ART SAFETY PROCEDURES

for

Art Schools and Art Departments

By Michael McCann, Ph.D., C.I.H.

Center for Safety in the Arts

Copyright (c) 1992, 1997, 1998 Center for Safety in the Arts

ALL RIGHTS RESERVED. No part of this book may be used or reproduced in any manner whatsoever without prior written permission from the publisher, except for excerpts used in training materials by the purchaser, or in the case of brief quotations embodied in critical reviews and articles. All inquiries should be addressed to: Center for Safety in the Arts, Mailbox 310, 2124 Broadway, New York, Ny 10023.

PRINTED IN THE UNITED STATES OF AMERICA

TABLE OF CONTENTS

PREFACE

Art Safety Procedures for Art Schools and Art Departments developed out of the many industrial hygiene consultationsthat I have carried out for art schools and college and university art departments over the last fifteen years. Usually, I was called in by the Art Department or Art School to make recommendations for ventilation, storage and handling, personal protective equipment, etc.

However, what I almost universally found was a lack of health and safety programs and adequate procedures to make sure that health and safety hazards were identified and corrected on an on-going basis. This included no Material Safety Data Sheets, lack of approval mechanisms for new art materials and processes, lack of emergency procedures, lack of proper supervision of students, no training of students and teachers, etc. Most of these problems were also in violation of various federal and state laws.

As a result, from the beginning, my consultation reports included a preliminary section on general recommendations for a health and safety program and safe procedures. With time, these general recommendations became more extensive as I tried to give art schools and art departments a more comprehensive health and safety program they could adapt to their institution.

I finally decided that with reorganization and expansion, these general recommendations could constitute a separate health and safety manual that could be invaluable to art departments and art schools in setting up their own health and safety programs. Ann Toothaker of the Hudson Mohawk Association of Colleges and Universities was interested in the idea of such a manual for distribution to the various art departments in her Association. She provided some money from her grant from the New York State Department of Labor Occupational Safety and Health Training and Education Program to help develop a manual for New York State colleges in the Hudson Mohawk Valley. This manual is an expanded version of that manual.

Acknowledgments

Many of the chapters in this manual are adapted from various data sheets the Center for Safety in the Arts has produced over the years. In particular, the sections of Chapter 3 discussing the OSHA Hazard Communication Standard were adapted from a data sheet by Christine Proctor, M.S., C.I.H. Much of Chapter 10 on safety was adapted from material written by Angela Babin, M.S., Director of the Art Hazards Information Center of the Center for Safety in the Arts. The sections in Chapters 5 and 10 on waste management, and parts of Chapter 8 on fire safety were also adapted from data sheets co-authored with Angela Babin. I would also like to express my thanks to Ms. Proctor and Ms. Babin for their invaluable assistance in reviewing this manual and catching errors.

CHAPTER 1. INTRODUCTION

Over the last fifteen years, there has been growing concern about the hazards of art materials and processes. In fact, artists, art teachers, and even art students are developing many of the same occupational diseases as are found in industry. Of course this should not be entirely surprising, since artists use many industrial chemicals, often without knowledge of the hazards and how to work safely. These hazards are found in all different types of art media, as shown in Table 1-1, which is reprinted from the second edition of ***Artist Beware*** (Lyons and Burford, Publishers, New York, NY, 1992).

Health and safety hazards in art schools and art programs in colleges and universities have resulted in injuries from fires and from accidents involving machinery, and occupational illnesses from exposure to toxic chemicals or other hazards. In certain cases, fatalities have resulted.

Examples include bladder cancer in painters; lead poisoning in stained glass artists, potters, and enamelists; peripheral nerve damage in commercial artists; emphysema in acid etchers; aplastic anemia and leukemia from use of benzene; severe asthma among users of fiber-reactive dyes; cyanide poisoning and cadmium poisoning in jewelers, kidney damage from cadmium silver solders in jewelers; brain damage in silk screen printers; death of a weaver from anthrax; and metal fume fever in welders.

In addition to possible injuries and illnesses, health and safety problems have legal implications. A variety of laws related to health and safety affect colleges and universities, including the Occupational Safety and Health Act, the Resource Conservation and Recovery Act, state workers' compensation laws, and local fire prevention laws. In addition, students, if injured due to the negligence of the teacher or college, can sue both the teacher and college. These laws are discussed in more detail in Chapter 6.

A formal, effective health and safety program is a proven way to reduce the number of injuries and occupational illnesses. Aside from reducing the serious problems of loss of life and health, a health and safety program can reduce the number of workers' compensations claims and minimize the chance of lawsuits.

An effective health and safety program is also important in accreditation of art schools. The National Association of Schools of Art and Design has made the adequacy of a health and safety program in college and university art departments a major factor in obtaining and keeping accreditation.

Table 1-1. Hazards of Art Techniques

CRAFT	MATERIAL/PROCESS	HAZARD
Batik	wax	fire, wax fumes
	dyeing	dyes
Ceramics	clay dust	silica
	glazes	silica, lead, cadmium, and other toxic metals
	slip casting	talc, asbestiform materials
	kiln firing	sulfur dioxide, carbon monoxide, fluorides, infrared radiation, burns
Electroplating	gold, silver cyanide	cyanide salts, hydrogen
	other metals	acids, electricity
Enameling	enamels	lead, cadmium, arsenic, cobalt, etc.
	kiln firing	infrared radiation, burns
Forging	hammering	noise
	hot forge	carbon monoxide, polycyclic aromatic hydrocarbons, burns
Glassblowing	batch process	lead, silica, arsenic, other metals
	furnaces	heat, infrared radiation, burns
	coloring	metal fumes
	etching	hydrofluoric acid, fluoride salts
	sandblasting	silica
Jewelry	silver soldering	cadmium fumes, fluoride fluxes, burns
	pickling baths	acids, sulfur oxides
	gold reclaiming	mercury, lead, cyanide
Lapidary	gemstones	silica
	grinding	noise, silica
Lithography	solvents	mineral spirits,kerosene, gasoline
	acids	phosphoric, nitric, hydrofluoric acids
	talc	asbestiform materials
	inks	see painting pigments
	photolithography	solvents, dichromates
Lost wax casting	investment	silica
	wax burnout	wax fumes, carbon monoxide
	crucible furnace	carbon monoxide, metal fumes
	metal pouring	metal fumes, infrared radiation, burns
	sandblasting	silica
Neon signs	neon tubes	mercury, electricity,

		ultraviolet radiation, phosphors
Painting	pigments	cadmium, cobalt, lead, manganese, mercury, etc.
	oils, alkyds	turpentine, mineral spirits
	acrylics	trace ammonia, formaldehyde
Pastels	pigment dusts	see Painting pigments
Photography	developing bath	hydroquinone, monomethyl-p-aminophenol sulfate, alkalis
	stop bath	acetic acid
	fixing bath	sulfur dioxide
	intensifier	dichromates, hydrochloric acid
	toning	selenium compounds, hydrogen sulfide sulfur dioxide, etc.
	color processes	formaldehyde, solvents, color developers
Relief printing	solvents	mineral spirits
Screen printing	pigments	see Painting pigments
	solvents	mineral spirits, toluene, xylene
	photoemulsions	ammonium dichromate
Sculpture, clay	see Ceramics	
Sculpture,plastics	epoxy resin	amines, diglycidyl ethers
	polyester resin	styrene, methyl ethyl ketone peroxide
	polyurethane resins	isocyanates, organotin compounds, amines, solvents
Sculpture, stone	marble	nuisance dust
	soapstone	silica, talc, asbestiform materials
	granite, sandstone	silica
	pneumatic tools	vibration, noise
Stained glass	lead came	lead
	soldering	lead, zinc chloride fumes, burns
	etching	hydrofluoric acid, ammonium hydrogen fluoride
Weaving	loom	ergonomic problems
	dyeing	dyes, acids, dichromates,
Welding	oxyacetylene	carbon monoxide, fire and explosion, burns
	arc	ozone, nitrogen dioxide,
	ultraviolet & infrared	radiation, electricity, burns
	metal fumes	copper, zinc, lead, nickel, etc.
Woodworking	machining	toxic wood dust, noise, fire, injuries

	glues	formaldehyde, epoxy
	paint strippers	methylene chloride, toluene, methyl alcohol, etc.
	paints & finishes	mineral spirits, toluene, turpentine, ethyl alcohol, etc.
	preservatives	chromated copper arsenate pentachlorophenol, creosote

Adapted from Artist Beware by Michael McCann (2nd ed., Nick Lyons Books, 1992)

CHAPTER 2. A HEALTH AND SAFETY PROGRAM

GOALS OF A HEALTH AND SAFETY PROGRAM

The ultimate goal of a health and safety program is to reduce or eliminate occupational injuries and illnesses. However this goal, taken by itself, is insufficient. To provide a proper framework there is a need to develop clear and measurable objectives. These objectives then become a basis for assigning activities, allocating staff and funds, communicating information about the program and evaluating the effectiveness of the program.

On this basis, more defined goals of a health and safety program would be: 1) to recognize hazards in the workplace, 2) to evaluate these hazards, and 3) to reduce the hazards to the extent possible. The various activities included in a health and safety program are all intended to effectively carry out the above defined goals.

STRUCTURE OF A HEALTH AND SAFETY PROGRAM

A formal health and safety program must have certain characteristics:

* It must be recognized and supported by top levels of the administration. This is an essential step for the program to compete for funds and staff time, to exert authority and to initiate activities.

* There must be specific individuals designated as responsible for the functioning of the health and safety program and who are accountable for its operation.

* There must be defined, approved activities which are aimed at carrying out the objectives of the health and safety program.

Administrative Support

Without the active support of the administration, a health and safety program is doomed to failure. As mentioned it would not be able to compete for resources or effectively obtain the cooperation of other staff members.

The most important visible step in showing administrative endorsement is the issuing of a policy statement by the Board of Trustees or other governing body of the institution.

The policy statement should formally initiate the health and safety program, give its purpose, name the person responsible for the program, list the program functions, request the cooperation of all personnel, and indicate the Administration's intent to support the health and safety program and its initiatives. This policy statement should be posted and distributed to all personnel. (Figure 2-1 is a prototype policy statement.)

Figure 2-1. Prototype Health and Safety Policy Statement

The President of (college name), with the full endorsement of the Board of Trustees, states that it is the policy of (college name) to ensure that all students and staff have a safe and healthy learning and work environment, and to comply with all applicable safety laws and regulations.

In order to provide and maintain this safe and healthy environment, I am appointing (name, title) as Program Administrator of the Health and Safety Program. The role of the Program Administrator is to assume responsibility for the Health and Safety Program, and to ensure that health and safety needs receive adequate priority in the overall administration of (college name).

It is the policy of (college name) to purchase and use the least hazardous materials and processes available and feasible for intended uses, and to ensure that adequate precautions are taken when needed. We will also provide adequate education and training to all staff working with hazardous materials, in accordance with our Hazard Communication Program. We will also provide adequate education and training to all students in the hazards and precautions of the art materials and processes they will be using.

It is the responsibility of Department Chairpersons and other supervisors to ensure that the Health and Safety Program is properly implemented. It is the responsibility of staff and students to follow safe working procedures, as determined by the Program Administrator.

I urge all employees and students to cooperate in the implementation of this Health and Safety Program. It is my intention to ensure that appropriate measures are instituted to enforce this program.

Signed,

President, (college name)

Responsibility for the Health and Safety Program

A successful health and safety program should have two officers designated to perform distinctly different duties: 1) a Program Administrator, and 2) a Program Director.

The program administrator has to represent and in essence lobby for the program at the top administrative levels and therefore should be a top administrative official, such as a Vice President. Since the health and safety program affects all levels of operation of an institution, it must not be placed under any one organizational line of authority, but must be independent of them.

There should also be someone designated as health and safety program director to implement all the various aspects of the program. Many institutions have a safety officer on staff who may be fulfilling many of these functions. The health and safety program director should have additional knowledge and experience in industrial hygiene.

These two active administrators will require the cooperation of everyone in the institution. The head of a department and other staff members have the responsibility to be alert to health and safety hazards, to inform the program director of these hazards, and to cooperate in the elimination of these hazards.

HEALTH AND SAFETY COMMITTEES

One of the most effective ways to involve others in the health and

safety program is through the formation of a Health and Safety Committee. There could be an institutionwide Health and Safety Committee. For a small art school, this would be sufficient. However, for larger universities with a large staff, it would be advantageous to also form a separate art department Health and Safety Committee to specifically deal with the many hazards found in the various departments. Of course, there should also be a university-wide Health and Safety Committee.

Function

The major purpose of a Health and Safety Committee is to act as a conduit between the staff and the administration. Information on health and safety hazardsaccidents, recommendations, etc. are channeled to the administration from the staff through the Health and Safety Committee. Similarly, health and safety policy, rules, etc. are transferred to the staff via the Health and Safety Committee.

In addition the Health and Safety Committee can participate in many of the activities of a health and safety program, such as inspections, accident investigation, education, developing recommendations, recordkeeping, approving use of new materials, etc.

Composition

A Health and Safety Committee should be representative of all those working in the college or university including teachers, technicians, maintenance, administration, and students as well as people with health and safety responsibilities in the institution. Each committee member should have specific expertise and duties. The health and safety program director and program administrator should also be ex officio members.

The optimum size for a Health and Safety Committee is from 610 people. (In a smaller institution where there are not at least six people available, all the various functions can be performed by a fewer number of persons if need be.) Obviously the amount of time spent on Committee activities will vary from person to person, depending on their job. Health and Safety Committee members should serve staggered terms of membership so that there is continuity of activity. Members should also undergo special training.

Meetings

Health and Safety Committee meetings should be held at least once monthly during regular working hours. Attendance should be mandatory. Formal procedures should be adopted for the meetings and careful minutes kept and posted in a conspicuous spot or sent out prior to the next meeting. Agendas should be drawn up, made public, and followed.

It is crucial that all Health and Safety Committee activities be carefully documented. For example, recommendations for correction of health and safety problems should include what is to be done, by whom and when, how, and why the recommendations are needed. All of this should be in the minutes. This can be important in case of possible legal action, and also to document the effectiveness of the health and safety program.

FUNCTIONS OF A HEALTH AND SAFETY PROGRAM

There are a number of crucial activities that must be carried out in

order to have an effective health and safety program. These are:
* inspections;
* hazard evaluation and control;
* accident/illness reporting and investigation;
* emergency planning;
* education and training;
* medical surveillance; and
* monitoring and evaluation.

Inspections

One of the best ways to identify potential hazards is through regular inspections. Supervisors and staff usually carry out daily, informal inspections noting such problems as spills, failure of a ventilation system, hot plates left on, uncapped containers, etc. Problems that are found should be reported in writing to the Health and Safety Committee. In this way, deficiencies and hazards can be identified and corrected.

However, more formal, periodic (ie. monthly) inspections are also needed. They can be carried out by trained Health and Safety Committee members or health and safety professionals if they exist. Checklists and formalized reports of findings are crucial for these inspections.

Finally, outside professionals should be called in every few years to make an independent survey. This should especially be done if the institutions do not have a professional health and safety staff or if they do not have expertise in a given area, for example industrial hygiene. In some instances this might require specialized techniques such as air sampling.

Some outside organizations that can assist in such surveys are:

* ***State Consultation Plans:*** OSHA funds free consultative services in each state. In many cases these are operated by the state; in others, by universities. They will do an OSHAlike inspection, but they are not an enforcement agency. The only time they would report findings to OSHA would be in the case of imminent danger situations. You must agree, however, to implement their recommendations.

* ***NIOSH Health Hazard Evaluation Program:*** This program is particularly useful where medical problems are occurring and their source is uncertain. NIOSH (National Institute for Occupational Safety and Health) can also provide medical evaluations during such a survey.

* ***Environmental health departments of large universities:*** They are often looking for places where their industrial hygiene students can get experience, and can provide free assistance.

* ***Insurance company loss control programs:*** Many insurance companies will conduct a survey at your institution if you request it. They will usually only pick up on major hazards and it is important that they be told everything you work with since they are often not overly familiar with art materials and processes. (This is also true of many of the other services mentioned.)

* ***Private industrial hygiene firms or consultants:*** These can be good but expensive. The American Industrial Hygiene Association in Akron, Ohio has a list of consultants. I recommend only using firms that have a certified industrial hygienist on staff.

Hazard Evaluation and Control

Once hazardous conditions have been reported, they must be evaluated. Evaluation requires research into the particular hazards. To accomplish this, the institution will need a basic library of health and safety materials related to the chemicals and techniques used in their facilities. The references at the end of this chapter can help in establishing such a library.

Another important resource is a complete and up-to-date file of Material Safety Data Sheets (MSDSs) on all products used. These are obtained from the manufacturer or distributor. (See MSDS section of Chapter 3.)

Once the hazard evaluation step has been carried out, then it is necessary to decide what to do about the hazard. Since there are often a variety of hazards which need control or correction, and limited funds and time available to correct them, it becomes necessary to prioritize the hazards and to develop a timetable for appropriate action. By organizing the hazards according to their potential destructive consequences, it is possible to determine which conditions warrant immediate action, which can take secondary priority, and which can be addressed in the future. Without such a system, there can be no consistent guide for corrective action. Even worse, if time is not taken to rank hazards on a "worst first" priority basis, efforts and resources could be directed towards problems of lower consequence while those with greater potential for destruction will be overlooked.

Accident/Illness Reporting and Investigation

Most places have some sort of reporting mechanism for serious accidents and illnesses. Investigations of the causes of these accidents or illnesses can result in recommendations that can prevent a reoccurrence. However, cut fingers, spills, headaches, eye irritation, dermatitis, and other minor problems are often ignored until more serious manifestations such as a missing finger, fire, liver damage or chemical pneumonia result. If these earlier, minor problems were reported, investigated and their causes corrected, then the more serious problems might have been prevented.

A formal reporting mechanism for all proven and suspect occupational illnesses, accidents and spills, including near misses, should be developed. A report form to be filled out by the supervisor should be provided for this purpose. In some instances the health staff may be the ones to discover problems. In such a case they also should fill out a reporting form.

These reports should go to the Program Director or Health and Safety Committee, which should designate someone to investigate the cause of the problem and to recommend corrective action. The resulting investigative report should be discussed by the entire Committee and its recommendations recorded in the minutes.

Emergency Planning

A major component of any effective health and safety program is a detailed emergency plan. Such emergency plans are required by OSHA and the Environmental Protection Agency, and should cover fire, chemical spills, emergency abort procedures and other contingencies. Chapter 4 of this manual covers emergency procedures.

Education and Training

Education and training is one of the most crucial elements of any health and safety program. Anyone using chemicals or machinery should receive education about the hazards of the chemicals and processes they are using, and training in how to work safely. Education and training is covered in Chapter 3.

Medical Surveillance

A medical surveillance program should be established for staff. This program can involve two aspects: detecting preexisting medical conditions which could put particular individuals at greater risk, and monitoring those exposed to toxic chemicals or harmful physical agents for signs of illness.

Under the Americans with Disabilities Act of 1990 (see Chapter 5), it is illegal to discriminate against qualified job applicants (those meeting the "essential functions" of the job description). Pre-employment physical examinations and questions about disabilities are not permissible, although preplacement medical examinations can be performed after an employment offer has been made to determine pre-existing medical conditions or as baselines to monitor on-going changes, if such exams are given to all applicants. Some OSHA regulations require such medical examinations.

If a pre-existing condition is found, then the ADA would require "reasonable accommodation" to ensure that the person would not be placed

at risk of further damage. For example, a hearing impaired individual might require special measures such as engineering controls or hearing protectors to protect their hearing in a noisy environment that might not be dangerous to non-hearing impaired people.

All individuals hired for a job with high noise exposure, for example, should have a baseline audiogram. Then regular audiometric examinations in this example would help monitor any changes in their hearing status. In fact, this is required by OSHA for exposures over 85 decibels.

Similar types of medical surveillance could be applicable to exposure to lead, cadmium, silica and other chemicals which can cause occupational illnesses, and in some cases are also required by OSHA regulations.

Monitoring and Evaluation of the Health and Safety Program

Monitoring and evaluation of the effectiveness of a health and safety program is essential to ensure that the program is actually carrying out its functions of preventing injuries and illnesses, and to provide objective criteria to prove this to the administration.

Monitoring of a health and safety program is the daytoday review of its progress. This ensures that inspections are being carried out, that accidents and illnesses are properly reported and investigated, that recommendations are actually being carried out on schedule, and that health and safety training is adequate.

The evaluation of a health and safety program is an overall review of the program itself to see that it is functioning properly. Often this is best done by an outside evaluator.

ART DEPARTMENT PROCEDURES

Traditional experimental attitudes on the part of art students and some teachers often create situations with the potential for serious health and safety problems, and the possibility of liability on the part of the school in case of an accident or occupational illness. In order to exert some control over these potentially hazardous situations, but still not stifle student initiative, standard procedures are needed.

Approval Mechanism

The health and safety program director or designee (e.g., health and safety committee) should formally evaluate and approve all proposed changes in art processes and materials to determine if they can be used safely in a particular studio. This includes not only regular course materials, but also individual projects being carried out by students.

Material Safety Data Sheets (MSDSs) should be obtained on all proposed art materials in order to assist in this evaluation. When necessary, outside technical assistance should be obtained to evaluate the safety of a material or process.

Purchase of Art Materials

Whenever possible, art materials should be centrally ordered in order to have control over the ordering process. If individual departments order their own materials, then there should be a central approval mechanism for all new materials, as discussed above.

Material Safety Data Sheets should be obtained from suppliers as a

condition of purchase. For new materials, MSDSs should be obtained in advance in order to evaluate the material for approval. In order to ensure that MSDSs are obtained when needed, the purchase order should contain a box indicating yes or no for MSDS required. Filling out this box by the person requesting the purchase should be mandatory.

Students should only be allowed to purchase art materials on an approved inventory list, unless special documented permission is obtained. MSDSs should be obtained. (See Chapter 3 for more information on MSDSs.)

STUDENT SUPERVISION

Traditionally, art schools have taken a very laissez-faire attitude towards students working after hours on class assignments, and have even encouraged it. In many schools, students have keys and can get into art buildings at any time of the day or night. Unfortunately, this has had serious consequences, including injuries and death.

In addition to the health risks from the art materials, allowing students unlimited access to studios can create other problems. For example, if security personnel are not aware that students are in a building, then these students might not be informed of possible emergencies such as a fire. Unrestricted access has also resulted in vandalism and violent crime.

One of the most important ways to minimize these hazards is for colleges to expand the hours in which studios are supervised (or to close the studios). This would be particularly important for studios such as sculpture and woodworking where extensive safety hazards exist. An alternative, which is used by many universities, is to lock all dangerous equipment after hours.

