides, manganese silicates or dioxide)
- cadmium red or orange (cadmium sulfide, cadmium selenide)
- cadmium yellow (cadmium sulfide)
- cadmium barium colors (cadmium colors and barium sulfate)
- cadmium barium yellow (cadmium sulfide, cadmium selenide, barium sulfate, zinc sulfide)
- chrome green (prussian blue, lead chromate)
- chrome orange (basic lead carbonate)
- chrome yellow (lead chromate)
- cobalt violet (cobalt arsenate or cobalt phosphate)
- cobalt yellow (potassium cobaltinitrate)
- lead or flake white (basic lead carbonate)
- lithol red (sodium, barium and calcium salts of soluble azo pigment)
- manganese violet (manganese ammonium pyrophosphate)
- molybdate orange (lead chromate, lead molybdate, lead sulfate)
- naples yellow (lead antimonate)
- strontium yellow (strontium chromate)
- vermilion (mercuric sulfide)
- zinc sulfide
- zinc yellow (zinc chromate)

XVII. Appendix C: Moderately Toxic Pigments/Slightly Toxic Pigments

- alizarin crimson (lakes of 1,2-dihydroxyanthraquinone or insoluble anthraquinone pigment)
- carbon black (carbon)
- cerulean blue (cobalt stannate)
- cobalt blue (cobalt stannate)
- cobalt green (calcined cobalt, zinc and aluminum oxides)
- chromium oxide green (chromic oxide)
- manganese blue (barium manganate, barium sulfate)
- prussian blue (ferric ferrocyanide)
- toluidine red (insoluble azo pigment)
- toluidine yellow (insoluble azo pigment)
- viridian (hydrated chromic oxide)
- zinc white (zinc oxide)

XVIII. Appendix D: Information for Employees Using Respirators When Not Required Under the OSHA Standard

Respirators are an effective method of protection against designated hazards when properly selected and worn. Respirator use is encouraged, even when exposures are below the exposure limit, to provide an additional level of comfort and protection for workers. However, if a respirator is used improperly or not kept clean, the respirator itself can become a hazard to the worker. Sometimes, workers may wear respirators to avoid exposures to hazards, even if the amount of hazardous substance does not exceed the limits set by OSHA standards. If the employer provides respirators for voluntary use, or if you provide your own respirator, follow the procedures outlined below so that the respirator itself does not present a hazard:

1. Read and heed all instructions provided by the manufacturer on use, maintenance, cleaning and care, and warnings regarding the respirators limitations.
2. Choose respirators certified for use to protect against the contaminant of concern. NIOSH, the National Institute for Occupational Safety and Health of the U.S. Department of Health and Human Services, certifies respirators. A label or statement of certification should appear on the respirator or respirator packaging. It will tell you what the respirator is designed for and how much it will protect you.
3. Do not wear your respirator into atmospheres containing contaminants for which your respirator is not designed to protect against. For example, a respirator designed to filter dust particles will not protect you against gases, vapors, or very small solid particles of fumes or smoke.
4. Keep track of your respirator so that you do not mistakenly use someone else's respirator.

Acknowledgement of Voluntary Use of Filtering Facepiece Respirator

I have read and understand the contents of [29 CFR 1910.134](#), [TTU Respiratory Protection Program](#), and Appendix D (Mandatory) Information for Employees Using Respirators When Not Required Under Standard.

Last	First	T number	Signature	Date

Note: Completed Voluntary Use of Filtering Facepiece Respirator forms should be sent to EHS at sdifurio@ntech.edu or Interoffice Mail at 5041.

XIV. Training documentation for paid employees: Art Safety Manual

It is the responsibility of each Faculty member or Supervisor to ensure that all personnel who work within the art department receive adequate familiarization training on the requirements this Art Safety Manual covers. Each worker must thoroughly understand the rules and regulations associated with this manual before any duties requiring them to come into contact with such materials are assigned to them.

This sheet is to be maintained by the Faculty member or Supervisor. The training documentation must be readily available for regulatory review.

BY MY SIGNATURE BELOW, I ACKNOWLEDGE THAT I AM THOROUGHLY AWARE OF AND UNDERSTAND THE RULES AND REGULATIONS ASSOCIATED WITH THE ART SAFETY MANUAL. FURTHERMORE, I AGREE TO COMPLY WITH THESE RULES IN MY WORKPLACE.

Last	First	T number	Signature	Date

Last	First	T number	Signature	Date