There are two aspects to the problem of students working unsupervised. First, at what stage of his or her education should an art student be allowed to work unsupervised? Second, what restrictions should apply to protect the student and the university?

Written procedures are needed for evaluating when students are allowed to work unsupervised in regular studios or in individual studio spaces. These procedures should include the experience of the students and the amount of training in safety and emergency procedures necessary for students to work unsupervised. In general, I do not think first or second year students have the experience with art processes to work unsupervised. More advanced students should have at least a 3-hour lecture on art hazards and precautions, along with training in the college's emergency procedures, before being allowed to work unsupervised.

There are two major restrictions that should apply to working unsupervised. First, no one should be allowed to work alone, in case of emergencies. Second, there should be restricted access. Students should not have keys. Instead, there should be a sign-in and sign-out procedure with regular checks by security. Methods of indicating who is approved to work unsupervised could include a pass system or list of approved students available to the guards. Such a check-in system is also important to allow emergency personnel to know who is inside a building in case of emergency.

Safety Procedures for Individual Studios

Many art schools have individual studios or group studios for senior students or graduate students. Written safety procedures, including penalties for noncompliance, should be developed for such studios. These

rules should include what materials can be used (which can depend on the ventilation), no smoking, drink or food in studios, etc. Students should have to sign a contract agreeing to these rules in order to be assigned a studio. Enforcement procedures should be developed, including possible loss of studio privileges.

Similar procedures should be developed for students working unsupervised in regular classroom studios.

ART DEPARTMENT HEALTH AND SAFETY MANUAL

The art department should develop its own health and safety manual and distribute it to all employees and students.

The health and safety manual should include at least the following topics:

* the administration's health and safety policy statement;
* roles and responsibilities of health and safety personnel and the health and safety committee;
* procedures for ordering materials;
* a formalized inspection program;
* safe working procedures for standard activities;
* proper waste management procedures
* emergency procedures;
* a list of mandatory safety rules and penalties for noncompliance;
* accident/illness reporting procedures; and
* procedures for obtaining safety information and equipment.

Many of the sections in this manual could become part of the art department health and safety manual.

REFERENCES

1. A. M. Best Company. (1990). ***Best's Safety Directory***. two volumes. Oldwick, NJ. Updated regularly.

2.American Conference of Governmental Industrial Hygienists. (1992). ***Threshold Limit Values for Chemical Substances and Physical Agents in the Work Environment***. ACGIH, Cincinnati, OH.

3. American Mutual Assurance Alliance. (1986). ***Handbook of Organic Industrial Solvents***. 6th edition, Chicago, IL.

4. Clark, N., Cutter, T., and McGrane, J. (1984). ***Ventilation***. Lyons and Burford, Publishers, New York, NY. *

5. Hawley, G. (Ed.) (1981). ***The Condensed Chemical Dictionary***. 10th ed., Van NostrandReinhold, New York, NY.

6. Lewis, R.J. (1992). ***Sax's Dangerous Properties of Industrial Materials***, 3 volumes. 8th ed. Van Nostrand Reinhold, New York, NY.

7. McCann, M. (1992). ***Artist Beware***. 2nd ed., Lyons and Burford Publishers, New York, NY. *

8. National Institute for Occupational Safety and Health. (1990). ***NIOSH Pocket Guide to Chemical Hazards***. DHHS (NIOSH) Publication No. 90-117. Government Printing Office, Washington, DC. Updated regularly.

9. National Institute for Occupational Safety and Health. (1979). ***Occupational Safety and Health in Vocational Education***. DHEW (NIOSH) Publication 79-138. DHEW (NIOSH), Cincinnati, OH.

10. Occupational Safety and Health Administration. (1989). ***General Industry Occupational Safety and Health Standards. 29 CFR 1910***. U.S. Department of Labor, Washington, DC.

11. Patty, F. (Ed.) (1982). ***Industrial Hygiene and Toxicology. Vol. II***, 3 parts. 3rd ed., Interscience Publishers, New York, NY.

* These are available from the New York Committee for Occupational Safety and Health.

CHAPTER 3. HAZARD COMMUNICATION

The OSHA Hazard Communication Standard (29 CFR 1910.1200) applies to all employees in the United States who are exposed or potentially exposed to hazardous substances at their workplace. The purpose of the Hazard Communication Standard is to ensure that the hazards of all chemicals produced or imported are evaluated, and that information concerning their hazards is transmitted to employers and employees by means of comprehensive hazard communication programs. Such hazard communication programs must include container labeling and other forms of warning, material safety data sheets and employee training.

WHO IS COVERED

Because OSHA's provisions do not apply to state and local governments in their role as employers, public employees such as state college teachers are not covered by the Hazard Communication Standard unless they work in a state with an OSHA-approved state plan. For example, New York has an approved state plan that covers public employers, such as state colleges, called Public Employee Safety and Health (PESH). Private colleges are covered under federal OSHA.

The 26 States and 2 Territories with their own OSHA-approved occupational safety and health plans must adopt a comparable standard within 6 months of the publication date of a final standard. These states and territories include: Alaska, Arizona, California, Connecticut*, Hawaii, Indiana, Iowa, Kentucky, Maryland, Michigan, Minnesota, Nevada, New Jersey*, New Mexico, New York*, North Carolina, Oregon, Puerto Rico, South Carolina, Tennessee, Utah, Vermont, Virgin Islands, Virginia*, Washington, and Wyoming. (* These state plans cover public sector employees only.) Federal workers are covered under executive order.

The Hazard Communication Standard preempts all state (in states without OSHA-approved job safety and health programs) or local laws which relate to an issue covered by the federal standard. The only state worker right-to-know laws authorized would be those established in states and jurisdictions that have OSHA-approved state programs, for example, New York.

WHAT IS COVERED

A chemical is considered hazardous by OSHA if it poses a physical or health hazard. Health hazards may include both acute and chronic health effects. Physical hazards include combustible liquids, compressed gases, explosives, flammables, organic peroxides, oxidizers, pyrophorics, and unstable or water-reactive chemicals. The burden of evaluating chemicals to determine whether they are hazardous remains on the chemical manufacturers and importers who produce or import such chemicals.

Certain products are not covered under the Hazard Communication Standard, including hazardous waste, wood or wood products, articles (defined as manufactured items), foods, drugs, or cosmetics intended for personal consumption in the workplace, and any consumer product or hazardous substance as defined by the Consumer Product Safety Act and

Federal Hazardous Substances Act that is used in the workplace in the same manner as normal consumer use.

Although wood and wood products are exempted from the requirements of the standard, wood dust is not exempted, and is considered a "hazardous chemical".

WORKPLACE INVENTORY

The first step in developing a hazard communication program is to assemble an inventory of all hazardous substances present in the workplace. Material Safety Data Sheets should be obtained for all products with warnings of any type on the label. The inventory list should include the product name, the manufacturer, hazardous components, and location where the product is used or stored. The type of hazard (fire, health, etc.) and the amount of the product would also be useful information for the inventory. This inventory should be updated annually.

LABELS

Containers must be labeled with the identity of the hazardous chemicals and provide hazard information in the form of words, pictures, symbols or a combination thereof. The purpose of the label is to serve as an immediate visual warning of the chemical hazards in the workplace.

Certain products or chemicals are exempt from labeling requirements if they are labeled in accordance with other Federal regulations and include pesticides and consumer products.

If chemicals are dispensed from a large container into a smaller container, the new container must be labeled (unless it would be used up in one day).

MATERIAL SAFETY DATA SHEETS

The college must obtain Material Safety Data Sheets (MSDSs) on all hazardous products. These MSDSs are produced by the manufacturer or importer of a hazardous product. MSDSs are not required for non-hazardous products, although many manufacturers of art materials provide MSDSs for their nonhazardous products, with a statement saying the product is nonhazardous. The manufacturer must provide distributors and other customers with MSDSs, upon first purchase of a hazardous product, and if the MSDS changes. Distributors of hazardous chemicals must automatically provide MSDSs to commercial customers, including colleges.

MSDSs should be stored centrally, as well as in the area where the product is used. I recommend storing the MSDSs in a three-ring binder for easy access.

SARA and MSDSs

Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA) also requires employers covered by the Hazard Communication Standard to maintain MSDSs and submit such information to State emergency response commissions, local emergency planning committees, and local fire departments if the chemical is present in excess of reporting thresholds (see the SARA section of Chapter 5). This provides information to fire

departments and the community in case of fire and other emergencies.

The reporting thresholds are 10,000 pounds for chemicals not on the Extremely Hazardous Substance List, and 500 pounds or the threshold planning quantity (TPQ), whichever is lower, for chemicals listed as Extremely Hazardous Substances (EHS), as reported in the Federal Register, April 22, 1987 (52 FR 13378). The only chemicals on the Extremely Hazardous Chemical List likely to be found in Art Departments in excess of the reporting thresholds are sulfuric acid and nitric acid. The reporting threshold for each of these is 500 pounds (approximately one 55-gallon drum). If an EHS is present in greater quantities than its TPQ (1000 pounds for each), then the college has to cooperate with local emergency authorities in emergency planning under section 303 of SARA, as well as more detailed inventory reporting under section 312 of SARA. Note that the total amount any EHS on the campus has to be counted in determining whether the reporting threshold has been reached, not just the amount in the Art Department.

Understanding MSDSs

OSHA has a standard MSDS format. Manufacturers are not required to use this format as long as all the required information is present. The MSDS must be in English and must have no blank spaces.

The following gives information on what should be contained in the various sections of a MSDS:

Identity

The identity of the product should be the same name as found on the product label.

Section I

The MSDS must have the name, address, and telephone number of the chemical manufacturer, importer, employer or other responsible party preparing the MSDS who can give further information on the product hazards and emergency procedures. It must also give the date of preparation of the most recent version.

Section II - Hazardous Ingredients/Identity

Information: This must include the chemical and common names of hazardous ingredients. For mixtures that have been tested as a whole, only the ingredients found to be hazardous must be listed. If the mixture has not been tested, all toxic ingredients at a concentration greater than 1% must be listed, as well as all carcinogenic ingredients at concentrations over 0.1%.

Materials are considered hazardous if they are listed in OSHA's Z list (29 CFR 1910, Subpart Z, Toxic and Hazardous Substances), if the American Conference of Governmental Industrial Hygienists has assigned a Threshold Limit Value (TLV) to the material, or if it has been found to be toxic, carcinogenic, irritating, sensitizing or damaging to certain body organs. The MSDS does not have to list the percentage concentration of each ingredient.

This section must also have the OSHA Permissible Exposure Limit (PEL), the ACGIH Threshold Limit Value (TLV) or any other exposure limit used by the manufacturer.

The one exception to listing the chemical names or common names of hazardous ingredients, according to OSHA, is if the manufacturer claims, and is able to document, that it is a trade secret. In this case, the manufacturer must state on the MSDS that the identity of the ingredients is a trade secret.

Section III-Physical/Chemical Characteristics: This section should include information on boiling point, vapor pressure, vapor density, solubility in water, specific gravity, percent volatile, evaporation rate and appearance and odor. Sometimes the pH is included for aqueous solutions.

Section IV - Fire and Explosion Hazard Data: This section has information on the flammability of the product, on types of fire extinguishers needed, and on other special precautions. This data is important when planning for emergencies.

Section V - Reactivity Data

This section tells you about the product's compatibility with other

chemicals, and special conditions to avoid. The stability of the product indicates whether the product can decompose and what conditions can do this. The incompatibility section tells you what chemicals can react with the product. This section is very important in determining what materials you should not store near this product. Hazardous decomposition products tells you what hazardous chemicals can be produced when the product is heated or burned. The hazardous polymerization section tells you whether the product can polymerize, and what conditions can cause this.

Section VI - Health Hazard Data

This section should tell you the routes (skin contact, inhalation, ingestion) by which the product can affect you, the symptoms of overexposure, acute and chronic health effects, emergency first aid measures, and carcinogenicity. If the product, or chemicals in the product, has been found to be a carcinogen or probable carcinogen by the International Agency for Research on Cancer (IARC) or OSHA, or is listed in the National Toxicology Program (NTP) ***Annual Report on Carcinogens***, then the MSDS must state so. It should also list medical conditions which could be aggravated by exposure to the product.

Section VII - Precautions for Safe Handling and Use

This section covers such topics as spill control, waste disposal, storage and handling precautions, and other special precautions such as personal protective equipment needed for spills. Unfortunately, the section on waste disposal often just says dispose of according to local, state and federal regulations.

Section VIII - Control Measures

This section should give you a lot of information about respirators, ventilation and other personal protective equipment, but often doesn't. The respirator recommendations should state what type of cartridge should be used. The ventilation section should tell you whether general mechanical ventilation (dilution ventilation) is sufficient, or if local exhaust ventilation is recommended, and if so, what type. This section should also list other recommended personal protective equipment such as gloves, goggles and protective clothing. Unfortunately most MSDSs do not tell you what type of glove to use.

SIGNS

Signs are a useful adjunct to other hazard communication methods. Signs can be used in a given area to describe normal procedures, for example, how to use a given piece of equipment, or for restrictions, for example, that solvents should not be used in a glaze spray booth. Some OSHA standards also require warning signs on rooms restricting access, for example with certain carcinogens.

Another major purpose of signs is for emergencies. Signs should be used to indicate the location of emergency equipment such as fire extinguishers, emergency showers and eyewash fountains. In addition, signs are required for emergency procedures, such as evacuation in case of fire or spills.

TRAINING AND EDUCATION

Under OSHA's Hazard Communication Standard, education and training must be provided to the employee at the time of the initial work

assignment, whenever a new hazard is introduced into the work area, or when new information becomes available.

Employees must be given information on the following topics:

* discussion of employee rights and employer responsibilities under the OSHA Hazard Communication Standard;
* location and employee access to the written Hazard Communication Program, including any inventory lists of hazardous chemicals;
* location and employee access to MSDS collections;
* instructions in the use and interpretation of product labels and MSDSs; and
* operations in the work area where hazardous materials are present.

The training requirements must include detailed information on hazardous materials stored or used in their workplace, including:

* methods and observations employees can use to detect the presence or release of hazardous chemicals (e.g. appearance, smell, monitoring);
* the physical and health hazards of hazardous materials present in the workplace; and
* measures employees can take to protect themselves, including appropriate work practices, emergency procedures, and personal protective equipment.

Student Training

Although the Hazard Communication Standard requires only training of employees, I recommend that students also receive training in the hazards of art materials and suitable precautions. Besides protecting students, this training is also essential for liability reasons.

First year students should receive a hazard awareness lecture to alert them to potential hazards and suitable precautions. A more detailed course at this level is not likely to be effective since most of the students will not have much experience with the art materials and processes. A more detailed course - approximately 1520 hours in length - could be given at a more advanced level.

Students should be tested in writing on their knowledge of health and safety, and copies of these tests kept for documentation.

Training Programs

The Center for Safety in the Arts had a variety of educational programs aimed at providing this training, including 1) a 2-3 hour awareness lecture, 2) full day training workshops, and 3) 18-hour courses on art hazards. These are available independently by CSA staff. For further information write CSA or visit the CSA web site.

In addition, CSA has available a two-hour videotape on art hazards entitled Art Safety: Hazards and Precautions, which can be used for training students and staff.

CSA has a wide variety of written materials on art hazards which can be used in training, including the new second edition of Dr. McCann's book *Artist Beware*.

Art Hazards News is a newsletter published by the Center for Safety in the Arts which provided up-to-date-information on hazards, precautions, regulations, lawsuits, etc. that are related to art hazards. There are four 8-page issues and one 24-page Resource Issue annually.

CSA also has consultative and other programs for Art Departments of colleges and universities. (See Appendix 1.)

WRITTEN HAZARD COMMUNICATION PROGRAM

A written hazard communication program must be developed and implemented for each workplace. This written program must describe how the Hazard Communication Standard will be implemented in your workplace. This written program must be available to employees, designated representatives of the employees, and OSHA and NIOSH (National Institute for Occupational Safety and Health). Employers must establish an information and training program for employees exposed or potentially exposed to hazardous chemicals.

This written hazard communication program must include the following:

* description of hazard determination procedures;
* description of labeling procedures;
* description of MSDS collection and review procedures;
* description of employee information and training programs;
* description of methods to be used to exchange MSDSs and information concerning labeling and work practices with other employers at the worksite; and
* listing of all hazardous chemicals known to be present in the workplace.

Figure 3-2 is a sample written Hazard Communication Program which could be adapted to the needs of individual colleges.

Figure 3-2. Sample Written Hazard Communication Program

NOTE: The written program must include the specific methods that are used to achieve compliance with the requirements of the Hazard Communication Standard (29 CFR 1910.1200). The specific methods described in this sample written program are for illustrative purposes, and other effective methods may be substituted to satisfy local needs or practices.

I. General

The purpose of this instruction is to ensure that (college name) is in compliance with the OSHA Hazard Communication Standard (HCS) 29 CFR 1910.1200.

(name, title) is the overall coordinator of the Hazard Communication Program, acting as the representative of the Health and Safety Program Administrator, who has overall responsibility.

In general, each employee will be informed of the substance of the HCS, the hazardous properties of chemicals they work with, and measures to protect themselves from these chemicals.

II. List of Hazardous Chemicals

The (title) will maintain a list of all hazardous chemicals used in the facility, and update the list as necessary. The hazardous chemical list will be updated upon receipt of hazardous chemicals at the facility. The list of hazardous chemicals is maintained at (location).

III. Material Safety Data Sheets (MSDSs)

The (title) will maintain an MSDS library on every product containing a substance on the list of hazardous chemicals. This MSDS library will be located in the (location). The MSDS will consist of a fully completed OSHA Form 174 or equivalent. The (title) will ensure that each work area maintains an MSDS for hazardous materials used in that area. MSDSs will be readily available to all employees.

The (title) is responsible for acquiring and updating MSDSs. The (title) will review each MSDS for accuracy and completeness, and will consult with the Health and Safety Program Administrator if additional research is necessary. All new products procured for the facility must be approved by the Program Administrator or his or her designee(s). Whenever possible, the least hazardous substance will be used.

MSDSs that meet the requirements of the HCS must be fully completed and received at the facility either prior to, or at the time of receipt of the first shipment of any potentially hazardous chemical purchased from a vendor. It may be necessary to discontinue procurement from vendors failing to provide approved MSDSs in a timely manner.

IV. Labels and other Forms of Warning

The (title) is designated to ensure that all hazardous chemicals in the facility are properly labeled. Labels should list at least the chemical identity, appropriate hazard warnings, and the name and address of the manufacturer, importer or other responsible party. The (title) will refer to the corresponding MSDS to verify label information. Immediate use containers, small containers into which materials are poured for use on that shift by the employee drawing the material, do not require labeling. To meet the labeling requirement of HCS for other in-house containers, refer to the label supplied by the manufacturer. All labels for in-house containers will be approved by the (title) prior to their use.

The (title) will check monthly to ensure that all containers in the facility have up to date labels.

V. Training

Each employee who works with or is potentially exposed to hazardous chemicals will receive initial training on the HCS and the safe use of those hazardous chemicals. Additional training will be provided for employees whenever a new hazard is introduced into their work areas. Hazardous chemical training is conducted by (title). (Attach a copy of course outline, training schedules, and a description of course materials).

The training will emphasize these elements:

* a summary of the standard and this written program;
* hazardous chemical properties including visual appearance and odor and methods that can be used to detect the presence or release of hazardous chemicals;
* physical and health hazards associated with potential exposure to workplace chemicals;
* procedures to protect against hazards, e.g., personal protective equipment, work practices, and emergency procedures;
* hazardous chemical spill and leak procedures; and
* where MSDSs are located, how to understand their content, and how employees may obtain and use appropriate hazard information.

The (title) will monitor and maintain records of employee training and advise the facility manager on training needs.

VI. Contractor Employers

All outside contractors must notify the Health and Safety Program Administrator, or his or her designee, in advance of proposed activities. If these activities will involve the use of hazardous products, the contractor must provide MSDSs.

The (title), upon notification of proposed activities, will advise contractors of any chemical hazards which they may encounter in the normal course of their work on the premises.

VII. Non-Routine Tasks

Any supervisor contemplating a non-routine task, e.g. boiler repair, will consult with the (title), and will ensure that employees are informed of chemical hazards associated with the performance of these tasks and appropriate protective measures. This will be accomplished by a meeting of supervisors and the Health and Safety Program Administrator, or his or her designee, with affected employees before such work is begun.

VIII. Additional Information

Further information on this written program, the hazard communication standard, and applicable MSDSs is available at (location & telephone no.).

REFERENCES

1. Accrocco, J.O. (1988). ***The MSDS Pocket Dictionary***. rev. Genium Publishing Company, Schenectady.

2. Occupational Safety and Health Administration. (1985). ***Hazard Communication. 29 CFR 1910.1200***. U.S. Department of Labor, Washington, DC.

CHAPTER 4. EMERGENCY PROCEDURES

Emergency procedures are a major, neglected area in many colleges. However, they are essential. If written emergency procedures are not developed beforehand, then someone is going to have to develop them on the spot in an emergency, a situation not to be recommended.

Most colleges have emergency plans in case of fire because of the grave threat to both occupants and property. However there are many other types of emergencies which can require evacuation or other emergency procedures. These include natural disasters such as floods and hurricanes, electrical failure, sprinkler leakage, bomb threats, chemical contamination, medical emergencies, etc. In addition, art departments can have emergencies such as toxic chemical spills, fires and explosions, and personal injuries from accidents involving machinery.

Whether the emergency emanates from an art studio or in an unrelated section of the college, the art department staff must be able to safely shutdown any process at any point and prepare to evacuate the building. Failure to have preplanned emergency abort procedures for such processes as a foundry pour, for example, could result in a more serious emergency than the original one.

GENERAL EMERGENCY PROCEDURES

OSHA requires that all employers have written emergency action plans. According to 29 CFR 1910.38(a)(2), the emergency action plan must, at a minimum, contain the following elements:

* emergency escape procedures and escape route assignments;
* procedures to be followed by employees who remain to perform (or shut down) critical processes before they evacuate;
* procedures to account for all employees after emergency evacuation has been completed;
* rescue and medical duties for those employees who are to perform them;
* preferred means for reporting fires and other emergencies; and
* names or regular job titles of persons or departments to be contacted for further information or explanation of duties under the plan.

The plan developed must cover the college as a whole, as required by OSHA regulations. The art department, however, because of the special hazards found there, needs to develop its own emergency procedures which should be incorporated into the overall college emergency plan.

There are three main steps involved in the preparation and implementation of an emergency plan: 1) planning and documentation of such, 2) training, and 3) periodic drills. All three of these are crucial if the emergency plan is going to work as intended.

Planning

The effectiveness of the emergency plan will depend primarily on the amount of planning. The first step of the planning stage involves identifying all the potential emergencies that could develop. Next, procedures must be developed which will be followed in case of an emergency. In particular, this involves establishing a chain of command, and assigning particular roles to employees, and developing the following procedures:

* an adequate emergency communications system of alarms and notifications;
* a detailed evacuation procedure;
* shutdown procedures; and
* procedures for meeting other types of emergencies.

It is important to involve all employees in this planning process in order to ensure maximum effectiveness of the final emergency plan.

Role of Staff

The emergency plan, when formulated, will rely on various staff members to form Emergency Teams and carry out the various emergency procedures developed. An Emergency Coordinator should be appointed to coordinate the work of the Emergency Teams.

The duties of this coordinator include:

* assessing possible emergencies to determine the response needed;
* directing the emergency response effort;
* calling in outside emergency services such as the fire department and medical aid as needed;
* directing shutdown of the college when necessary; and
* directing/determining safe reentry or other postemergency procedures.

Since the role of the Emergency Coordinator is so crucial, it is essential that a backup coordinator be appointed. In addition there must be adequate trained personnel for the Emergency Teams themselves so that trained teams are always available.

Depending on the size of the college there may be more than one team trained for various types of emergencies. Possible areas in which teams have to be trained include:

* use of various types of fire extinguishers;
* first aid, including cardiopulmonary resuscitation (CPR);
* shutdown procedures;
* evacuation procedures;
* chemical spill control procedures;
* use of selfcontained breathing apparatus (SCBA); and
* search and emergency rescue procedures.

Obviously many of the emergency functions would be college-wide rather than specific to the Art Department. First aid and evacuation procedures, for example, are often assigned to security staff since they are wellacquainted with the buildings and all their exits. In addition they are usually readily available in case of emergency.

In some instances, security guards might also be trained in emergency search and rescue procedures, although this is often left to police or firefighters. This might be particularly important when students or staff with disabilities need to be evacuated (e.g., people in wheelchairs or with disabling diseases such as severe emphysema). Of course, if security guards are going to have expanded roles beyond their original guard duties, then the increased responsibility must be accompanied by more careful recruiting, more training, and even higher pay scales.

In all these situations, it is important that members of Emergency Teams be able to determine when not to intervene. They must be trained to recognize when a fire or other emergency is beyond their capability to handle. If there is a chance that team members might receive fatal or disabling injuries, they should wait for professional firefighters or emergency response teams.

In many instances, especially in small colleges, it might not be practical to have Emergency Teams for all these emergencies, and instead they should rely on outside help, for example, Fire Department HazMat Teams.

Communications

There are three groups of people who need alerting in case of an emergency: employees and others in the college; Emergency Teams; and special groups of people outside the college.

Alarm system: An alarm system is needed to alert people inside the

building as to the emergency and the need for evacuation. OSHA regulations (29 CFR 1910.165) requires that alarm boxes be available within a travel distance of 200 feet. Recommended alarm systems include supervised telephone, manual fire alarm, or pull box stations with paging systems to transmit messages throughout the building. Special alarm systems connected to smoke detectors, sprinkler systems, ventilation systems or the like can also be part of the overall alarm system. In addition, special alarms to alert visually or hearing impaired individuals should be considered. Note that these alarm systems should have an independent power supply in case the emergency affects the electrical system.

The alarm system must be distinctive so that employees will easily recognize it and respond quickly. In addition, each employee should be informed as to the proper procedures for reporting emergencies.

Emergency communications system: This is needed for the Emergency Teams. Portable radio units are the best for this. The office of the Emergency Coordinator should serve as the headquarters for coordinating emergency efforts. In case of evacuations, the reporting area for evacuees might be the best location for an alternate headquarters for quickness of communications.

Outside notification: There are a number of people outside the college who should be notified in case of emergencies. In some instances colleges choose to connect alarm systems to a central facility such as the guard station and whoever is on duty there has the responsibility to notify the appropriate outside people. An uptodate, written list of key personnel to be notified in order of priority must be easily accessible.

One such group consists of local authorities such as the fire department, police department, Health Department, OSHA, and other emergency services. Where appropriate, alarm systems should be directly connected to appropriate authorities. The other group that might need notifying would include top college administration officials, staff physician, and other offduty essential personnel.

Evacuation Procedures

Emergency evacuations should be considered even as the building is planned and built. At this time, the proper number of exits and routes should be incorporated into the building. The Life Safety Code and OSHA regulations specify building construction, numbers, locations and sizes of exits, access to exits, marking of exits, etc. (29 CFR 1910.36 and 1910.37). (See Chapter 10.)

The essence of the regulations are that repetitive and wellmarked exit routes be provided for each and every building occupant. While OSHA regulations do not cover students or visitors, they must be considered an additional dimension to the evacuation problem.

Evacuation routes should be clearly identified for each working location. Floor plans showing evacuation routes and any safe areas should be included in the plan and also located in visible spots throughout the building.

The crucial factor in planning evacuation routes and procedures is getting everyone out of the building in the shortest time possible.

The plan should include descriptions of particular duties assigned to employees including those needed to:

* maintain essential services;
* assist evacuation;

* count staff;
* check for total evacuation; and
* attend to any first aid needs.

Special attention has to be given to the problem of evacuating persons with disabilities. This not only includes the obvious examples of disabilities such as people in wheelchairs, and visually and hearing impaired persons, but also people with less obvious mobility impairments such as severe emphysema, heart problems, or advanced age. Such people might not be able to move fast enough on their own to leave the building in a short enough period of time. Procedures for evacuation of persons with disabilities might include training of security guards in moving people in wheelchairs, provision of safe areas to wait for evacuation assistance, etc. The emergency coordinator should have knowledge of the locations of disabled employees and students.

Training

Without proper training of all employees about emergency procedures, the emergency plan remains just a piece of paper. There are several levels of training required. All employees and students should receive training in how to report an emergency, how to recognize emergency communications, and how to escape. Depending upon the nature of the emergency plan, all, some or no employees will receive training in how to use fire extinguishers and how to give emergency first aid.

Emergency Teams will receive specialized training depending upon the nature of their assignment. In particular, personnel responsible for responding to chemical spill and leak emergencies will require specialized training in the proper selection and use of such personal protective equipment as face and eye protection, gloves, whole body suits, and selfcontained breathing apparatus (SCBA). Insufficient training in the use of personal protective equipment could result in severe injuries or even fatalities to Emergency Team personnel in actual emergencies.

Training needs to be done at the following times:

* when the emergency plan is first developed;
* when it is updated;
* when new equipment, materials or processes are introduced;
* for all new employees, or if an employee gets new duties;
* if drills indicate the need for further training; and
* at least annually.

While some of the above mentioned training can be provided by supervisory staff (e.g. drill procedures), certain areas require outside personnel to properly and effectively carry out training programs (e.g. use of SCBA gear).

Drills

Rather than wait for an actual emergency to test the effectiveness of an emergency plan, regular drills should be instituted. Fire drills are the classic form of emergency drill. These should be carried out semiannually and only a few crucial individuals such as the Emergency Coordinator, the chief of Security and the college president should know about the drill in advance. The fire drill should also be held in conjunction with your local fire department.

It is essential that all staff and students participate in the drill and this should be enforced by college administrators. If the college has

certain activities that go on that should not be disrupted except in an actual emergency, then possibly advance warning could be given that an emergency drill will be held during a certain period (e.g. a week). During this period, no crucial activities should take place that could not be interrupted so as to ensure that all personnel participate in the drill. Note that special drills might be necessary to practice shutting down these special activities in case of an actual emergency.

A fire drill is the most common type of emergency practice. However drills for other types of emergencies, such as a medical emergency, chemical spill or leak of toxic gas should also be instituted. In many cases these would not involve evacuation so that there would be minimal disruption of college activities.

Evaluation

Once the drill is completed, an evaluation of its effectiveness must be carried out. Critical areas for evaluation include number of people evacuated, number of people left inside the building and unaware of the drill, and people "late" in leaving the building (i.e. past the evacuation time goal). Comparisons of average and slow evacuation times are useful for replanning evacuation routes.

FIRE EMERGENCIES

Fire prevention plans shall contain the following minimum elements, according to 29 CFR 1910.38(b):

* a list of major workplace fire hazards and their proper handling and storage procedures, ignition sources, and control procedures; and
* names of job titles of personnel responsible for maintaining fire control procedures and equipment

The fire control plan shall also cover housekeeping procedures, training and maintenance. Fire safety is discussed in detail in Chapter 8.

REGULATIONS FOR SPILLS AND LEAKS

Spills and leaks of chemicals can create significant fire and health risks. The Occupational Safety and Health Administration (OSHA), under its Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120), requires schools, colleges and other employers to develop procedures for emergency response to spills and leaks. Employers who do not operate an EPA or state-permitted hazardous waste treatment, storage and disposal facility must comply only with paragraph (q) of this standard.

Section 304 of the Superfund Amendments and Reauthorization Act (SARA) has emergency notification of various emergency authorities in cases of releases of toxic chemicals into the environment in excess of reportable quantities.

In addition, RCRA requires large and small quantity generators to appoint an emergency coordinator who is present or on call, and the development of an emergency/contingency plan in case of spills or leaks of hazardous waste that could expose the public or contaminate the environment (40 CFR 262.34). The emergency plans developed in this

section could fulfill this requirement.

OSHA Definition of Emergency Response

According to paragraph (a)(3) of the OSHA standard (29 CFR 1910.120), an "Emergency Response" means "a response effort by employees from outside the immediate release area or by other designated responders (e.g., mutual-aid groups, local fire departments, etc.) to an occurrence which results, or is likely to result, in an uncontrolled release of a hazardous substance. Responses to incidental releases of hazardous substances where the substance can be absorbed, neutralized, or otherwise controlled at the time of release by employees in the immediate release area, or by maintenance personnel are not considered to be emergency responses within the scope of this standard. Responses to releases of hazardous substances where there is no potential safety or health hazard (i.e., fire, explosion, or chemical exposure) are not considered to be emergency responses."

Procedures for non-emergency spills and leaks, as defined above, are discussed in a later section.

Emergency Response Plan

Paragraph (q) of this standard requires employers to develop a written emergency response plan. This plan shall address the following points, unless already covered in the Emergency Action Plan (29 CFR 1910.38):

* pre-emergency planning and coordination with outside parties;
* personnel roles, lines of authority, training, and communication;
* emergency recognition and prevention;
* safe distances and places of refuge;
* site security and control;
* evacuation routes and procedures;
* decontamination;
* emergency medical treatment and first aid;

* emergency alerting and response procedures;
* critique of response and follow-up; and
* personal protective equipment and emergency equipment.

If the employer has a policy of immediate evacuation of their employees from the danger area when an emergency occurs, and does not permit any of their employees to assist in handling the emergency, then they are exempt from the requirements of paragraph (q), provided they have an emergency action plan in accordance with CFR 1910.38(a). This emergency action plan should include procedures for small spills that can be cleaned up quickly, how to recognize and report spill emergencies, and immediate evacuation of all employees for larger, dangerous spills. Employees who might discover or witness a spill or leak should have first responder awareness training (see below).

Emergency Notification Under SARA

If a spill or leak into the environment has the potential to expose the public, and if the size of the spill is in excess of SARA reportable quantities for the chemical, then section 304 of SARA requires emergency notification of appropriate authorities. If there is a toxic release of a

chemical on the CERCLA list in excess of the reportable quantity for that chemical, then the National Response Center must be notified (Telephone 800/424-8802). The National Response Center must also be notified if the spill involves hazardous waste. If the chemical is listed by SARA as an Extremely Hazardous Substance (EHS), then local emergency authorities (the local emergency planning committee and the state emergency planning committee) must also be notified.

Table 4-1 lists chemicals that might be found in Art Departments in excess of reportable quantities, and could be involved in a spill or leak into the environment. Note that some states or municipalities might have more stringent reporting requirements.

In cases of such a reportable release of a toxic substance into the environment, the emergency notification must include:

* the name of the chemical;
* an indication of its hazardous quality;
* an estimate of the amount released into the environment;
* the time and duration of the release;
* an estimate of the quantity released;
* the medium into which the release occurred;
* health hazard information on the chemical;
* evacuation procedures;
* name and telephone number of a contact person; and
* a written follow-up notice including response action, anticipated health hazard data, and medical advice for exposed individuals.

Table 4-1. Reportable Quantities (RQ) for Certain Chemicals Under Section 304 of SARA.

Chemical	**RQ (lbs.)**	**EHS**
Ammonia	100	yes
Asbestos	1	
Cadmium oxide	1	yes
Cellosolve	1	
Cyanides (soluble salts)	10	
Diglycidyl ether (some epoxy resins)	1	yes
Hydrogen fluoride	100	yes
Hydrogen peroxide (> 52%)	1	yes
Hydroquinone	1	yes
Lead	10	
Lead-containing leachable wastes	10	
Mercuric chloride	1	yes
Mercury	1	
Methyl ethyl ketone peroxide	10	

Potassium cyanide	10	yes
Potassium silver cyanide	1	yes
Silver cyanide	1	yes
Sodium cyanide	10	yes
Silver nitrate	1	

Emergency Response Procedures

The senior emergency response official responding to the emergency shall become the individual in charge of the site-specific Incident Command System (ICS). As more senior officials arrive, this command position is passed up the line of authority. All emergency responders and their communications shall be coordinated and controlled through this individual in charge of the ICS, assisted by the senior official present for the employer.

The individual in charge of the ICS shall do the following:

* Identify the hazards.
* Implement appropriate emergency operations.
* Ensure that appropriate personal equipment is worn. For actual or potential inhalation hazards, positive-pressure self-contained breathing apparatus (SCBA) shall be worn, as long as an inhalation hazard exists.
* Limit the number of emergency personnel at the emergency site to those actively performing emergency operations. A buddy system shall be used in hazardous areas.
* Provide for back-up personnel standing by for assistance or rescue, including advanced first aid personnel.

* Designate a safety official with knowledge of the situation to identify and evaluate hazards and provide direction for the safety of operations. This safety official shall have the authority to alter or suspend activities in case of immediately dangerous to life or health (IDLH) or imminent danger situations.
* Implement decontamination procedures after emergency operations have terminated.

The standard also has procedures for medical surveillance and consultation [CFR 1910.120(q)(9)], chemical protective clothing [CFR 1910.120(q)(10)], removal of hazardous substances and contaminated materials [CFR 1910.120(q)(11)], and personal protective equipment test methods (Appendix A).

Training

Many colleges have a health and safety department with personnel trained and equipped to handle hazardous spill and leak emergencies, and this department should be consulted to determine whether spill response services are available. The OSHA Hazardous Materials Operations and Emergency Response Standard defines the amount of training needed for different levels of emergency response personnel.

In order of the amount of training required and competence, the types of emergency response personnel are:

1) first responder awareness level;

2) first responder operations level;
3) hazardous materials technician; and
4) hazardous materials specialist.

In addition, there are training requirements for an on-scene incident commander, and skilled support personnel.

Except for first responder awareness training, the employer shall certify all competencies and provide a certificate to the employee. All emergency response employees shall receive annual refresher courses of sufficient content and duration to maintain and demonstrate their competencies.

1. First responder awareness level: All employees who might discover or witness a spill or leak should receive basic training in initiating the proper emergency procedures, even if the college policy is for evacuation of all employees in an emergency. These requirements are similar to and can be incorporated into OSHA Hazard Communication training requirements (see Chapter 3). First responders at the awareness level shall have training or sufficient experience to demonstrate competence in the following areas:

* understanding the types of hazardous substances, and possible risks (e.g. fire, explosion, toxic effects, etc.);
* understanding the potential outcomes of an emergency when hazardous substances are present;
* the ability to recognize the presence of hazardous substances in an emergency;
* the ability to identify the hazardous substances, if possible;
* an understanding of the role of first responder awareness individuals in the employer's emergency response plan, including site security and control and

  the U.S. Department of Transportation Emergency Response Guidebook; and
* the ability to realize the need for help and to notify the proper officials.

Basically, an individual with first responder awareness training identifies the existence and nature of an emergency, if possible, and initiates the emergency response plan by calling for help. The individual takes no further action and immediately leaves the danger area, unless he or she has had more advanced emergency response training.

2. First responder operations level: First responders at the operations level respond to releases of hazardous materials in a defensive manner without trying to stop the release. Their intent is to contain the release from a distance, keep it from spreading, and prevent exposures. They must have first responder awareness level competency, and 8 hours of training or proven experience in the following competencies:

* basic hazard and risk assessment techniques;
* knowledge of appropriate personal protective equipment selection and use;
* understanding of hazardous materials terms;
* knowledge of basic control, containment and/or confinement operations;
* basic decontamination procedures; and
* an understanding of relevant operations and shutdown procedures.

3. Hazardous materials technician: A HazMat technician responds

aggressively to stop the release of hazardous substances. He or she shall have at least 24 hours of First Responder Operations Level training, the competencies of a first level operations responder, and proven experience in the following additional competencies:

* implementation of the emergency response plan;
* use of field survey equipment to identify materials;
* knowing how to function in the Incident Command System;
* knowledge of advanced control procedures; and
* knowledge of basic chemical and toxicological terminology and behavior.

4. Hazardous materials specialist: A HazMat specialist responds with and in support of HazMat technicians, but has more specific knowledge of various hazardous substances. He or she shall have 24 hours of HazMat technician training, proven experience in the competencies of a HazMat technician, as well as the following additional competencies:

* knowledge of the state emergency response plan;
* in-depth knowledge of hazard and risk assessment techniques;
* knowledge of specialized control procedures;
* an understanding of chemical, radiological and toxicological terminology and behavior; and

* the ability to develop a site safety and control plan.

5. On-scene incident commander: The incident commander assumes control of the incident scene beyond the first responder awareness level. The incident commander shall have 24 hours of first responder operations level training and proven competencies, as well as the following additional competencies:

* knowledge and ability to implement the employer's incident command system;
* knowing the hazards of working in personal protective equipment;
* knowing how to implement the local emergency response plan;
* knowing of the state emergency response plan and Federal Regional Response Team; and
* knowing and understanding the importance of decontamination procedures.

6. Skilled support personnel: Non-emergency personnel whose skills might be needed to operate specific equipment in an emergency, and who might be exposed to hazardous substances do not have to have the above training required of emergency responders. However, they shall be given an initial briefing at the site prior to participation in emergency operations. This briefing shall include:

* instruction in wearing appropriate personal protective equipment;
* nature of the chemical hazards; and
* duties to be performed.

CLEANING UP SPILLS AND LEAKS

Many of the basic steps involved in cleaning up emergency and non-emergency spills and leaks are similar. The primary difference is the

degree of hazard, the level of training, and the types of personal protective equipment necessary to clean up the spill safely. Even non-emergency spills and leaks take knowledge and training to know how to clean up safely. This can be done in standard Right-To-Know training given in compliance with the OSHA Hazard Communication Standard.

Preparing for Spills and Leaks

To prepare for hazardous spills, even non-emergency ones, certain supplies are needed. These can include:

* Proper personal protective equipment, including chemical resistant overalls, gloves, goggles and face shields, boots, full protective suits, and appropriate respirators. Some of this equipment (SCBA, in particular) would only be worn by trained HAZMAT personnel, but anyone cleaning up even minor spills should know what to wear for the type of spills that could occur.

* Clean-up equipment and supplies, including spill control materials, absorption materials and pillows, spark-proof tools, fire extinguishers, leak patches, etc. You should have appropriate spill control materials available for the types of spills likely to occur. Spill control kits are available from safety equipment suppliers.
* First aid supplies (see the next section).

Standard Spill Control Procedures

The following procedures should be used in evaluating how to clean up spills and leaks.

1. Get away. The first person to notice the spill or leak, should get away from the immediate area of the spill in order to evaluate the situation but without exposing him or herself. Obviously, this might not be needed if the nature of the spill is known and is minor (e.g. 1/4 cup of a known solvent).

2. Identify the spill to the extent possible. Do so without being at risk. This includes identifying:
* the type of material spilled (e.g., from the label);
* the size of the spill and whether the leak has stopped;
* whether two chemicals are involved in the leak and could react with each other; and
* any unusual features such as foaming, odor, fire, etc.

3. Is this an emergency? Leaks that can be cleaned up by personnel on the spot or by maintenance personnel are not emergencies. If this is not clear, consider it an emergency. Table 4-2 gives examples of spills and leaks that should be considered emergencies:

If there is an emergency situation, initiate the emergency procedures defined in the Emergency Response Plan. The following steps might be part of the Emergency Response Plan. If the plan involves immediate evacuation, then do not proceed any further. Rather sound the alarm and assist evacuation.

Any fires involving hazardous substances (e.g. solvents, oxidizers, corrosive chemicals), or any spill or leak that causes any injury such as unconsciousness should be considered emergencies.

4. Get help for all but very minor spills. In emergency situations, the amount of training determines the degree of participation in the cleanup.

5. Identify the material spilled. Is it flammable, combustible, toxic and volatile, toxic or corrosive and nonvolatile, or an oxidizing agent? The label and Material Safety Data Sheet on the product should give information on safe cleanup procedures.

6. Plan how to clean up the spill or leak. Procedures for common types of spills and leaks are discussed below.

7. Obtain the proper spill control materials. This would include spill control materials, leak patches, etc., as discussed under Preparing For Spills and Leaks.

8. Put on appropriate personal protective equipment. This can include respirators, gloves, goggles, etc., as needed.

9. Stop the source of the spill or leak. This can include turning off the valve of a leaking gas cylinder, patching a leaky hose, or uprighting a knocked over container of liquid.

Table 4-2. Emergency Spill Amounts

Type of spill	**Amount**	**Examples**
extremely flammable liquids	> 1 pint	acetone, rubbe
cement flammable liquids	> 1 quart	toluene, ethy
alcohol combustible liquids	> 1 quart	minera
spirits toxic, volatile liquids	> 1 quart	aceti
acid, methyler
chloride ammonia concentrated acids	> 1 gallon	sulfuri
acid concentrated alkalis	> 1 gallon	ly
solution poisonous, reactive	any	cyanide
and materials sulfides oxidizing agents	> 1 pound	conc. nitri
acid nitrates, dichromates, chlorates leaks from gas cylinders	uncontrolled	
oxygen, acetylene		

10. Stop the spill from spreading. This can include use of appropriate spill control pillows or other spill control materials for spilled liquids to build a dike, shutting down ventilation systems to keep gases and vapors from spreading, and plugging drains to prevent contamination of the water supply. Flammable liquids in the sewer system, for example, can be an extreme explosion hazard. Allowing hazardous chemicals to enter the sewer system may also be a violation of EPA, state, or local disposal regulations.

11. Clean up the spill. Use appropriate adsorbing materials and equipment. In general, paper towels or rags should not be used for liquids that evaporate quickly since they will not prevent further

evaporation. For very small spills, you can use paper towels if they are immediately placed in an approved oily waste can.

12. Dispose of contaminated materials properly. Contaminated spill control materials and disposable personal protective clothing must be disposed of as hazardous waste. Contaminated tools and non-disposable personal protective equipment should be safely decontaminated.

13. File an incident report. The incident report should be filed with the health and safety program director for every spill, including non-emergency spills, detailing the nature of the spill, how it occurred, how it was cleaned up, any problems, and recommendations for preventing further spills of the type. The spill might also have to be reported to local, state or federal authorities (see section on Emergency Notification Under SARA).

Specific Recommendations

The following section gives the hazards and specific recommendations for cleaning up a variety of common spills and leaks that could occur in an art department. When a spill is large enough for cleanup to be considered an emergency response, then the Emergency Response Plan should be followed. The recommendations below should be incorporated into the emergency response procedures.

Flammable Liquid Spills

Spills of flammable liquids are among the most dangerous types of spills because they are potentially hazardous to health as well as a fire hazard at room temperature and below. A spill of a flammable liquid will spread out and evaporate very quickly to reach high vapor concentrations. The lower explosive limit (LEL), the lowest concentration of the flammable vapor in air which can burn, can be achieved very easily, and then all it takes is a spark, flame or other source of ignition to cause a fire or explosion. Spills of more than a one pint of an extremely flammable liquid or one quart of a flammable liquid should be considered emergency response situations.

The following are procedures to be followed for flammable liquid spills:

1. Immediately shut off any flames. For large, emergency spills, shut off power to any electrical equipment, lights, etc. in the spill area using a control outside the spill area (e.g fuse box) to prevent sparks setting off a fire or explosion.
2. Open the windows and turn on any explosion-proof fans exhausting to the outside (they should be on separate circuits from the rest of the room). Air conditioning and ventilation systems should be turned off to prevent vapors from spreading throughout the building.
3. Evacuate the area as a precaution because of the fire risk. In emergency response situations, trained emergency personnel would determine the degree of evacuation needed, unless the college has an immediate evacuation plan.
4. Wear gloves, goggles and air-purifying respirators for small spills (although minor spills might not require a respirator). Cleaning up large spills or unknown spills requires positive-pressure self-contained breathing apparatus (SCBA) because of high vapor concentrations that could be present. The fire department might be able to do this if no one in-house is qualified and trained with SCBA. Other protective clothing and equipment that might be needed for large spills includes gloves, goggles and face shield, impermeable clothing, and boots.
5. Control the spread of large spills by diking with spill control pillows

or similar materials. Make sure the flammable liquid does not enter drains.
6. Use appropriate spill control materials to clean up the spill. Dry clay or vermiculite will work if proper spill control materials are

not available. Paper towels should not be used for more than tiny amounts of volatile liquids because the paper will aid evaporation. 7. Pick up contaminated spill control materials using sparkproof tools (e.g. plastic, aluminum), and place in garbage bags. This material must be treated as hazardous waste under EPA regulations. Flush the affected area with water afterwards.

Combustible Liquid Spills

Combustible liquids are not a fire hazard at room temperature since their flash point is above 100E F. In general, handle combustible liquid spills (e.g. mineral spirits) as a volatile liquid spill. However, if a spilled combustible liquid contacts hot surfaces, then heating of the liquid could result in a fire hazard and the spill should be handled as a flammable liquid spill.

Volatile Liquid Spills

Inhalation of vapors and possible skin absorption of the liquid are the major hazards associated with volatile liquid spills such as 1,1,1-trichloroethane, methylene chloride, acetic acid and combustible liquids. Spills of solutions of gases dissolved in water such as ammonia, and bleach are also discussed here. Flammable liquids are treated separately. Spills of more than one quart should be considered emergency response situations.

The following are procedures for cleaning up spills of volatile liquids:
1. Open windows and turn on any fans exhausting to the outside. Ventilation systems should be turned off to prevent vapors from spreading throughout the building.
2. Evacuate the immediate area as a precaution because of the health risk. In emergency response situations, trained emergency personnel would determine the degree of evacuation needed, unless the college has an immediate evacuation plan.
3. Wear gloves, goggles and air-purifying respirators for small spills (although minor spills might not require a respirator). Cleaning up large spills or unknown spills requires positive-pressure self-contained breathing apparatus (SCBA) because of high vapor concentrations that could be present. The fire department might be able to do this if no one in-house is qualified and trained with SCBA. Other protective clothing and equipment that might be needed for large spills includes gloves, goggles and face shield, impermeable clothing, and boots.
4. Control the spread of large spills by diking with spill control pillows or similar materials.
5. Use appropriate spill control materials to clean up the spill. Dry clay or vermiculite will also work if proper spill control materials are not available. Paper towels should not be used for more than tiny amounts of volatile liquids because the paper will aid evaporation.
6. Pick up contaminated spill control materials and place in approved waste disposal containers. This material must be treated as hazardous waste under EPA regulations. Flush affected area with water afterwards.

Acid and Alkali Spills

With acids and alkaline solutions, the concern is mostly skin contact due to the corrosive properties of concentrated acids and alkalis, and irritation from dilute solutions. Note that many concentrated acids react violently with water. Spills of more than a gallon of concentrated acids or alkalis should be considered an emergency response situation. All concentrated hydrofluoric acid spills should be considered an emergency and need special procedures.

The following are recommended procedures:

1. Do not touch spilled material.
2. Wear protective clothing, gloves, goggles, and boots in order to avoid skin contact. For concentrated acids and alkalis, a face shield is needed in addition to goggles. For volatile concentrated acids, SCBA may be needed. The MSDS should be checked.
3. Control the spread of large spills of concentrated acids by diking with spill control pillows or similar materials for later disposal as hazardous waste.
4. Small acid spills can be neutralized with sodium bicarbonate or sodium carbonate and alkali spills with sodium bisulfate or citric acid. Commercial adsorbent spill control materials can also be used.
5. Neutralized acids and alkalis can then be mopped up, wringing out the mop in the sink or a pail with a wringer.

Cyanide and Sulfide Spills

Reactive materials such as cyanide and sulfide powders and solutions are potentially very hazardous because of the risk of producing extremely toxic hydrogen cyanide and hydrogen sulfide gases, especially if the spill also involves acids. Cyanide solutions may also be absorbed through the skin. All spills of cyanide, sulfide and other reactive materials should be considered emergency response situations.

The following are recommended procedures:

1. Do not touch spilled material.
2. Wear protective apron, goggles, gloves, and respiratory protection (positive-pressure SCBA). For small powder spills, air-purifying respirators with a HEPA filter would suffice.
3. Scoop up powder with clean shovel or other tool, and place in a dry, container approved by the Department of Transportation.
4. Liquid spills should be adsorbed with spill control materials. Do not allow spill to enter drains or sewer system.
5. Flush spill area with water.
6. Dispose of as reactive hazardous waste.

Oxidizing Agent Spills

Oxidizers such as dichromates, nitrates, chlorates, concentrated hydrogen peroxide, and concentrated nitric acid are strong oxidizing agents which can ignite solvents and other combustible materials. They are also skin and respiratory irritants and may have other health hazards. See Material Safety Data Sheets on individual materials for specific instructions on cleaning up spills.

Spills of more than one pound of an oxidizing agent should be considered an emergency response situation.

The following are general procedures for oxidizer spills:

1. Do not touch the spilled material. Keep away from combustible materials (wood, paper towels, oil, etc.)
2. Wear appropriate protective equipment (e.g. apron, goggles, gloves, respirators, etc.) For small powder spills, air-purifying respirators with a HEPA filter would suffice; for larger spills, SCBA is required.
3. Scoop up powder with clean shovel or other noncombustible tool, and place in a dry container approved by the Department of Transportation.
4. Liquid spills should be adsorbed with spill control materials. Do not allow spill to enter drains or sewer system.
5. Concentrated hydrogen peroxide spills are not emergencies. The solution should be diluted with water, and then allowed to decompose to ordinary oxygen. The residue can be poured down the drain.
6. Flush spill area with water.
7. Dispose of the adsorbed material as flammable hazardous waste.

Organic Peroxide Spills

Methyl ethyl ketone peroxide and benzoyl peroxide are hardeners used with various plastics resins and can be ignited by sparks, flames and heat. They are normally dissolved in solvents to make them less reactive. Spills of organic peroxides should be handled as flammable liquid spills.

Water-Based Paint Spills

Latex paints and other water-based paints are not an inhalation hazard even though they may contain small amounts of organic solvents. Even large spills of water-based paints are not considered emergency response situations. The following are basic procedures for clean-up:
1. Gloves and goggles should be worn for cleanup.
2. Wet mopping is the best method of cleanup.
3. The diluted paint can be flushed down the sewer if it does not contain lead, chromates, cadmium, or other toxic metals. If toxic metals are present, dispose of as hazardous waste.

Compressed Gas Cylinders

Leaking compressed gas cylinders can be an emergency if the cylinder gas is oxygen (an oxidizer), a flammable gas such as acetylene or propane, or a toxic gas such as ammonia, and if the leak cannot be turned off by closing the cylinder valve. In this situation, follow prescribed emergency response procedure.

The following are recommended procedures:
1. If a leak is suspected, test with nonfat (detergent) soap or other leak detection solution. Do not use a flame.
2. If the leak cannot be stopped by turning off the cylinder valve, take the leaking cylinder outside well away from sources of ignition if the gas is oxygen or is flammable. (If the gas is toxic, wear positive-pressure SCBA.)
3. Try and temporarily stop the leak through the cylinder valve by attaching a regulator which is closed.

4. Reopen the cylinder valve slightly to allow gas to escape slowly.
5. Clearly tag and secure the cylinder. Post a sign warning people not to approach within 20 feet with cigarettes or other sources of ignition. If necessary, post a security guard.
6. Contact the supplier or manufacturer, and follow their further instructions.

FIRST AID

First aid is not medical treatment. The purpose of first aid is to provide emergency supportive treatment until the injured person can get medical treatment from a physician. First aid can also be used to attend to minor cuts, bruises, etc. where medical treatment is not necessary.

OSHA's section on medical services and first aid (29 CFR 1910.151) requires that employers ensure the ready availability of medical personnel for advice and consultation on matters of workers' health. In the absence of an infirmary, clinic, or hospital in near proximity to the workplace which is used for the treatment of all injured employees, there should be personnel adequately trained to render first aid. First aid supplies approved by the consulting physician shall be readily available.

Where the eyes or body of any person may be exposed to injurious corrosive materials, suitable facilities for quick drenching or flushing of the eyes and body shall be provided within the work area for immediate emergency use.

First Aid Kit

First aid kits should be available in all studios where injuries could occur requiring their use. Prepackaged first aid kits are available from safety equipment suppliers. They should be regularly checked to ensure they are kept stocked.

First Aid Training

Various courses in first aid are regularly given by the American Red Cross. These can be useful for teachers, guards, etc. However, if emergency facilities are not readily available, the college should ensure that state-certified first aid practitioners are available.

There are a variety of state-certified levels for first aid practitioners. The lowest level is certified first aid responder with 40 hours of training. In increasing order of training are basic EMT (Emergency Medical Technician), EMT intermediate, EMT critical care technician, and EMT paramedic. EMT intermediate and higher levels must work under a physician's supervision. This can be by radio or telephone, and most hospital emergency departments maintain facilities for such supervision.

EMT basic and certified first responders can immobilize a patient for transportation, bandage wounds, do CPR and similar classic first aid measures. They cannot administer oxygen or medications, give intravenous solutions, read electrocardiograms, use a defibrillator, or use most other resuscitation equipment.

Employees who are trained in first aid and designated by their employer as first aid responders are covered by OSHA's Bloodborne Pathogens Standard (CFR 1910.1030). This standard applies to all occupational exposure to blood and other potentially infectious materials. This standard requires offering first aid responders Hepatitis B vaccination, written procedures for cleaning up blood exposures, medical follow-up for exposed workers, personal protective equipment, training and proper disposal of infected materials. OSHA policy, however, is to allow employers to delay Hepatitis B vaccination for first aid responders until after they have actually provided treatment where there was exposure to blood or other infectious material. This, however, only applies to

employees for whom first aid response is only an incidental duty.

Eyewash Fountains and Emergency Showers

In case of splashes of irritating chemicals in the eye(s), it is crucial to begin rinsing the eyes within the first 15 seconds since damage begins immediately. Rinsing of the eyes should continue for at least 15 minutes.

Eyewash Fountains: Plumbed eyewash or plumbed eye/face wash fountains should be in every studio where chemicals can be splashed in the eyes. All eyewash fountains should meet the requirements of the American National Standard for Emergency Eyewash and Shower Equipment (ANSI Z358.1-1990).

Laboratory faucet adapters are generally not recommended because they share their water with the sink faucets, are difficult to reach easily, and it is difficult to adjust the temperature of the water quickly and properly. Hand-held hoses are not recommended because they require holding and a person needs both hands to hold eyes open for rinsing.

Small, portable eyewash bottles are not recommended because of danger of contamination, and lack of adequate water to rinse eyes for 1520 minutes. If plumbed water is not available, ANSI-approved self-contained eyewash fountains should be used and regularly checked for contamination.

Emergency Showers: Emergency showers should be present wherever concentrated acids, alkalis or other corrosive materials are mixed and used since spills of corrosive chemicals can cause severe damage. If splashed with a corrosive chemical, stand under the shower and start the water flowing (about 30 gallons/minute); then remove contaminated clothing. Emergency showers should be ANSI-approved. Combination eyewash fountains/emergency showers are also available.

Eyewash fountains and emergency showers should meet the following criteria:

* They should be ANSI-approved.
* They should be accessible within 10 seconds and not be more than 100 feet away. An individual should not have to go through a door or be separated by a wall. Note that some local regulations may require closer locations.
* They should be conspicuously located with a visible sign. The area around the shower or eyewash fountain must be kept clear.
* They should be located a safe distance from electrical equipment and outlets because of splashing.

* They should have an instant on, stay-open ball valve. This allows people to hold both eyes open, for example, while rinsing, and to remove clothing.
* Spray heads should be protected by dust covers when not in use.
* Potable water should be supplied. For comfort and to prevent shock or other injury, water temperatures between 60E F and 95E F are suggested.
* The flow of water from eyewash fountains should be gentle so as not to injure soft eye tissue.
* All personnel should be trained in their use.
* They should be tested weekly (according to the ANSI standard).
* Adequate floor drains should be provided for emergency showers.

REFERENCES

1. American National Standards Institute. (1990). ***American National Standard for Emergency Eyewash and Shower Equipment (ANSI Z358.1-1990).*** ANSI, New York, NY.

2. 3M Occupational Health and Environmental Safety Division. (1989). ***Hazardous Spill Clean-Up***. 3M Company, St. Paul, MN.

3. National Fire Protection Association. (1985). ***NFPA 101 Life Safety Code 1985***. NFPA, Quincy, MA.

4. Occupational Safety and Health Administration. (1990). ***Hazardous Waste and Emergency Response (OSHA 3114).*** U.S. Department of Labor, Washington, DC.

5. Occupational Safety and Health Administration. (1985) ***How To Prepare for Workplace Emergencies (OSHA 3088 Rev.)***, U.S. Department of Labor, Washington, DC.

6. Occupational Safety and Health Administration. ***Occupational Safety and Health Standards 29 CFR 1910.*** U.S. Department of Labor, Washington, DC.

7. Occupational Safety and Health Administration.
   1910.38 Employee emergency plans and fire prevention plans
   1910.120 Hazardous waste operations and emergency response
   1910.151 Medical services and first aid
   1910.165 Employee alarm systems
   1910.1030 Bloodborne pathogens

8. Office of Hazardous Materials Transportation. (1987). ***1987 Emergency Response Guidebook***. U.S. Department of Transportation, Washington, DC.

CHAPTER 5. LAWS AND REGULATIONS

A wide variety of federal, state and local agencies administer laws and regulations on health and safety that apply to college art departments. In addition, in case of accident, teachers and colleges can be subject to lawsuits if negligence is involved. This chapter will discuss the most important of these laws and relevant government agencies.

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA)

Employers are required by the federal Occupational Safety and Health Act of 1970 (OSHAct) ***"to ensure as far as possible every working man and woman in the Nation safe and healthful working conditions"***. The Occupational Safety and Health Administration (OSHA), a federal agency, has the responsibility for administering OSHAct, issuing standards on health and safety, and carrying out inspections to enforce the regulations and law. OSHA can fine employers who do not comply.

Coverage of OSHAct applies to all private employers and their employees in the 50 states, the District of Columbia, Puerto Rico, and all other U.S. territories. In 26 states and 2 territories with OSHA-approved state plans, OSHA has delegated its authority to enforce OSHAct. OSHA-approved state plans must cover state and local government employees. State plans may also cover private employers and their employees. Once federal OSHA has adopted a regulation, these states must adopt a comparable standard within 6 months of the publication date of a final standard. States with OSHA-approved state plans include: Alaska, Arizona, California, Connecticut*, Hawaii, Indiana, Iowa, Kentucky, Maryland, Michigan, Minnesota, Nevada, New Jersey*, New Mexico, New York*, North Carolina, Oregon, Puerto Rico, South Carolina, Tennessee, Utah, Vermont, Virginia*, Virgin Islands, Washington, and Wyoming. (* These state plans cover public sector employees only.)

OSHA does not protect students. However, it does apply to students who are working for the college as studio assistants and similar jobs.

Rights and Responsibilities

Under OSHAct, employers are responsible for keeping a hazard-free workplace, knowing and obeying OSHA standards, informing employees about OSHA and their rights, keeping appropriate records, informing OSHA of fatalities and 3 or more injuries requiring hospitalizations, posting citations, and abating citations.

Employees are responsible for following employer health and safety rules and OSHA standards, wearing required personal protective equipment, reporting hazardous conditions and accidents to their supervisor, and cooperating with OSHA compliance officers.

Employees have the right to see copies of applicable OSHA standards, to request information on hazards and precautions, to request OSHA to make an inspection if it is believed there are hazardous conditions or violations of OSHA standards, to have his or her name kept confidential when filing an OSHA complaint, to have an authorized employee

representative present during inspections, to have access to monitoring and medical records, and to not be discriminated against for exercising these rights.

OSHA Standards

The general duty clause of OSHAct states that each employer "shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees." This general duty clause can be used by compliance officers when there is no specific OSHA standard. OSHA also promulgates and enforces specific health and safety standards.

OSHA standards cover such areas as emergency plans, fire safety, machine guarding, flammable and combustible liquids, spray finishing, welding, sanitation, toxic and hazardous substances, etc. These ***General Industry Standards*** are found in 29 CFR 1910. Many applicable OSHA standards were discussed in Chapter 4. OSHA standards are available from OSHA offices.

Toxic and Hazardous Substance Standards

Subpart Z, Toxic and Hazardous Substances, of the OSHA standards lists the Permissible Exposure Limits (PELs) for several hundred chemicals (CFR 1910.1000). The PELs are legal standards. The original PELs were based on 1968 Threshold Limit Values (TLVs) of the American Conference for Governmental Industrial Hygienists (ACGIH). In the late 1980's, OSHA tried to wholesale update its PELS, but the courts rejected this approach, saying updates had to be done on a chemical by chemical basis. ACGIH TLVs are defined as "airborne concentrations of substances and represent conditions under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse effect." One problem with TLVs for many chemicals is that the manufacturers of those chemicals had a major say in the TLV development. As a result there is considerable controversy over the adequacy of the resulting TLVs. In addition, they do not protect sensitive workers. In order to apply the numerical TLVs (or PELs), there must be air sampling to determine the concentration in air of that chemical.

In addition to the PELs, Subpart Z has specific standards for many hazardous substances, including asbestos, lead, cadmium, formaldehyde, and many other carcinogens.

Inspections

OSHA has the right to inspect any workplace without advance notice. There are several types of inspections:

* imminent danger;
* fatality and multiple injuries;
* valid employee complaints;
* special emphasis programs (aimed at high risk industries); and
* random inspection programs.

The OSHA inspector can issue citations and penalties for violation of OSHA standards. These citations usually give an abatement date for correction of the violations. The size of the penalty depends on the type of the violation, which includes other than serious, serious, willful, and repeated violations, and failure to correct a prior violation. The

citation and penalty (or lack of same) can be appealed by the employer. Employees or unions can contest abatement times for correcting violations.

Hazard Communication Standard

The OSHA Hazard Communication Standard (29 CFR 1910.1200) applies to all employees in the United States who are exposed or potentially exposed to hazardous substances at their workplace. The purpose of the hazard communication rule is to ensure that the hazards of all chemicals produced or imported are evaluated, and that information concerning their hazards is transmitted to employers and employees by means of comprehensive, written hazard communication programs. The OSHA Hazard Communications Standard was discussed in detail in Chapter 3.

Employee Exposure Access and Medical Records

OSHA requires that employers allow employees and their designated representatives to examine and copy employee exposure records and medical records (29 CFR 1910.20). Exposure records includes air sampling and other workplace environmental monitoring data and reports, biological monitoring results, Material Safety Data Sheets, and any other information related to an employee's exposure to toxic substances and harmful physical agents. Medical records means any records concerning the health of an employee, and includes medical examinations, questionnaires, physician's opinions, etc. To release medical records to designated representatives such as unions, the employee must sign a release form.

The employer must keep medical records for the period of employment plus 30 years, and employee exposure records for 30 years.

Record-keeping and Reporting

OSHA requires that most employers keep records of occupational illnesses and injuries on OSHA forms 300 and 301 (29 CFR 1904). Employers with fewer than 10 employees and employers in certain low risk industries - including colleges and universities - do not have to follow these record-keeping requirements.

However, if an on-the-job accident results in the death of an employee or in the hospitalization of three or more employees, all employers - including colleges and universities - must report the accident in detail to the nearest OSHA office within eight hours (29 CFR 1904.39).

Voluntary Compliance Program

OSHA funds a voluntary compliance program, usually operated by the state departments of labor. Under this free program, a voluntary compliance officer will conduct an inspection of the workplace at the request of the employer, and make recommendations for correction of any hazards. Employers working with this program may be exempt from OSHA general schedule enforcement inspections for a period of one year. The voluntary compliance program does not report to OSHA any violations found, except in cases of imminent hazard which could involve death or serious injury. Appendix 3 lists the voluntary compliance offices in each state.

STATE RIGHT-TO-KNOW LAWS

State right-to-know laws were preempted by the OSHA Hazard Communication Standard except for public employees in states with OSHA-approved state plans. The New York State Right To Know Law (RTK), for example, requires public employers to 1) notify workers of their rights to information on toxic substances they are exposed to; 2) respond in writing to employee requests about toxic substances within 72 hours; 3) conduct annual training of employees in the identity, properties and safe use of toxic substances that the employees might encounter in their work; and 4) keep records of employees exposure to substances with enforceable exposure standards under OSHA's Subpart Z, Toxic and Hazardous Substances for 40 years. The record-keeping requirements also apply to private employers. Both the OSHA Hazard Communication Standard and the NYS RTK Law are enforced for public employers in New York, for example state colleges.

Contact the regional OSHA office in your state (or the state Health or Labor Department) to find out if there is a Right-To-Know Law in your state.

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

The National Institute for Occupational Safety and Health was established by the OSHAct to conduct research on occupational health and safety, to provide technical assistance to OSHA, and to recommend standards for OSHA to adopt.

NIOSH can make workplace investigations as part of this research. It can require that employers measure their employees' exposures and provide medical examinations of employees (at NIOSH expense). NIOSH also certifies respirators.

NIOSH provides technical assistance to employers and employees. Employers or three or more employees can request a Health Hazard Evaluation if they suspect that health hazards exist in the workplace. NIOSH will come in and conduct any air monitoring and medical examinations necessary. In addition, employers can request a Technical Assistance inspection, which is a more limited version of the Health Hazard Evaluation.

NIOSH also provides information to employers and employees upon request and has a wide variety of literature. See Appendix 2 for a list of NIOSH offices.

WORKERS COMPENSATION LAWS

Most employees in the United States are required to be covered by state workers' compensation laws. These laws provide a variety of benefits for job-related injuries and illnesses, including benefits for medical expenses, wage replacement, loss of limbs (or their use), rehabilitation and survivor's benefits in case of death. These laws vary from state to state.

Workers' compensation is a "no fault" insurance system, meaning an injured employee can collect without having to prove it was the employer's fault. In addition, the injured employee can collect benefits even if the injury was his or her fault. In return, the employer is protected from lawsuits for negligence. Thus workers' compensation is the sole remedy for injured
employees with respect to their employer. (See the section on Liability for information on lawsuits against other parties besides the employer.)

What Is Covered?

Injuries are covered under workers' compensation if they are job-related. The usual requirements are that the injury result from an accident arising out of and in the course of employment. The actual injury does not have to occur on the job site. For example, a car accident on the road during a delivery for the employer would be covered.

Occupational illnesses may also be covered. The extent of coverage and what illnesses are covered varies widely from state to state. In New York State, the illness does not have to be solely caused by something on the job, but the job has to substantially contribute to the illness. A classic example of a compensable occupational illness is contact dermatitis from exposure to chemicals.

There are usually statutes of limitations for filing claims for occupational diseases. In New York State, a worker may file a claim for up to 2 years after becoming aware that the disease was caused by the job.

An injured employee has the right to file a workers' compensation claim with the state workers' compensation board if he or she thinks the injury is work-related, whether or not the employer agrees. If the employer does not think the injury or illness was work-related, then the employer can challenge the claim.

Insurance Carriers

There are a variety of ways to be covered under workers' compensation: private carriers, state funds, and self-insurance. State laws vary widely in the types of carriers permitted. Some states have an exclusive state fund, which is a non-profit agency that provides workers' compensation insurance for employers. Other states allow private insurance companies to provide workers compensation and have non-exclusive State Funds which must provide coverage to employers. New York State allows private carriers, and has a State Insurance Fund. Large employers often have self insurance, meaning they cover themselves for workers' compensation benefits. Of course, these plans have to meet state regulations.

The premiums for workers' compensation insurance is paid entirely by the employer. The premium size depends on the company's experience rating. This depends on the number of workers' compensation claims that have been filed by the company and on the average for the industry.

ENVIRONMENTAL PROTECTION AGENCY (EPA)

The Environmental Protection Agency (EPA) regulates the disposal of hazardous waste under the Resource Conservation and Recovery Act, and industrial wastewater discharges under the Clean Water Act and Water Pollution Act. The EPA also regulates emergency planning and community right-to-know under the Superfund Amendments and Reauthorization Act.

Resource and Conservation Recovery Act (RCRA)

Legally, colleges and universities have to properly dispose of hazardous waste. This section discusses waste management laws. Information on waste management and disposal procedures is discussed in Chapter 9.

The Resources and Conservation Recovery Act (RCRA) was enacted in 1976 as an amendment to the Solid Waste Disposal Act. The basic goals of

RCRA are: to protect human health and the environment, to reduce waste, to conserve energy and natural resources, and to reduce or eliminate the generation of hazardous waste as expeditiously as possible.

The RCRA regulations are found in Part 240 of Title 40 of the Code of Federal Regulations (40 ***CFR 240).*** Subtitle C of Part 240 regulates the management of hazardous waste through its "cradle-to-grave" system of statutory and regulatory requirements for the identification of hazardous waste and generators, amongst other requirements. Using a waste manifest system, the hazardous waste is tracked through its production, transportation, and final disposal.

The responsibility for administering RCRA rests with the individual states. Most of the states' hazardous waste programs directly resemble RCRA. One can contact individual state environmental offices to elucidate particular differences between states. The relevant offices may be named a variety of names, for example: the NYS Department Environmental Conservation (NYS DEC), and Wyoming Department of Environmental Quality (WY DEQ).

Hazardous waste generators are the first link in the cradle-to-grave chain of hazardous waste management under RCRA. There are different categories of producers of hazardous waste. The basic distinctions center around the amounts of hazardous waste produced. As written in ***40 CFR Part 261.5***, there are three categories of hazardous waste generators.

1. Large Quantity Generators (LQGs): LQGs produce more than 1000 kilogram per month (kg/month) of hazardous waste, or more than 1 kg/month of acutely hazardous waste. LQGs must obtain a US EPA identification number from state hazardous waste management agencies or EPA regional offices. These numbers are part of a national data base on hazardous waste activities. They must comply with storage time, quantity, handling and record-keeping (manifest) requirements. In addition, LQGs must have an emergency/contingency plan in case of spills of stored hazardous waste (40 CFR 262.34). See the Spills and Leaks section of Chapter 4.

2. Small Quantity Generators (SQGs): SQGs produce more than 100 kg/month and less than 1000 kg/month, and accumulate less than 6,000 kg. SQGs must obtain a US EPA identification number from state hazardous waste management agencies or EPA regional offices. These numbers are part of a national data base on hazardous waste activities. They must also comply with storage time, quantity, handling and record-keeping (manifest) requirements. SQGs must also have an emergency/contingency plan in case of spills of stored hazardous waste (40 CFR 262.34).

3. Conditionally Exempt Small Quantity Generators (CESQGs): CESQGs produce less than 100 kg/month (220 pounds) of hazardous waste, and less than 1 kg/month (2.2 pounds) of acutely hazardous waste. They are "conditionally exempt" from Subtitle C, and the manifest system. Notwithstanding, CESQGs must identify all hazardous waste, never accumulate more than 1000 kg, treat or dispose of their waste on-site or make sure that the waste is sent to an approved facility. This includes permitted or interim status treatment storage or disposal facilities (TSDFs), permitted municipal or industrial solid waste facility, or a recycling facility. Not all states, however, recognize a difference in requirements for CESQGs compared to SQGs. Check your state laws for more stringent requirements.

Clean Water Act (CWA)

The EPA has developed regulations that establish the basis for wastewater management under the Clean Water Act of 1977. Each municipality develops and enforces programs regulating sewer and wastewater treatment. For specific information on local regulations, one must consult the local
Public Works and own Department of Environmental Protection.

The federal Water Pollution Act of 1972, and the Clean Water Act of 1977 were enacted with the goal to "restore and maintain the chemical, physical and biological integrity of the nation's waters". Title 40 CFR Section 402 requires that publicly-owned treatment works (POTWs) or sewage treatment plants establish local pretreatment programs to ensure compliance. The pretreatment requirements are given in Section 403.

All POTWs are required to develop local sewer use codes. These limits are designed to reflect the particular local environmental conditions of the area. Sewer codes will vary according to where POTW discharges are made. Many states are allowed to administer their own approved programs, and may have more stringent requirements.

Superfund Amendments and Reauthorization Act

The Superfund Amendments and Reauthorization Act of 1986 (SARA) revised and extended the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), commonly known as Superfund. Title III of SARA established authority for emergency planning and preparedness, emergency notification reporting, Community Right-to-Know reporting, and toxic chemical release reporting.

Community Right-to-Know reporting: Section 311 of SARA requires all facilities, including colleges, which are covered by OSHA's Hazard Communication Standard to submit Material Safety Data Sheets (MSDSs) or a list of hazardous chemicals to the local emergency planning committee (LEPC), the state emergency response committee (SERC), and the local fire department if the chemical is present in the facility in amounts exceeding reporting thresholds. Section 312 can impose further reporting requirements.

The reporting thresholds are 500 pounds for EPA-designated Extremely Hazardous Substances or the threshold planning quantity (TPQ) for that chemical, whichever is lower, and 10,000 pounds for chemicals that are not on the Extremely Hazardous Substances List. Most colleges do not store chemicals in quantities exceeding the reporting thresholds. See the Material Safety Data Sheet section of Chapter 3 for a list of chemicals that could be in excess of the reporting thresholds.

Emergency notification reporting: Section 304 of SARA requires notification of the National Response Center if there is a toxic release into the environment of a chemical on the CERCLA list in excess of its Reportable Quantity, and of local emergency authorities (LEPC, SERC) if the chemical is on the Extremely Hazardous Substance List. See the Spills and Leaks section of Chapter 4 for emergency notification requirements.

AMERICANS WITH DISABILITIES ACT (ADA)

The Americans with Disabilities Act of 1990 (ADA) was signed into law on July 26, 1990. This act gives civil rights to individuals with disabilities similar to that provided for people on the basis of sex,

race, national origin and religion.

The ADA has several anti-discrimination sections that are relevant to colleges: 1) Title IV, dealing with employment; 2) Title II, dealing with public services; and 3) Title III, dealing with public accommodations operated by private entities.

Employment

As of July 26, 1992, employers with 25 or more employees are prohibited from discriminating against qualified individuals with a disability in the following areas:

* job application procedures;
* hiring, advancement or discharge of employees;
* employee compensation;
* job training; and
* other terms, conditions, and privileges of employment.

Disability definition: According to the ADA, a disability is: 1) a physical or mental impairment that "substantially limits" one or more of the major life activities of an individual; 2) a record of such an impairment; or 3) being regarded as having such an impairment. Exclusions from this definition include compulsive gambling, and illnesses resulting from the current use of illegal drugs.

Qualified job applicant: A "qualified job applicant with a disability" is "an individual with a disability who, with or without reasonable accommodation, can perform the essential functions of the employment position." The term "essential functions" refers to the "primary job duties that are intrinsic to the employment position." These essential functions should be spelled out in a job description. It is illegal to require physical abilities that actually are not required for the job.

An employer may require as a job qualification that employees not pose a direct threat to the health or safety of themselves or others. To exclude a person with a disability on this basis, however, an employer would have to show the nature, severity, probability, and imminence of potential harm.

Reasonable accommodation: The employer is required to make "reasonable accommodation" to the disability of an employee as long as such accommodation does not impose an "undue hardship" on the employer. Such accommodation can include making existing facilities accessible, job structuring, part-time or modified work hours, acquisition or modification of equipment, provision of qualified readers or interpreters, etc.

If performing the essential job functions would have a high probability of substantial harm to the disabled person, an employer could exclude that person from a job unless reasonable accomodation would prevent the harm.

In Art Departments, exposure to certain chemicals - especially solvents - may put certain individuals with disabilities or who are taking medications, at higher risk of illness than non-disabled individuals. For example, this can include people who have asthma or have chemical sensitivities. In these situations, reasonable accommodation could include installing extra precautions such as better ventilation or substituting safer chemicals in order to protect these individuals. These provisions would also apply to someone who becomes ill or injured as a result of his or her job.

Medical examinations and questions: An employer may not use medical examinations or questions in a discriminatory manner. Pre-employment physical examinations and questions about disabilities are prohibited, although an employer can ask if an applicant can perform job-related functions.

An employer may require a preplacement medical examination after an employment offer is made, and the employment offer subjected to satisfactory results from the test, if all entering employees are subject to such examinations and the results kept confidential with certain exceptions (e.g. a supervisor's need to know about job restrictions). In order to exclude a person from a job because of the results of a medical examination, it must be shown that the examination is job-related, consistent with business necessity, and that reasonable accommodation can not solve the problem.

Medical examinations and inquiries about an employee's disability are allowed if they are shown to be job-related and consistent with business necessity. Voluntary medical examinations as part of an employer's health program are allowed.

Medical examinations required by federal, state or local law (e.g. OSHA-required medical surveillance) are allowed if they are job-related and a business necessity.

Public Services

Under Title II of the ADA, all public services must be made accessible, including public transportation. State colleges and universities come under the category of public services. The effective date of this section was January 26, 1992.

In essence, colleges receiving federal funds have had to be accessible for years under the requirements of Section 504 of the Rehabilitation Act of 1973, which prohibited discrimination on the basis of disability. This particularly applies to students.

Public Accommodations

Private colleges which own, lease, lease to, or operate a place of public accommodation are prohibited from discriminating against individuals with disabilities. This can include restaurants, theaters, museums, etc. associated with the college. This section also became effective January 26, 1992.

Examples of discrimination would include eligibility criteria that would tend to screen out individuals or classes of individuals with disabilities, failure to make reasonable modifications in policies and procedures, failure to provide needed auxiliary aids and services, and failure to remove architectural and communications barriers which are "readily achievable".

As with public services, most colleges have had to implement many of these policies already under Section 504 of the Rehabilitation Act of 1973.

NEGLIGENCE LAWSUITS

Lawsuits for negligence against colleges where students or others have been injured are on the increase. Obvious questions are who can sue, who can be sued, and what constitutes negligence.

Who Can Be Sued?

As discussed under Workers' Compensation, if an employee is injured on the job, he or she cannot sue the employer (or other employees) - even if their negligence caused the accident, since workers' compensation is the sole remedy for employees. The injured employee, however, can sue independent contractors (individuals or companies) whose negligence was a cause of the accident.

However, if a student is injured through the negligence of the college or its employees, then the student can sue the college and, sometimes, their teacher if the teacher was negligent.

What Is Negligence?

In general, to recover damages in a lawsuit, an injured student would have to prove there was an injury or illness, that there was negligence, and that the negligence caused the injury or illness. In many

states, colleges are held in loco parentis to students, which means that the college is acting like a parent and would have to take the same degree of precautions as a parent.

Factors that could indicate negligence include lack of a safe working environment, lack of training of the students in the hazards of art materials and processes and suitable precautions, and lack of supervision of students.

REFERENCES

1. Babin, A., and McCann, M. (1992). ***Waste Management and Disposal for Artists and Schools***. Center for Safety in the Arts, New York.

2. Bureau of Occupational Health. (1990). ***Right to Know Hazard Communication Implementation Kit***. NYS Department of Health, Albany, NY.

3. Eastern Paralysed Veterans Association. (1991). ***Understanding the American With Disabilities Act.*** EPVA, Jackson Heights, NY.

4. Environmental Protection Agency. (1989). ***40 CFR 260 to 267. Hazardous Waste Management Regulations***. Government Printing Office, Washington, DC.

5. Environmental Protection Agency. (1990). ***RCRA Orientation Manual 1990 Edition***. Office of Solid Waste, Washington, DC.

6. McCann, M. (1986). ***Teaching Art Safely to the Disabled***. Center for Safety in the Arts, New York.

7. Occupational Safety and Health Administration. (1989). ***Occupational Safety and Health Standards For General Industry, 29 CFR Part 1910***. U.S. Department of Labor, Washington, DC.

CHAPTER 6. GENERAL PRECAUTIONS

This chapter discusses general precautions that should be taken when using art materials and processes. Personal protective equipment is discussed in Chapter 7, fire safety in Chapter 8, waste management and disposal in Chapter 9, and safety in Chapter 10.

KNOW YOUR MATERIALS

Knowing the contents of art materials and their hazards is essential to having a safe studio program. Labels and Materials Safety Data Sheets (MSDSs) are keys to finding this information. As discussed in Chapter 3, OSHA, as part of its Hazard Communication Standard, requires that employers have proper labeling on containers and have MSDSs for all hazardous products.

Keeping an up-to-date inventory of all products, including names, amounts, date purchased, and special hazards, is also recommended.

SUBSTITUTION

One of the most basic rules of chemical safety is to use the safest materials and processes possible. Examples include:

* Use the least toxic solvents possible (e.g. denatured alcohol, isopropyl alcohol, acetone, odorless mineral spirits).
* Eliminate toxic metals such as lead and cadmium (e.g. using cadmium-free silver solders and lead-free glazes and enamels.
* Use water-based materials instead of solvent-based ones (e.g. water-based silk screen inks and water-based paints).
* Use liquid materials to replace powders (e.g. wet clay or water-based dyes instead of dry clay or powdered dyes).
* Use wet techniques instead of dry techniques (e.g. wet sanding, wet grinding).
* Apply coatings by brushing or dipping instead of spraying.
* Eliminate cancer-causing chemicals (e.g. asbestos, cadmium fumes, lead and zinc chromate, benzene, and chromated copper arsenate).

It is important when substituting one material for another to allow sufficient time to learn how to use the substitute properly. For example, it can take a semester to properly switch from solvent-based to water-based screen printing inks.

VENTILATION

There are three reasons for ventilation: 1) for toxic airborne chemicals, 2) to prevent a build-up of flammable gases or vapors, and 3) for comfort of the inhabitants of the area. Since health effects of chemicals occur at air concentrations well below the lower explosive limits of solvents and gases, then if you ventilate to prevent health effects, you are also preventing a buildup of vapors which could catch fire or explode.

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. An open door or window, or recirculating air-conditioning system is not adequate dilution ventilation for toxic gases and vapors.

Local exhaust ventilation involves trapping airborne contaminants at their source before they contaminate the air which is breathed. Examples include spray booths and dust-collecting hoods. (For further information on ventilation for toxic substances, see the CSA book ***Ventilation***.)

Ventilation for comfort is usually done through heating, ventilating and air-conditioning systems.

Dilution Ventilation

Dilution ventilation should not be used to exhaust large amounts of toxic solvent vapors, or for highly toxic solvent vapors, because of the requirement for large amounts of makeup or replacement air to replace the air being exhausted. This makeup air has to be heated or cooled to a comfortable temperature.

Dilution ventilation should also not be used for dusts or fumes because of the difficulty of calculating the amount of dilution air required. The exhausted air should be completely exhausted to the outside and not recirculated.

For solvents, the amount of exhaust ventilation required can be calculated by the procedure on pages 26-28 of Ventilation. For example, if 1 pint of mineral spirits is used in cleaning intaglio inking slabs and presses over a 3-hour class period, then the amount of dilution ventilation required would be:

total amt evaporated x dilution volume/pint x K /# minutes
= 1 pt x 35,000 cu. ft/pint x 10 / 180 minutes
= 1950 cubic feet/minute (cfm).

where the dilution volume for mineral spirits is 35,000 cu. ft/pt and safety factor K = 10. The dilution volume is the volume of air required to dilute one pint of evaporated solvent to the Threshold Limit Value for that solvent. (See Table 6-1 for the dilution volumes of common solvents used in art.)

Table 6-1. Dilution Volumes for Common Solvents

Solvent	**Dilution volume (cu. ft pint)**
Acetone	7,300
Ethyl alcohol	6,900
n-Hexane	61,700
n-Heptane	6,900
1,1,1-Trichloroethane	11,400
Methyl ethyl ketone	22,500
Methylene chloride	126,800

Mineral spirits
30,000-35,000
Toluene
76,000
Turpentine
25,500
Xylene
33,000

Local Exhaust Ventilation

A local exhaust ventilation system consists of a hood to capture the contaminants, ducts to transport them to the outside, an exhaust fan to move the air, and sometimes air cleaners to remove particulates from the air. The only air cleaners I would recommend are filters in spray booths and dust collectors for woodworking and other dust-producing machines. Charcoal filters are not recommended because of large amounts of charcoal required and the difficulty of telling when the charcoal is saturated.

Particular types of hoods are used for particular operations. OSHA requires local exhaust ventilation for abrasive blasting, grinding, polishing and buffing, spray finishing, and open surface tanks (23 CFR 1910.94). Examples of typical local exhaust systems for art operations include canopy hoods over electric kilns, 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.

In many instances, either a slot exhaust hood or enclosed hood can provide adequate local exhaust ventilation. If practical, an enclosed hood requires a lower exhaust rate and therefore less makeup air. For example, a 3-foot slot exhaust hood would require an exhaust rate of 1050 cfm. By comparison, an enclosed hood with a 3-foot by 18-inch (1.5 ft) opening would require only 360 cfm. Thus an enclosed hood, if practical for the type or work being done, can result in lowered energy costs for makeup air.

Some rules for operation of local exhaust systems are:

* Provide adequate makeup air. Ensure that the air intakes are not located near truck loading platforms, exhaust air outlets, furnace chimneys, etc. This makeup air should not enter the room close enough to the exhaust hood to create turbulence and affect the hood's capturing contaminants.
* Direct the flow of air so that clean air passes your face before becoming contaminated and being exhausted.
* Enclose the process as much as possible.
* Place the hood as close to the operation as possible.
* Fans should be located outside so all ducts are under negative pressure, and to decrease noise levels.
* Do not recirculate any of the exhausted air.
* Make sure exhausted air cannot reenter the area (or other areas).
* Always test the exhaust systems when it is installed. This should include smoke tube observations at hood openings to ensure adequate capture of contaminants. A child's soap bubble kit will also work. The engineer designing the ventilation system should instruct maintenance and other individuals responsible for the system in the complete operation and maintenance of the system before signing off on the project.

* Ducting should be round not rectangular, and have as few elbows as

possible to reduce friction. These bends should be gradual not sharp. If needed, ducting should be corrosion-resistant.
* Spark-proof construction of exhaust systems and placing fan motors outside the airstream is important for all local exhaust ductwork systems exhausting flammable gases and vapors.
* Provide regular maintenance. If the college does not have personnel with industrial ventilation experience, then hiring an outside firm for maintenance is recommended.

In selecting an engineer to design a ventilation system for toxic substances, it is important to choose someone experienced in industrial ventilation. Most heating, ventilating and air-conditioning engineers do not have this experience.

Comfort Ventilation

If a studio or office does not use toxic chemicals that can become airborne, then the only ventilation needed is for the comfort of the inhabitants of the area. The American Society of Heating, Refrigerating and Air-Conditioning Engineers is the traditional source of information on comfort ventilation through its standard ***ASHRAE 62-2001Ventilation for Acceptable Indoor Air Quality***.

ASHRAE 62-2001 is based on the concept of specifying minimum and recommended outdoor air flow rates to obtain acceptable indoor air quality for a variety of indoor air spaces. This standard is referenced in many building codes.

This standard does not provide acceptable air quality for everyone. An appendix to the standard says that "The air can be considered acceptably free of annoying contaminants if 80% of a panel of at least 20 untrained observers deems the air to be not objectionable under representative conditions of use and occupancy."

Table 6-2 contains selected minimum outdoor air quality requirements taken from Table 2 of ASHRAE 62-2001.

UPDATE//////////////////

Table 6-2. Minimum Outdoor Air Requirements (ASHRAE 62-1989)

	Estimated maximum occupancy (people/1000 sq ft)	**Outdoor air requirements (cfm/person)**
office space	7	20
classrooms	50	15
laboratories	30	20
training shops	30	20
libraries	20	15
corridors		0.1 cfm/sq ft.

auditoriums 150
15
smoking lounges 70
60

Obviously, these minimum outdoor air requirements do not apply if toxic chemicals are being emitted into the air.

STORAGE AND HANDLING OF TOXIC CHEMICALS

Storage

* Keep the minimum amount of materials on hand and purchase in smallest practical container size in order to reduce risk in case of spills or fire, and to minimize waste disposal costs. See also the section in Chapter 8 on flammable and combustible liquids.
* Choose appropriate containers. Avoid breakable glass containers whenever possible.
* 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.
* All containers should be labeled with contents and hazards.

* Store art materials safely so they will not fall. Hazardous chemicals should not be stored above eye level.
* Do not store chemicals that can react with each other in close proximity. The reactivity section of Material Safety Data Sheets describe the chemical incompatibilities of their products. Table 6-3 lists the incompatibility of common chemicals found in art materials.
* Do not store chemicals in food refrigerators or in food containers. Use separate refrigerators, which should be explosion-proof if flammable chemicals are stored there.

Handling

* Cover containers to prevent liquids from evaporating and powders from spilling.
* Use a glove box to mix small amounts of powders. This can be made out of cardboard. Take a cardboard box, put two holes in the sides for gloved hands, place container of liquid and powder inside box and cover with glass or plexiglass top. The inside of the box can be shellaced for easy cleaning.
* Transfer powders carefully to avoid getting large amounts of dust in the air.
* Pour liquids carefully to avoid splashing, using a funnel where possible.
* Wear appropriate personal protective equipment. See Chapter 7 for more information.

Table 6-3. Incompatibilities of Common Art Materials

Chemical	**Incompatibilities**

Acetic acid	chromates, dichromates, chlorates, nitric acid, hydrogen peroxide, and other oxidizers
Acids, inorganic	alkalis, hypochlorite bleach, sulfides, metals
Alkalis	acids, aluminum
Ammonium hydroxide	silver, chlorine, bromine, mercury, acids
Chlorinated hydrocarbons	ultraviolet radiation, aluminum
Chromates and dichromates	glacial acetic acid, camphor, glycerin, naphthalene, turpentine, and many other flammable liquids
Copper	hydrogen peroxide, many acids, acetylene
Cyanides, inorganic	acids, alkalis
Flammable liquids	chromates, dichromates, chlorates, nitric acid, hydrogen peroxide, and other oxidizers
Hydrofluoric acid	ammonium hydroxide, glass,
Hydrogen peroxide (concentrated)	most metals and their salts, organic substances, many flammable liquids
Mercury	nitric acid, ammonia
Nitrates, inorganic	acids, metals, nitrites, sulfur
Nitric acid	metals, sulfuric acid, sulfides, nitrites, solvents, combustible materials, chromates, dichromates
Peroxides, organic	acetone, heat
Potassium chlorate	ammonium salts, acids, metal powders, finely divided organic or combustible substances
Silver	acetylene, ammonia compounds, oxalic acid, tartaric acid
Sulfides, inorganic	acids
Sulfites, bisulfites	acids,
Sulfuric acid	nitric acid, metals, chlorates, permanganates

WORK PRACTICES AND HYGIENE

* Do not eat, drink, smoke, apply makeup or chew gum in the work area.
* Wash hands after work. Never use turpentine or other solvents to clean hands; instead use soap and water or a safe waterless hand cleanser (obtained from a safety supply house). Baby oil will remove paint from hands.
* Wear separate clothes in the studio and wash separately from other clothes.

Housekeeping

* Dusts should always be wet mopped or vacuumed, never swept. Sweeping just stirs up the dust.
* Highly toxic dusts like clay dust, asbestos, and lead dusts require a special high efficiency (HEPA) vacuum cleaner because very fine dusts go right through normal industrial vacuum cleaners.
* Cement floors should be sealed with commercial cement sealers or even paint to make cleanup easier.
* Dusty work surfaces should be wet mopped daily.

REFERENCES

1. Clark, N., Cutter, T., and McGrane, J. (1984). ***Ventilation***. Lyons and Burford, Publishers, New York, NY. *

2. Committee on Industrial Ventilation. (1988). ***Industrial Ventilation: A Manual of Practice***. 20th ed., American Conference of Governmental Industrial Hygienists, East Lansing, MI. Updated regularly.

3. Council of State Science Supervisors. (1984) ***School Science Laboratories: A Guide to Some Hazardous Substances***, U.S. Consumer Product Safety Commission, Washington, DC.

4. McCann, M. (1992). ***Artist Beware***. 2nd ed., Lyons and Burford Publishers, New York, NY. *

5. McCann, M. (1985). ***Health Hazards Manual for Artists***, 3rd ed, Lyons and Burford Publishers, New York, NY.*

6. National Research Council Committee on Hazardous Substances in the Laboratory. (1981). ***Prudent Practices for Handling Hazardous Chemicals in Laboratories***. National Academy Press, Washington, DC.

CHAPTER 7. PERSONAL PROTECTIVE EQUIPMENT

Suitable and individual personal protective equipment (such as gloves, goggles, respirators) should be provided or made available to students and staff requiring such equipment.

It must be remembered, however, that personal protective equipment has its limitations. It can be uncomfortable, have fitting problems, and only protects the person wearing the personal protective equipment.

GENERAL PROCEDURES

Selection of personal protective equipment should be centralized (e.g., through the health and safety committee) to ensure that proper equipment is chosen, fit testing occurs and that training is given in its proper use and maintenance. A variety of sizes should be made available since one size will not fit everyone.

Written procedures should be developed for the proper use of personal protective equipment. Wearing of personal protective equipment should be mandatory for processes where it is needed to prevent injury. Records should be kept of operations requiring the wearing of personal protective equipment.

OSHA PPE STANDARD

OSHA has updated its regulations for personal protective equipment for employees (29 CFR 1910.132, .133, .135, .136, and .138). This excludes respirators. Employers must conduct a hazard evaluation to determine if hazards are present, or likely to be present, necessitating the use of personal protective equipment (PPE). If such hazards are present, the employer must: 1) select and have employees use the types of PPE that will protect them; 2) communicate selection choices to employees; and 3) select PPE that properly fits each employee. The employer must certify in writing that the hazard assessment has been performed.

Employees who are required to wear PPE must be trained in the following: 1) when PPE is necessary; 2) What PPE is necessary; and 3) How to put on and off, adjust and wear PPE. 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. The employer must certify the training of employees.

RESPIRATORS

Respirators should be a last resort which is used only when ventilation and other protective measures are not sufficient. In fact, OSHA permits the use of respirators only when effective engineering controls are not feasible, or while they are being instituted. In fact,

proper use of respirators takes a lot more effort and knowledge than many people assume.

Employees wearing respirators come under OSHA=s respirator standard. This standard (29 CFR 1910.134) has just been updated. The revised standard became effective April 8, 1998, with employers having to be in complete compliance by October 5, 1998. The revised standard can be found on CSA's web site (http://artswire.org:70/1/csa) in the Precautions subdirectory. The revised standard has several new or enlarged requirements:

* a written plan with work-site specific procedures;
* a hazard evaluation to determine respiratory hazards and work conditions in order to help in respirator selection (compliance date September 8, 1998);
* medical evaluations to determine the ability of employees to wear a particular respirator;
* fit testing of tight-fitting respirators;
* training in the safe use of respirators; and
* regular respirator program evaluations.

Respiratory Protection Program

OSHA requires employers to develop and implement a written respiratory protection program with workspecific procedures and procedures for respirator use. The program must be administered by a trained administrator, and must include the following features.

1. Whenever respirators are necessary to protect health or whenever an employer requires wearing of respirators, there must be a written respiratory protection program with the following elements:

* procedures for selecting respirators;
* medical evaluation of employees required to wear respirators;
* fittesting procedures for tightfitting respirators;
* procedures for proper use of respirators in routine and emergency situations;
* procedures and schedules for maintenance of respirators;
* procedures for proper functioning of atmospheresupplying respirators;
* training of employees in hazards and proper use of respirators; and
* procedures for regularly evaluating the effectiveness of the program.

2. If respirator use is not required:

* An employer may provide employees with respirators or allow employees to use their own respirators, if the employer determines such respirator use will not create a hazard. If voluntary respirator wearing is allowed, then the employer must provide the information in Appendix D of the respirator standard to the respirator user;
* An employer must have a written respirator program that includes medical evaluation of ability to wear a respirator and adequate maintenance of the respirator. An exception is when an employee voluntarily wears a filtering facepiece (dust mask), whether provided by the employee or employer. However the employer must still make sure the dust mask is not a hazard to the wearer and is not dirty or contaminated.

3. An employer shall designate a program administrator who is qualified by training or experience to administer the program.

4. Employers shall provide respirators, training, and medical evaluations at no cost to the employee.

Type of Respirators

Atmospheresupplying respirators: Atmospheresupplying respirators provide a source of clean air from compressed air tanks or compressors. Examples are supplied air (airline) respirators and selfcontained breathing apparatus (SCBA). For situations involving oxygen deficiency or that are immediately dangerous to life or health (IDLH), only fullfacepiece pressure demand SCBA certified by NIOSH for a minimum service life of 30 minutes, or a full facepiece pressure demand airline respirator with auxiliary selfcontained air supply is acceptable. Pressure demand or positive pressure respirators are respirators in which there is always a positive air pressure inside the facepiece so that contaminated air cannot leak into the facepiece.

The source of air for atmospheresupplying respirators can be compressed or liquid oxygen or compressed air. Compressed or liquid oxygen must meed the US Pharmacopoeia requirements for medical or breathing oxygen. Compressed air must meet the specifications for Type IGrade D breathing air: 19.5 23.5 % oxygen, less than 5 mg/cu.m. of hydrocarbons, less than 10 ppm carbon monoxide, less than 1000 ppm carbon dioxide, and no noticeable odors. OSHA has other requirements for cylinders.

Since the use of supplied air respirators is more complicated than air purifying respirators, it is imperative that people wearing these have adequate and training in their use and practice with them on a regular basis.

Airpurifying respirators: Airpurifying respirators remove contaminants from the air in a given location in a variety of ways, including filtering particulates from the air, absorbing the contaminant, or chemically reacting with the contaminant. The air is pulled into the facepiece by lung power, which creates a negative pressure inside the facepiece during inhalation. Thus if the fit is not perfect, contaminants can leak into the facepiece because of this negative pressure.

Airpurifying respirators come in two types: gaseous and particulate. There can also be combinations of the two. Gaseous types contain cartridges for organic vapors (e.g. solvent vapors), ammonia, and acid gases (e.g. for chlorine bleach, sulfur dioxide, hydrogen chloride). In the past, particulate filters included ones for paint spray, dusts and mists (DM); dusts, mists and fumes (DMF, e.g. for welding fumes); and high efficiency (HEPA) filters.

In 1995, NIOSH published revised standards for particulate respirators. The new regulation provides for nine classes of filters: three levels of filter efficiency, each with three categories of resistance to filter efficiency degradation from oil. The three levels of filter efficiency are 95%, 99%, and 99.97%. The three categories of resistance to filter efficiency degradation are labeled N (not resistant to oil) , R (resistant to oil for a limited time), and P (oilproof.). N95 and N99 filters outperform DM and DMF filters.

Airpurifying respirators cannot be used in oxygendeficient atmospheres, in IDLH situations, or for very high concentrations of contaminants. They also should not be used for chemicals with poor warning properties (when air concentrations at or above the recommended exposure levels create no observable odor, irritation or taste) because there is no way to detect when the cartridge is no longer removing the contaminants. Examples include methyl alcohol, nitrogen dioxide, isocyanates, and carbon monoxide. Airpurifying respirators should also not be relied upon to give adequate protection against cancercausing chemicals (carcinogens) because they are not 100% efficient and do allow some contaminants to penetrate through the respirator (see section below

on protection factors). Finally, airpurifying respirators are not to be used for abrasive blasting because this type of respirator is not approved for very high levels of particulates (see protection factors below).

Powered airpurifying respirators (PAPRs): PAPRs actually come under the classification of airpurifying respirators. They differ, however, in that the air is pumped through the cartridge or filter so that there is always a positive pressure inside the respirator facepiece. This reduces a major disadvantage of airpurifying respirators which create a negative pressure inside the face piece. The same restrictions applying to airpurifying respirators apply to powered airpurifying respirators. In addition they are only approved for particulates, although there are also cartridges for gaseous contaminants. Recently there have been studies indicating that they do not provide as great a protection factor as originally thought.

Respirator facepieces: Respirator facepieces come in a variety of types and sizes. These include:
* hoods, which cover the entire head and shoulders;
* fullfacepiece types, (typified by the classic "gas mask", and required for protection against eye irritants);
* halffacepiece types which cover mouth, nose, and chin;
* quarterfacepiece types, covering the mouth and nose; and
* filtering facepieces (dust masks).

The revised OSHA standard defines filtering facepieces as a negative pressure airpurifying particulate respirator with a filter as an integral part of the facepiece or with the entire facepiece consisting of the filtering medium. These dust masks do not have to have full written respirator programs.

Selection of Respirators

Respirators must be selected for the particular contaminants, their physical state, and exposure conditions that will be encountered by the individual wearing the respirator. The revised OSHA respirator standard requires that employers evaluate respiratory hazards in the workplace and exposure conditions in order to assist in respirator selection. (This must be completed by September 8, 1998.) If the employer can't identify or reasonably estimate the level of exposure to a contaminant, the employer shall consider the atmosphere to be IDLH (immediately dangerous to life or health).

Table 71 is a general protocol for determining the allowable types of respirators for a given contaminant and conditions. Table 72 is a more specific selection chart for types of filters and cartridges for various art processes. At high concentrations of toxic contaminants, airsupplied respirators might become necessary instead of airpurifying types.

Different types of respirators vary in the degree of efficiency with which they can protect. To properly select a respirator, you need to know the actual concentration of the contaminant in the work area, the Threshold Limit Value (or OSHA Permissible Exposure Limit) of the contaminant, and the rated Protection Factor of the various types of respirators.

Table 71. Respirator Selection Protocol

Hazard	Respirator Type
Oxygen Deficiency	SCBA Combination Airline and auxiliary SCBA
Toxic Contaminants	
Gaseous	
IDLH *	Positive Pressure SCBA Positive pressure airline respirator plus auxiliary SCBA
Not IDLH	Air line respirator Chemical cartridge respirator
Particulate	Dust, mist or fumes respirator Airline respirator
Abrasive blasting respirator	Gaseous and Particulate
IDLH	Positive pressure SCBA Positive pressure airline respirator plus auxiliary SCBA
Not IDLH	Airline respirator Chemical cartridge respirator with special filter

* IDLH Immediately dangerous to life or health

Table 72. Selection Chart for Filters and Cartridges

Substance or process	Cartridge	Filter
Acid gases	AG	-
Acid mists	AG	N95
Aerosol spray cans	OV	N95
Air brush		
waterbased		N95
solventbased	OV	N95
Ammonia	A	
Asbestos		N100, HEPA *
Clay and glaze powders		N100, HEPA
Dye powders		N95
Fiberglass dust		N95
Formaldehyde	FOR	
Lacquers	OV	
Metal grinding		
oilbased lubricant		R95, P95
waterbased/no lubricant		N95
Leadcontaining powders		N99, N100, HEPA
Metal melting		N95
lead, cadmium		N100, HEPA
Metal powders		N95
Oil mists		P95, R95
Paint strippers (solvent)	OV	

Pastel dusts		N95
Pigment powders (no lead, cadmium or chromates)		N95
Plastic resins and glues	OV	
Plastics sanding, grinding		N95
Polyvinyl chloride	AG	N95
Polyurethane	OV	N95
Formaldehyde plastics	FOR	N95
Silica		N100, HEPA
Soldering, lead		
acid fluxes	AG	N100, HEPA
organic fluxes	OV	N100, HEPA
Soldering, hard (no cadmium)		
fluoride fluxes	AG	N95
borax fluxes		N95
Solvents	OV	
Spraying		
waterbased		N95
solventbased	OV	N95
Sulfur dioxide	AG	
Welding (metal fumes only)		N95
lead, cadmium, nickel		N100, HEPA

Key

OV	organic vapor
A	ammonia
AG	acid gas
FOR	formaldehyde
HEPA	high efficiency
N95	95% efficient filter

* atmosphere-supplying respirator recommended

Protection Factors: The Protection Factor of a respirator is defined as the concentration outside the respirator divided by the concentration inside the respirator. These protection factors are developed from laboratory studies. Table 73 gives the Protection Factors for a variety of respirators based on recommendations from NIOSH.(OSHA will be issuing Protection Factors in the future) You can obtain the maximum concentration of the contaminant for which you can use a given respirator by multiplying the Protection Factor for that respirator by the recommended exposure level for the contaminant of concern. If the actual concentration is higher than the calculated maximum concentration, then you need to select a respirator with a higher Protection Factor.

For example, suppose someone is exposed to xylene, which has a Threshold Limit Value of 100 ppm. The standard halfface respirator with organic vapor cartridges has a Protection Factor of 10. Therefore, for xylene, the maximum concentration against which this respirator can be used is 1000 ppm. If the actual concentration is greater than 1000 ppm, then a fullface respirator or a suppliedair respirator would be needed.

If the concentration of the substance is unknown and can not be estimated, particularly if it is one that can be immediately dangerous to life or health, then a positivepressure SCBA type or positivepressure

demand airline respirator with emergency SCBA should be used. This would apply, for example, in many spill situations.

In some cases, cartridges for gaseous contaminants have limitations for exposure concentrations not related to the facepiece. In such instances, the most protective respirator should be used.

Table 73. Respirator Protection Factors

Respirator Type	Protection Factor
1. Airpurifying respirators	
Singleuse, dust	5
Quarterface, dust	5
Halfface (including filtering facepiece)	10
Fullface, dusts, mists and/or fumes filter	10
Fullface, HEPA filter or chemical cartridge	50
Powered airpurifying respirator, hood or helmet	25
Powered airpurifying respirator, half or full face with HEPA filter or chemical cartridge	50
2. Suppliedair respirators	
SCBA, opencircuit, demand, fullface	50
SCBA, opencircuit, pressuredemand, fullface	10,000
Airline, demand, halfface	10
Airline, demand, fullface	50
Airline, pressuredemand, halfface	1000
Airline, pressuredemand, fullface	2000
Airline, continuous flow, fullface	50
Airline, continuous flow, hood	25

Medical Factors

Before requiring an employee to be fit tested for a respirator, a medical evaluation must be provided to determine the ability of the employee to wear a respirator since respirators put an extra strain on the heart and lungs. OSHA does not require a medical examination; at the minimum, the medical evaluation can be done by a questionnaire found in Appendix C of the revised standard. The evaluation must be performed by a physician or other licensed health care professional qualified to do the evaluation. The OSHA standard has further requirements on what information must be provided to the health care professional and what information they can divulge to the employer.

Persons with heart or lung diseases such as arrhythmias, asthma, emphysema, and chronic bronchitis may be limited in their ability to wear a particular type of respirator. Other medical factors that could limit respirator use include anemia, hemophilia, poor eyesight or hearing (i.e. not being able to detect warnings), lack of proper use of fingers or hands, and claustrophobia. In cases where a medical condition would limit the use of negativepressure airpurifying respirators, the employer must provide a powered airpurifying respirator if the health professional finds the employee can use one.

Additional medical evaluations must be done if an employee reports symptoms related to his or her ability to wear a respirator, if the health care provider or supervisor or respiratory program administrator indicates

the need, or if there is a change in workplace conditions that might result in an increased physiological strain on the employee.

Fitting of Respirators

If a respirator with a tightfitting facepiece does not fit properly, then it is not serving its intended purpose. In order to fit, there must be an adequate seal between the facepiece and the wearer's face. Anything interfering with this seal can allow inward leakage of contaminants. There are a variety of factors affecting the fit of a respirator, including the model and size of the facepiece, facial characteristics, and eyeglasses. No two people have the same size and shape of face. Similarly there are variations in shape of respirator facepieces between the different models of respirators. As a result, it cannot be expected that one size or model of respirator would fit everyone. Until a few years ago, respirators were designed to fit men only, and women and others with small faces found it impossible to get a proper fit with a respirator. Today most major respirator manufacturers make a variety of models and sizes. It is therefore advisable, and is required by OSHA, to provide a variety of makes and sizes available to be certain of a proper fit.

Beards, sideburns or other facial hair between the facepiece and the skin will prevent you from obtaining a proper respirator to face seal. Many men who shave regularly can even find difficulty in getting a proper fit if they have a heavy growth during the day. In some instances it is necessary to shave just before putting on the respirator. In addition facial scars, missing teeth, and a broken nose can prevent a proper fit.

Eyeglasses can also prevent a proper fit if the temple bars of eyeglasses interfere with the seal of the respirator. Changing eyeglass styles can often help. Another solution is to mount corrective lenses inside a fullface respirator.

OSHA requires annual fit testing to determine if a respirator with a tightfitting facepiece fits properly. Employees must also be fit tested if a different respirator facepiece is used, or if there is any question about the fit of the respirator. If the employee notifies the employer that the fit is unacceptable (even after passing a fit test) then the employee shall be given a reasonable opportunity to select another respirator and be retested.

There are two basic types of fit tests: quantitative and qualitative. Quantitative fit testing involves exposing the respirator wearer to an atmosphere of some agent such as corn oil and measuring the concentration of this agent both inside and outside the respirator. This is the best method but is expensive.

Qualitative fit testing involves exposing the respirator wearer to an agent which can be detected by irritation, odor or taste. Examples of approved qualitative fit testing agents include isoamyl acetate (banana oil), irritant smoke, saccharin mist, and Bitrex. The isoamyl acetate requires an organic vapor cartridge and the irritant smoke, saccharin and Bitrex require a particulate filter. Qualitative fit testing may only used to test negative pressure airpurifying respirators that must achieve a fit factor of 100 or less.

The following is the general steps required by OSHA for qualitative fit testing. The entire protocol can be found in the mandatory Appendix A of the respirator standard.

1. The person to be tested shall be allowed to select the most acceptable respirator from a variety of choices.

2. Prior to selection, the person shall be shown how to put on and adjust a respirator.
3. The selected respirators is put on and worn for at least 5 minutes to assess comfort.
4. The adequacy of the fit shall be checked using listed criteria.
5. The test subject shall conduct either a positive or negativepressure seal check as described in Appendix B1.
6. The fit test procedure shall be described, including exercises to be performed.
7. The fit test will be performed wearing any other personal protective equipment that would be normally worn and which could affect respirator fit.
8. For qualitative fit tests, a threshold sensitivity test will be performed to determine if the person can detect the odor, taste or other response used to indicate a poor fit.
9. The person shall conduct the following 1minute exercises while wearing the respirator in the fit testing atmosphere:
* normal breathing;
* deep breathing;
* turning head side to side;
* moving head up and down;
* talking;
* bending over; and
* repeat of normal breathing.
10. If a person fails a fit test with a given respirator, the procedure is repeated with a different respirator.

Records of fit tests must be kept until the next fit test.

Use of Respirators

OSHA requires employers to establish procedures for the proper use of respirators. These include:
* prohibiting conditions that would interfere with the facepiece seal. Employers shall not allow employees with tightfitting facepieces to be worn by employees who have facial hair that comes between the sealing surface of the facepiece and the face or have any other condition that would interfere with the seal or valve function.
* Employers shall ensure that corrective glasses or goggles or other personal protective equipment worn by employees does not interfere with the facepiece seal.
* Employees wearing respirators with tightfitting facepieces must perform a user seal check each time they wear the respirator, as described in Appendix B1 (or approved manufacturer procedures).
* Ongoing surveillance of the workplace conditions to determine if they may affect respirator effectiveness.
* Employers shall ensure that employees leave respirator use area to 1) wash their faces as needed to prevent eye or skin irritation; 2) if they detect vapor or gas breakthrough, changes in breathing resistance or leakage; and 3) to replace filers, cartridges or canisters.
* Employers must have proper emergency procedures for use of respirators in IDLH atmospheres.

Changing Filters/Cartridges: One of the major disadvantages of airpurifying respirators is that the cartridges become saturated with the gaseous contaminant and breakthrough of the contaminant occurs into the lungs. The revised OSHA standard requires that airpurifying respirators be

equipped with endofservice indicators certified by NIOSH for the contaminant or that the employer implement a change of cartridge schedule based on objective data. The data relied on shall be included in the respirator program.

In the absence of air sampling data to help determine when to change cartridges, the respirator manufacturer should be consulted. In any case, change cartridges if odor breakthrough is detected.

With filter cartridges, the more particulates collected on the filter, the more efficient the filtering action. Particulate filters should get changed whenever it becomes difficult to breathe through them.

Maintenance and Care of Respirators

OSHA requires employers to provide for cleaning and disinfecting, storage, inspection and repair of respirators used by employees.

* Appendix B2 of the respirator standard specifies cleaning and disinfection procedures. Respirators used by one person shall be cleaned and disinfected as needed to maintain them in a sanitary condition. Respirators worn by more than one person shall be cleaned and disinfected before being worn by different individuals. Emergency respirators shall be cleaned and disinfected after every use.
* Respirators shall be stored to protect them from damage, contamination, lights, temperature extremes, etc.

* Respirators used routinely shall be inspected before each use and during cleaning. Inspections must include a check of respirator function, tightness of connections, condition of various parts including valves, straps, facepiece, etc. There are special procedures for emergency and escapeonly respirators.
* Defective respirators must be repaired before being used. Repairs must be done by trained personnel.

Respirator Training

Employees required to wear respirators must be trained before being required to use a respirator, and at least annually thereafter. The training must be understandable by the employees and employers must demonstrate that employees know at least the following:

* why the respirator is needed and the how improper fit, use or maintenance can affect its effectiveness;
* limitations and capabilities of the respirator;
* what to do in emergency situations, including cases of respirator malfunction;
* how to inspect, put on and remove, and check the seal of the respirator;
* how to recognize medical signs that may limit or prevent respirator use;
* the general requirements of the OSHA respirator standard.

Employees voluntarily wearing respirators must be given the information in Appendix D.

Program Evaluation

Employers must conduct regular evaluations of the workplace to ensure that the written respiratory program is being properly implemented. This shall include consulting employees about the effectiveness of the program. Factors to be assessed include:

* respirator fit;
* appropriate respirator selection;

* proper respirator use under existing workplace conditions;
* proper respirator maintenance.

Respirators and Students

OSHA regulations only apply to employees, and do not cover students (unless they are working for the Art Department). However, in order to protect students, it is good practice to use the same procedures for respirator use with students as is required for employees. However, I would not recommend that students ever be in situations where atmosphere-supplying respirators are required for reasons of the complexity of the equipment, the danger of accidents, and possible liability in case of accidents.

GLOVES AND HAND PROTECTION

Many acids, solvents, and other liquids found in art materials are capable of damaging the skin to cause dermatitis, the leading occupational disease. Gloves are available that can protect the hand against most hazardous exposures. These include chrome-tanned leather gloves for protection against heat, sparks, molten metal, chipping and cuts; cotton or fabric gloves work gloves for protection against dirt, abrasion, cold, and chips or slivers; metal mesh gloves for protection against hand saws, knives, and similar tools; and plastic and rubber gloves to protect against toxic liquid chemicals. Asbestos gloves aren't recommended for use because of the release of hazardous fibers.

OSHA requires that employers select and require that employees use appropriate hand protection when exposed to hazards that can damage the skin or can result in skin absorption of harmful substances (29 CFR 1910.138).

Liquid Penetration

There are a wide variety of types of rubber and plastic gloves on the market for use with liquids, each with different properties. Examples include natural rubber, neoprene rubber, polyvinyl chloride, nitrile, etc. There is no one type or brand of glove which is resistant to all kinds of liquids. One brand may be able to resist turpentine, but will dissolve in xylene, while another brand may do the opposite. Other gloves, while seemingly resistant to a liquid, actually allow permeation of the substance's vapor. Dishwashing, hairdressing, and surgical gloves almost never protect wearers against the solvents and acids found in many art materials.

Liquids, especially solvents, may penetrate gloves either as liquids or as vapors. In liquid form, solvents can cause some glove materials to dissolve. This is usually apparent to the wearer as the gloves soften and disintegrate. Vapor penetration or permeation of gloves is more difficult to detect and may leave the glove unchanged in appearance.

Some general principles, however, determine a glove material's resistance to liquid and vapor penetration:

* Certain rubber or plastic glove materials are especially suited to resist particular solvents or acids.
* Denser gloves manufactured by a solvent-dipping process are usually more resistant than latex-dipped gloves, especially to vapor permeation.
* Penetration usually increases as glove thickness decreases.
* The more concentrated the solution, the faster glove penetration can occur.
* Heat and abrasion will adversely affect glove performance.

Selection of Gloves

Glove selection begins with knowledge of the chemical composition of your materials. Material Safety Data Sheets (MSDSs), with the listing of ingredients can be obtained from the manufacturer. Glove charts gotten from safety supply distributors list chemical resistances rated on performance under ordinary conditions. Remember that glove performance varies between manufacturer even if the actual glove material is the same. Therefore, each chemical resistance chart is supplier-specific. For gloves used in special circumstances, such as with heated solutions or with abrasive action, it is recommended that you consult the manufacturer or test the glove in its particular application to ensure suitability.

Gloves are available in various sizes. It important that the glove fit well. Gloves also come in a variety of lengths. Be sure to select a glove of sufficient length to adequately protect the hand and forearm while working.

Table 7-4 gives relative resistance ratings of certain glove materials to some commonly used liquids in industry. It is adapted from a table in National Safety Council's 3rd edition of ***Fundamentals of Industrial Hygiene***.

Table 7-4. Glove Selection Chart

	GLOVE MATERIAL							
	Natural Rubber	Neo prene	BunaN	Butyl	PVC	PVA	Poly ethylene	Nitrile
CHEMICAL								
mineral acids								
e.g. Hydrochloric	G	E	E	G	G	P	G	E
organic acids								
e.g. Acetic	E	E	E	E	E	E	G	
caustics								
e.g. Sodium hydroxide	E	E	E	E	G	P	E	G
alcohols								
e.g. Methanol	E	E	G	E	E	F	E	E
aromatics								
e.g. Toluene	P	F	F	F	P	P	E	E
petroleum distillate								
e.g. Mineral spirits	E	E	E	F	P	E	E	E
ketones								
e.g.Methyl ethyl ketone	G	G	F	E	NR	F	G	F
chlorinated hydrocarbons								
e.g. Perchorethylene	NR	F	F	NR	NR	E	G	G
glycol ethers								
e.g. Cellosolve*	G	F			F	E	G	P
MISCELLANEOUS								
Lacquer Thinner	F	NR	NR	F	F	E	F	F
Benzene	NR	P	G	NR	F	E	F	G
Formaldehyde	E	E	E	E	E	P	E	F
Ethyl Acetate	F	G	F	G	P	F	G	F
Vegetable Oil	G	E	E	G	G	E	E	E
Animal Fat	P	E	E	G	G	E	E	E
Turpentine	F	G	E	F	F	E	G	E
Phenol	F	E	G	G	G	P	E	NR
PHYSICAL PERFORMANCE								
Abrasion resistance	F	G	G	G	G	E	E	
Cut resistance	E	E	G	F	E	F	E	
Puncture resistance	E	E	G	G	F	E	E	E
Heat resistance	E	E	F	P	P	F	P	F
Flexibility	F	G	F	G	F	F	G	G
Dry Grip	E	G	G	F	E	E	G	G
Wet Grip	G	F	G	F	E	E	G	F

* from glove manufacturer data

Key: E Excellent G Good PVC polyvinyl chloride
F Fair P Poor PVA polyvinyl alcohol
NR Not Recommended

Maintenance of Gloves

Periodic cleaning and drying of your gloves is necessary to keep them functional. One therefore needs a spare pair of gloves to wear while doing this maintenance. Hands should be washed twice: 1) with the gloves on to clean the gloves; and 2) with the gloves removed to clean the hands.

Barrier Creams and Waterless Hand Cleansers

There are also various protective creams, and waterless hand cleansers. Barrier creams are applied to the hands before chemical contact. These barrier creams are less protective than gloves, use is appropriate when gloves are impractical. Never use barrier creams for very corrosive chemical exposure. Water-soluble protective creams protect against solvents, cutting oils, paints, lacquers, and varnishes, while water-resistant types of creams protect against contact with acrylics, dyebaths, and mild acids. One should wash and reapply these creams often for best protection.

Waterless hand cleaners often contain solvents themselves, and are not a good substitute for plain soap and water for hand cleaning. As an alternative, baby oil can be used to remove paint from hands.

EYE AND FACE PROTECTION

The face and eyes must be protected against a variety of hazards, including flying particles (chipping, grinding, etc.), radiation (welding, glassblowing, carbon arcs, kilns, foundries) and chemical splash (acids, caustics, solvents, etc.), molten metal splashes, chemical gases or vapors, etc. OSHA requires that employees use appropriate eye or face protection when exposed to these hazards (29 CFR 1910.133). PPE purchased after July 5, 1994 must comply with American National Standards Institute ***Practice for Occupational and Educational Eye and Face Protection (ANSI publication Z87.11989).*** PPE purchased before July 5 must comply with ANSI Z87.1- 1968, or be demonstrated to be equally effective. All eye and face protection devices meeting this standard have the Z87 logo stamped on them.

One important factor is that face protection is different from eye protection. In certain instances, you may have to wear both protective goggles and a face shield to work safely. The use of a face shield does not necessarily provide adequate eye protection. Sometimes individuals will wear face shields when in fact they only need eye protection.

Art Departments and Art Schools should have a written policy mandating that students and wear suitable eye protection in all studios where there is a risk of chemical splash, flying particles, or radiation.

Protection Against Impact

Protection against impact or flying particles is of three types: spectacles with impact-resistant lenses and side shields, flexible or cushioned goggles, and chipping or eyecup goggles. For some types of exposure, a combination of goggles and face shield is advised. OSHA requires side protection when there is a hazard from flying objects.

Regular eyeglasses do not meet industrial impact protection standards. Flexible goggles are available that can be worn over eyeglasses. In addition it is possible to obtain goggles with prescription lenses.

Protection Against Radiation

The type of protection needed against radiation depends on the type of radiation exposure. Carbon arcs and electrical welding require protection against ultraviolet, visible and infrared radiation. The ultraviolet radiation can cause conjunctivitis ("arc eye"), sunburn, and skin cancer. A face shield is necessary as well as welding goggles. Table 7-6 lists minimum shade numbers for various operations, according to OSHA. In general, the rule is to use the darkest shade possible that is compatible with visibility.

In oxyacetylene welding, glassblowing, soldering, pottery and enameling kilns, and foundry work involving molten metal, the concern is mostly with protection against the visible and infrared radiation. Over a period of years, exposure to infrared radiation can lead to the development of cataracts. Goggles protecting against infrared radiation are recommended. In the case of foundry pours, a face shield protecting against infrared radiation is also recommended. Plastic lenses are recommended where there is a risk of molten metal splash. For looking in pottery or enameling kilns, use goggles with a shade number between 1.7 and 3. For glassblowing and foundry, a shade number of 3-5 is often used. Special infrared goggles are also available.

Table 7-6. Filter Lenses for Protection Against Radiant Energy

Operations	Electric arc size (1/32 inch)	Arc current (amps)	Minimum * Protective Shade
Shielded metal arc welding	Less than 3	Less than 60	7
	35	60160	8
	58	160250	10
	More than 8	250550	11
Gas metal arc welding and fluxcored arc welding	Less than 60	7	
	60160	10	
	160250	10	
	250500	10	
Gas Tungsten arc welding		Less than 50	6
		50150	8
		150500	10
Air carbon arc cutting	(Light)	Less than 500	10
	(Heavy)	5001000	11
Plasma arc welding		Less than 20	6
		20100	8
		100400	10
		400800	11
Plasma arc cutting	(Light) **	Less than 300	8
	(Medium) **	300400	9
	(Heavy) **	400800	10
Torch brazing			3
Torch soldering			2
Carbon arc welding			14

Operation	Plate thickness (inches)	Plate thickness (mm)	Minimum * Protective Shade
Gas Welding:			
Light	Under 1/8	Under 3.2	4
Medium	1/8 1/2	3.212.7	5
Heavy	Over 1/2	Over 12.7	6
Oxygen Cutting:			

Light	Under 1	Under 25	3
Medium	16	25100	4
Heavy	Over 6	Over 100	5

* As a rule of thumb, start with a shade that is too dark to see the weld zone. The go to a lighter shade which gives suficient view of the weld zone without going below the minimum. In oxyfuel gas welding or cutting where the torch produces a high yellow light, it is desirable to use a filter lens that absorbs the yellow or sodium line in the visible light of the (spectrum) operation.
** These values apply where the actual art is clearly seen. Experience has shown that lighter filters may be used when the arc is hidden by the workpiece.

Source: 29 CFR 1910.133 Eye and face protection.
==========

Protection Against Chemical Splash

Protection against chemical splash depends on the severity of the problem. For work with hot, concentrated acids in large amounts, complete acid hoods covering head and shoulders are available. In other cases face shields and goggles or simply chemical goggles with baffled ventilation are sufficient. For eye irritants, you should choose unventilated goggles.

If chemicals splash in the eyes, it is necessary to flush the eyes with water for 1520 minutes and consult a physician. (See the first aid section of Chapter 4.)

Contact Lenses

There has been considerable controversy about wearing contact lenses in the presence of chemical fumes, vapors, or splashes, intense heat, molten metals, or high concentrations of particulates. More recent research has not indicated an excess risk to the eyes of contact lens wearers. As a result, the American College of Occupational and Environmental Medicine and other professional organizations have recommended that contact lenses be permitted in all occupational settings in combination with proper eye protection, except where prohibited for specific reasons. For individuals requiring contact lenses for proper vision, the Americans with Disabilities Act requiring reasonable accommodation would apply.

Art departments and art schools should have a written policy about contact lenses for students and employees. The policy should include:
* identification of contact lens users;
* areas where contact lenses are not permitted and why;
* emergency and first aid procedures;
* designation of proper eye protection; and

* education and training of employees and students.

In case of chemical splashes in the eyes of contact lens users, the eye should be rinsed out with the contact lenses in place to avoid the delay involved in removing the contact lenses.

Equipment Maintenance

Goggles and face shields should be regularly inspected for scratches, pitting, clouding, etc. and replaced if necessary. They should be regularly cleaned, and disinfected if worn by more than one person, and stored away from heat and light.

HEARING PROTECTORS

Excessive noise over a period of years can cause permanent noise-induced hearing loss. OSHA's occupational noise exposure standard (29 CFR 1910.95) established Permissible Noise Exposures. For an 8-hour day, the OSHA standard sets a maximum time-weighted average sound level of 90 dBA (measured on the A scale of a sound level meter).

If the 8-hour exposure is over 85 dBA, then OSHA mandates a Hearing Conservation Program which involves regular hearing examinations, education, and provision of hearing protectors. If the level is over 90 dBA, then measures to reduce sound levels are required. Noise control measures can include quieter machines, isolation, proper maintenance, silencers and mufflers, vibration isolators (shock absorbers) and sound insulation.

The American Conference of Governmental Industrial Hygienists (ACGIH) has adoped more protective Threshold Limit Values (TLVs) for noise than OSHA. Their 8-hour time weighted average TLV is 85 dBA (compared to OSHA=s 90 dBA). In addition, the ACGIH adopted a increment of 3 dBA for halving the exposure time, compared to OSHA=s 5 dBA. (See Table 7-7) The ACGIH TLVs are intended to be more effective at preventing hearing loss.

Table 7-7. Comparison of OSHA PELs and ACGIH TLVs for Noise

Exposure Duration (hrs)	OSHA PEL (DBA)	ACGIH TLV (dBA)
24	none	80
16	80	82
8	90	85
4	95	88
2	100	91
1	105	94
0.5	110	97
0.25	115	100
ceiling	115	115

Ear plugs and ear muffs can protect artists from excessive noise exposure if engineering controls and other types of precautions are inadequate. Standard earplugs are generally inexpensive and are available in rubber, plastic, wax, urethane, foam and impregnated cotton. (Plain cotton is not effective). Although plugs can be molded for individual users, "off the shelf" varieties made of resilient foam material are usually effective in conforming to individual ear shapes.

Earmuffs are larger and more cumbersome than ear plugs, but can be more effective. They are constructed of materials containing plastic or rubber

foam and when well fit, provide a better acoustic seal than ear plugs. Earmuffs could also be equipped with speakers like those used for recording sessions.

The Noise Reduction Ratio (NRR) is used to determine the effectiveness of ear protective devices. On the average, sound intensity is decreased by 1530 dB when the subject is wearing correctly fitting plugs or muffs.

OTHER PERSONAL PROTECTIVE EQUIPMENT

There is a wide variety of other types of personal protective equipment available for particular purposes, including safety helmets, safety shoes, protective leggings and sleeves, heat-resistant clothing, impermeable protective suits, etc.

OSHA requires that employees wear protective helmets when working in areas where there is a potential for head injury from falling objects, and that the helmets must be designed to reduce electrical shock hazards when near exposed electrical conductors that could contact the head (29 CFR 1910.135). Helmets purchased after July 5, 1994 must comply with ANSI Z89.1-1986 - "American National Standard for Personnel Protection - Protective Headwear for Industrial Workers - Requirements." Helmets purchased before July 5 must comply with ANSI Z89.1-1969 or must be demonstrated to be equally effective.

OSHA requires that employees must wear protective footwear when working in areas where there is a danger of foot injuries due to falling and rolling objects, objects that can pierce the sole, and where feet are subject to electrical hazards. The selection of footwear purchased after July 5, 1994 must comply with ANSI Z41-1991, "American National Standard for Personal Protection - Protective Footwear." Equipment purchased prior to July 5 must comply with ANSI Z41.1-1867, "USA Standard for Men's Safety-Toe Footwear", or be demonstrated to be equally effective.

Personal protective equipment of all types is available from safety equipment suppliers. A partial list of such suppliers is found in Appendix 2.

REFERENCES

1. A. M. Best Company. ***Best's Safety Directory***. 2 Volumes. A.M. Best, Oldwick, NJ. Updated regularly.

2. American National Standards Institute. (1989). ***Practice for Occupational and Educational Eye and Face Protection. ANSI Z87.11989***. ANSI, New York, NY.

3. American National Standards Institute. (1980). ***Practices for Respiratory Protection. ANSI Z88.21980.*** ANSI, New York, NY.

4. Lab Safety Supply. (1991). ***Your Guide to Proper Glove Selection***. Lab Safety Supply, Janesville, WI.

5. McCann, M. (1992). ***Artist Beware***. 2nd ed., Lyons and Burford Publishers, New York, NY. *

6. McCann, M. (1989). Respirators. Center for Safety in the Arts, New York, NY. *

7. National Institute of Occupational Safety and Health. (1976). ***A Guide to Industrial Respiratory Protection. DHEW (NIOSH) #76189***. Government Printing Office, Washington, DC.

8. National Institute of Occupational Safety and Health. (1988). ***NIOSH Certified Equipment List as of October 1, 1987***. DHEW (NIOSH) #88-107. Government Printing Office, Washington.

9. Occupational Safety and Health Administration. ***Occupational Safety and Health Standards for General Industry - Respiratory Protection. 29 CFR 1910.134.***

10. Plog, B. (Ed.) (1988). ***Fundamentals of Industrial Hygiene***. 3rd ed., National Safety Council, Chicago, IL.

11. Segal E. (1997). Contact lenses and chemicals. Cehical Helath and Safety 4(3):33-37.

CHAPTER 8. FIRE SAFETY

There are many types of fire hazards in college art departments. These can include ordinary combustible materials such as wood, paintings, etc., flammable and combustible liquids, flammable gases, combustible metals, etc. Causes of fires can include lit cigarettes, welding sparks, static electricity, torches, and many others.

FIRE EMERGENCIES

According to OSHA, fire prevention plans shall contain the following minimum elements [29 CFR 1910.38(b)]:
* a list of major workplace fire hazards and their proper handling and storage procedures, ignition sources, andcontrol procedures; and
* names of job titles of personnel responsible for maintaining fire control procedures and equipment.

The fire control plan shall also cover housekeeping procedures, training and maintenance. Means of egress is covered in other OSHA regulations [29 CFR 1910.36 and 1910.37]. (See Chapter 10).

PORTABLE FIRE EXTINGUISHERS

A major part of fire emergencies is fire extinguishment policy, especially involving portable fire extinguishers. OSHA regulations for portable fire extinguishers are covered in 29 CFR 1910.157 and its appendix. More details are found in ***NFPA 10 Standard for Installation of Portable Fire Extinguishers***.

Employee Role

OSHA has different requirements for fire extinguishers, depending on the role of employees in fighting fires. There are three situations: 1) immediate evacuation where employees do not use fire extinguishers, 2) certain employees only are authorized to use fire extinguishers, and 3) all employees are authorized to use fire extinguishers.

In the first case where there is a written fire policy calling for immediate evacuation, and the only fire extinguishers present are those required by other regulations and are not to be used by employees, then only sections dealing with inspection, maintenance and testing, and hydrostatic testing apply. In addition there must be an emergency action and fire prevention plan meeting the requirements of 29 CFR 1910.38.

In the second case where only certain designated employees are authorized to use fire extinguishers, and all other employees are immediately evacuated, then sections dealing with fire extinguisher selection and distribution do not apply, but all other provisions do. In addition there must be an emergency action plan meeting requirements of 29 CFR 1910.38.

Where the employer provides fire extinguishers for the use of

employees, the employer shall provide educational programs covering principles of fire extinguisher use and hazards of incipient stage fire fighting to all employees. This training shall be conducted on initial employment and at least annually thereafter. Where only certain employees are designated to use fire fighting equipment as part of an emergency action plan, these employees shall receive such training upon first assignment to this duty, and at least annually thereafter.

General requirements

General OSHA requirements for fire extinguishers are found in 29 CFR 1910.157(c):

* The employer shall provide portable fire extinguishers and shall mount them, locate them, and identify them so they are accessible without subjecting the employee to possible injury.
* Only approved fire extinguishers shall be used. Carbon tetrachloride and chlorobromomethane extinguishers shall not be used.
* Employers shall assure that fire extinguishers are maintained in a charged and operable condition, and that they are kept in the designated locations.
* Soldered or riveted self-generating soda acid or self-generating foam and gas cartridge types that are operated by inverting them shall not be used.

Selection and distribution

Selection and distribution of fire extinguishers is covered in 29 CFR 1910.157(d):

* Fire extinguishers shall be selected and distributed based on class of anticipated fires and size and degree of hazard.
* Maximum travel distance to a Class A extinguisher shall be 75 feet.
* Maximum travel distance to a Class B extinguisher shall be 50 feet.
* Class C fire extinguishers shall be distributed based on patterns for Class A and B hazards.
* The maximum distance to a Class D fire extinguishing agent shall be 75 feet. They are required when combustible metal powders, flakes, shavings or similar sized products are generated more than once every two weeks.

Training and Education

Training and education is covered in 29 CFR 1910.157(g):

* Where the employer provides fire extinguishers for the use of employees, the employer shall provide educational programs covering principles of fire extinguisher use and hazards of incipient stage fire fighting to all employees.
* This training shall be conducted on initial employment and at least annually thereafter.

* Where only certain employees are designated to use fire fighting equipment as part of an emergency action plan, these employees shall receive such training upon first assignment to this duty, and at least annually thereafter.

Other Requirements

* Inspection, maintenance and testing requirements are covered in 29 CFR 1910.157(e).
* Hydrostatic testing requirements for portable fire extinguishers are

covered in 29 CFR 1910.157(f).

Appendix to 29 CFR 1910.157

The appendix to 29 CFR 1910.157 is a nonmandatory guideline to assist employers in meeting the requirements of this section.
* Extinguishers for Class A hazards (ordinary combustible materials) may be selected from foam, loaded stream, multipurpose dry chemical or water types.
* Extinguishers for Class B hazards (flammable and combustible liquids) may be selected from Halon 1211 or 1301, carbon dioxide, dry chemical, foam, or loaded stream types. (Note that halon is being restricted because of its effect on the ozone layer in the upper atmosphere.)
* Extinguishers for Class C hazards (energized electrical equipment) may be selected from Halon 1301 or 1211, carbon dioxide, or dry chemical types.
* There are specific extinguishing agents approved for particular types of combustible metals. However universal agents which may be used include Foundry flux, Lith-X powder, TMB liquid, pyromet powder, TEC powder, dry talc, dry graphite powder, dry sand, dry sodium chloride, dry soda ash, lithium chloride, zirconium silicate and dry dolomite.

Size and Distribution

Complete details on the size and distribution of portable fire extinguishers can be found in National Fire Protection Association ***NFPA 10 Standard for Installation of Portable Fire Extinguishers***.

Class A fire extinguishers: Fire extinguishers are available in a variety of sizes that are rated for different sized fires. Recommendations for distribution of Class A fire extinguishers are:
* The minimum rating for extra hazard occupancy is 3A. A college or studio may be considered extra hazard occupancy because of the storage and use of flammable and combustible liquids.
* For 3000 sq. ft., the minimum rating is 3A.
* For 4000 sq. ft., the minimum rating is 4A.
* For 6000 sq. ft., the minimum rating is 6A.
* A number of 3A fire extinguishers can replace 4A and 6A types.

Class B fire extinguishers: Recommendations for the distribution of Class B extinguishers are:
* Travel distance to a Class B extinguisher must not be more than 50 feet.
* The minimum rating for extra hazard occupance is 12B.

* Up to 3 foam type extinguishers of lower rating may be used to replace a 12B extinguisher. No other type of extinguisher of rating less than 12B is acceptable.

Class C fire extinguishers: Class C fire extinguishers are required in areas containing energized electrical equipment.

SPRINKLER SYSTEMS

Automatic sprinkler systems are highly recommended and in many instances are mandatory. Automatic sprinkler systems must meet design requirements of the National Fire Protection Association's ***Standard for***

the Installation of Sprinkler Systems (NFPA 13-1969), as well as OSHA requirements.

These requirements include:

* Each sprinkler system must have at least one automatic water supply that has adequate pressure, capacity, and reliability.
* There must be at least one connection through which the fire department can pump water.
* Maintenance procedures and annual testing are required.
* There must be at least 3 feet clearance between sprinklers and combustible storage, unless the material stored is in solid piles shorter than 15 feet high, or 12 feet high with horizontal channels. In the latter two cases, there may be a clearance of only 18 inches.
* There should be audible alarm systems provided with the sprinkler system which should sound whenever there is a flow of water from the total system equal to the amount of flow from a single sprinkler. Alarms should be easily accessible for inspection, maintenance, repair, and removal.
* If the water pressure is variable, there should be additionally a retarding device that can be accessed without shutting the sprinkler system. Sprinklers should be sealable in the open position.

STORAGE AND HANDLING OF FLAMMABLE AND COMBUSTIBLE LIQUIDS

In many inspections of art departments, the greatest immediate hazard has been the proper storage and handling of flammable and combustible solvents and solvent-containing materials.

Flammable liquids are liquids with a flash point below 100E F. Combustible liquids have flash points at or above 100E F. The flash point of a liquid is the temperature at which enough vapor forms at the surface of the liquid to ignite if a source of ignition is present. Possible sources of ignition include, but are not limited to: open flames, smoking, lightning, cutting and welding, hot surfaces, frictional heat, static, electrical and mechanical sparks, spontaneous combustion (including heat-producing chemical reactions), and radiant heat.

The National Fire Protection Association further subdivides flammable and combustible liquids into several classes, as shown in Figure 8-1.

Flammable liquids are a fire hazard at or near room temperature. The lower the flash point, the greater the risk of a fire. Combustible liquids are not normally considered to be serious fire hazards at ambient temperatures. However, heating a solvent to a temperature at or near its flash point will increase its fire hazard, for example, causing a combustible liquid to act as if it were a flammable liquid. This can be of concern in climates where temperatures can exceed 100E F in the summer.

STORAGE OF FLAMMABLE AND COMBUSTIBLE LIQUIDS

OSHA regulations covering the storage and handling of flammable and combustible liquids are found in 29 CFR 1910.106. In addition, local fire department regulations should be checked since they may be more stringent than OSHA regulations.

Container size: Use the minimum container sizes practical to minimize dangers of spills and fires. The National Fire Protection Association, in its ***NFPA 45 Fire Protection for Laboratories Using Chemicals*** specifies a maximum container size of 1 gallon (or 2-gallon safety cans) for Class I and II liquids in instructional laboratories. This would apply to college art studios. Larger containers should be stored in an inside storage rooms meeting NFPA requirements.

Storage amounts: A general recommendation is to store the minimum amounts of flammable and combustible liquids needed. Good practice would call for reordering several times per year rather than storing large amounts of flammable and combustible liquids on the premises (unless they are being stored in a proper storage room, as defined below). An inventory of chemicals presently being stored on the premises should be made and old materials and containers with small amounts of materials should be discarded in accordance with waste disposal regulations (see Chapter 9).

Table 8-1. NFPA Classification of Flammable and Combustible Liquids

Flammable Liquids

Class	**Flash Point**

IA	< 73E F (b.p. < 100E F)
IB	< 73E F (b.p. > 100E F)
IC	> 73E F and < 100E F

Combustible Liquids

Class	**Flash Point**
II	> 100E F and < 140E F
IIIA	> 140E F and < 200E F
IIIB	> 200E F

OSHA specifies that a maximum of 25 gallons of Class IA liquids, and 120 gallons of Classes IB, IC, II or III combined, can be stored outside flammable storage cabinets or storage rooms, or in any one fire area. In addition, state and local fire regulations often specify the amounts of flammable and combustible liquids that can be stored in places of public assembly such as colleges.

As a matter of good practice, I recommend storing any appreciable amount of flammable and combustible liquids in flammable storage cabinets or proper inside storage rooms.

Flammable storage cabinets: The purpose of a flammable storage cabinet is to prevent the contents from catching fire or exploding for at least ten minutes, in case of fire, in order to give personnel a chance to escape.

A flammable storage cabinet meeting NFPA and OSHA requirements can contain a maximum of 60 gallons of Class I and II liquids combined, or 120 gallons of Class III liquids. It is crucial to ensure that all flammable storage cabinets are properly capped unless local regulations require venting.

Inside storage rooms: *NFPA 30, Flammable and Combustible Liquids Code*, describes the requirements for inside storage rooms. These can include walls, floor and ceiling with a fire resistance rating of 2 hours, class B fire doors, automatic fire protection systems, explosion-proof wiring, a sill to contain spills, and mechanical ventilation (6 room air changes/ hour), depending on the amount stored. If flammable liquids (Class I) are stored in this room, then explosion vents, and Class I, Division 2 electrical wiring and fixtures are required. Only flammable and combustible liquids should be stored in these rooms.

Fire extinguishers: A Class B fire extinguisher of at least 12B rating should be located within 10-25 feet of where solvents are stored and less than 10 feet outside storage rooms. (See also the earlier discussion of portable fire extinguishers.)

Handling of Flammable and Combustible Liquids

Transfers from container to container: Areas where transfer of flammable or combustible liquids are transferred from one container to another must be separated from other operations by distance or walls with adequate fire resistance.

When dispensing Class I (flammable) liquids from one container to

another, the nozzle and container shall be electrically interconnected (bonded). Large containers (e.g. 5- and 55-gallon drums) should be grounded. With drums, dispensing pumps or faucets should be used.

There shall be a method to control spills and adequate ventilation. Spill control methods could include drainage or spill control materials. (See also the Spills and Leaks section of Chapter 4.)

Precautions at point of use: Cover all containers when not in use. Do not allow open flames or other sources of ignition within the possible path of vapor travel of flammable liquids. Have proper procedures for spill and leak control.

Fire control measures: Install appropriate fire extinguishers and other fire control equipment. Keep an adequate water supply for any fire control methods needing water. Properly maintain and inspect equipment.

Electrical: Electrical equipment and wiring in the vicinity of flammable-vapor/air mixtures must meet the National Electrical Code standards.

* In locations where flammable vapor-air mixtures may exist under normal conditions, electrical wiring must meet Class I Division 1 requirements of the National Electrical Code. (A Division 1 location is defined as 5 feet in all directions from all points of vapor liberation.)
* In locations where flammable vapor-air mixtures may exist under abnormal conditions, electrical wiring must meet Class I Division 2 requirements of the National Electrical Code. (Division 2 locations are defined as 20 feet horizontally, and 3 feet vertically from Division 1 locations; and up to 3 feet above floor or grade level for a 25-foot distance from any pump or other device handling flammable liquids.)

Housekeeping: Housekeeping must include procedures to contain leaks and accidental escape of flammable and combustible liquids. Spills must be cleaned up immediately, aisles kept clear, and combustible waste and residues kept to a minimum, stored in covered metal receptacles, and disposed of daily. See also the spills and leaks section of Chapter 4.

Disposal: Waste solvents should be placed in proper solvent waste cans. Small amounts (less than a pint) could be allowed to evaporate in a hood.

Solvent-soaked rags should be placed in self-closing oily waste cans which are emptied daily. Solvent-soaked rags can be allowed to dry in a manner similar to small amounts of solvents.

Oily rags should also be placed in proper oily waste cans which are emptied every day. Oily rags should never be stored in a pile where heat can build up to cause a spontaneous combustion fire. This can also occur with rags soaked in turpentine, lithotine, or d-limonene.

If oil- or solvent-soaked rags are recycled by a proper laundry service, then these rags are not considered hazardous waste. (See Chapter 9.)

SPRAYING FLAMMABLE AND COMBUSTIBLE LIQUIDS

The spraying of flammable and combustible liquids is strictly regulated because of the high risk of fire. OSHA regulations on spray finishing using flammable and combustible liquids are found in 29 CFR 1910.107.

According to OSHA, a spraying area is "any area in which dangerous quantities of flammable vapors or mists or combustible residues are present due to operation of spraying operations". A spray booth is "a

power-ventilated structure provided to enclose or accommodate a spraying operation to confine and limit the escape of spray vapor and residue and to safely conduct or direct them to an exhaust system".

Spray booths

Requirements for spray booths, ducts, and fan motors include:
* They may be constructed of aluminum or other substantially noncombustible materials for intermittent or low volume spraying; otherwise of steel or concrete masonry.
* The interior must be smooth, and floors noncombustible or covered with a noncombustible material that is easily and safely cleaned.
* Distribution or baffle plates must be noncombustible and removable.
* There must be maintenance procedures to ensure replacement of dry type overspray filters when the booth face velocity drops below 100 feet/minute (fpm). Gauges must be installed as an alarm to indicate when the face velocity is inadequate due to filter overloading. The filters must be noncombustible or have a combustible rating less than 2, according to Underwriters Laboratory. Discarded filters must be removed or placed in water-filled metal containers.
* There must be automatic sprinklers both up and downstream of the filters.
* If the booth opening is greater than 9 square feet, then metal deflectors or curtains at least 2.5 inches long must be placed at the upper, outer edge of the spray booth.
* The spray booth must be separated from other operations by at least 3 feet or by partitions or walls.
* There must be a 3 foot clearance on all sides of the spray booth which is kept free of storage or combustible construction.
* When spraying areas are illuminated through transparent panels, only fixed lighting sources can be used, the panels should isolate the spraying area from the lighting area, and the panels should be noncombustible and of such a material or located so that breakage is unlikely. The panels should be located so that any spray residue on the panels does not heat up to a dangerous temperature.

Electrical and other sources of ignition: Electrical wiring and equipment in and around spraying areas must meet National Electrical Code requirements.
* There shall be no open flames, spark-producing equipment or hot surfaces in any spraying area or within 20 feet, unless separated by partitions.
* No space heaters, steam pipes or hot surfaces may be located in the spraying area where combustible residues may accumulate.

* Unless approved no electrical equipment may be located in any spraying area where combustible residues may accumulate except wiring in rigid conduit or in boxes or fittings containing no taps, splices or terminal connections.
* Electrical wiring and equipment in spraying areas not subject to residue accumulation must be explosion-proof and be approved by the National Electrical Code for Class I Group D locations, and meet other requirements for Class I Division 1 Hazardous Locations.
* Electrical equipment and wiring outside, but within 20 feet of a spraying area, must not produce sparks, and must meet requirements for Class I Division 2 Hazardous Locations.
* Electric lamps outside the spraying area, but within 20 feet and not separated by a partition, must be totally enclosed, and protected from mechanical injury (ie shatterproof and in a safe location).

* Portable lamps shall not be used during spraying, and must be approved for a Class I hazardous location for use during cleanup.
* Spray guns and metal parts must be grounded.

Ventilation: All spraying areas shall be provided with mechanical ventilation during spraying and drying to prevent fires and explosions.
* Ventilation shall conform to NFPA 91-1967 and this section.
* Multiple spray booths shall have independent exhaust unless they are using the same materials and having a combined face area less than 18 sq. ft.
* Fan blades shall be nonferrous and non-sparking, and there shall be enough clearance between the blade and casing to prevent frictional heating. Bearings shall be self-lubricating or lubricated from outside the duct.
* Electric motors shall not be inside the booth or ducts.
* Exhaust ducts shall be made of steel, and protected against mechanical damage. There shall be at least 18 inches clearance from unprotected combustible structures around ducts (6 inches if ducts have a sprinkler system).
* Except for water wash booths, the terminal discharge point of ducts shall be at least 6 feet away from any combustible exterior wall, and no combustible construction or unprotected opening within 25 feet.
* The air exhaust shall not be directed so as to contaminate intake air and shall not be recirculated.
* Ducts shall have access doors to facilitate cleaning.
* There shall be adequate makeup air for the exhaust.
* Drying areas shall be ventilated to prevent explosions and shall be considered spraying areas.

Storage and handling: The storage and handling of flammable or combustible liquids to be sprayed must conform to OSHA regulations found in 29 CFR 1910.106 (see earlier discussion).
* Only the minimum amount of flammable and combustible liquids ordinarily needed for one day's operation may be stored in the vicinity of a spraying operation.
* Storage must be in original, closed containers or safety cans.

* Transfer of flammable and combustible liquids must be done in suitable mixing area or in spraying area with ventilation system operating. Precautions must be taken against sparks and sources of ignition. Transfer from containers larger than 60 gallons must be done with pumps.
* Spraying containers must meet certain standards.
* Piping and hoses for spraying must have a shutoff valve at the connection, automatic pressure release for pumps, be properly bonded and grounded, and be regularly inspected.
* Pump discharge line must have relief valve discharging to pump suction or a safe location.
* There must be proper bonding and grounding when transferring from one container to another.

Fire protection: Basic fire prevention requirements include:
* If the building is sprinklered, the spraying area must conform to NFPA 13-1968 dealing with extra hazard occupancies.
* Sprinkler heads must be kept clean.
* Fire extinguishers must be located near all spraying areas.

Operations and maintenance: Requirements include:
* Spraying must occur only in predetermined spraying areas.

* The spraying area must be kept clean of deposits, using non-sparking tools for cleaning.
* Spraying residues must be immediately removed from premises.
* Solvent- and paint-soaked rags must be kept in approved metal containers, which are emptied daily.
* Clothing used in spraying must not be kept overnight on premises, except in metal lockers.
* Cleaning solvents must have a flash point greater then 100E F (ie combustible). For cleaning spray nozzles and equipment, lower flash solvents may be used (but not lower than material being sprayed) if cleaning is done inside spray booth with ventilation in operation.
* Incompatible materials shall not be alternately used in a spray booth without cleaning residue first.
* No smoking signs shall be displayed in all spraying areas and paint storage rooms.
* There are special requirements for electrostatic hand-spraying equipment (29 CFR 1910.107(i)).

COMPRESSED GASES

Compressed gases are commonly used for welding and silver soldering. OSHA regulations for compressed gases are found in 29 CFR 1910.101, 1910.102, and 1910.104. Local fire departments may have stricter regulations.
* Oxygen and acetylene are the most common types of compressed gases used in cutting and welding. Other gases in use may include argon, carbon dioxide, helium, nitrogen, or propane.

* Only clearly labeled cylinders with hoses, valves and fittings in good condition should be used
* Oxygen and fuel gas cylinders should be stored at least 20 feet apart, or else with a 5 foot wall in between them that has a half-hour fire resistance rating. Preferably, storage should be outside. Indoor storage necessitates good ventilation
* The temperature of the storage area should never exceed 130E F. Cylinders should be kept far away from open flames (including welding and cutting torches), electric arcs, molten slag, sparks and radiators. Likewise, solar exposure can cause dangerous temperature levels in the cylinders. Cylinders should be stored 20 feet away from flammables storage (paint, solvents etc.).
* Storage areas must be identified. Post "no smoking" signs. Cylinders should be stored away from elevators, stairs, doorways, and aisles.
* Cylinders, regulators and other fittings should be kept clean of grease and oil contamination.
* Never have free-standing compressed gas cylinders. Secure acetylene cylinders upright, even if they are empty. Separate full from empty cylinders to prevent accidental use of an empty gas cylinder which could result in backfeeding from the full cylinder.
* Close valves of empty cylinders. These should be returned directly to the supplier.
* Cylinder caps must be in place during moving. A hand cart should be used for transport.

WELDING, CUTTING AND BRAZING

Welding, cutting and brazing involve both fire and health hazards. OSHA regulations covering these operations are found in 29 CFR 1910.251-254. Fire departments also often regulate welding operations. Only fire hazards are discussed here.

* Areas designated for welding and cutting operations should be free of flammable or combustible gases, liquids or vapors. If this is impossible, then these materials must be shielded from heat or sparks. Welding in the vicinity of painting operations can also create fire and health hazards to others in the area, as well as to welders. Fire extinguishing equipment must be available and maintained.
* Those working in welding and cutting must be trained in the safe operation of the equipment. I recommend that at least one welder should be certified by the American Welding Society. All manufacturer printed rules about equipment must be posted and heeded.
* A general statement of fire prevention precautions is found in 29 CFR 1910.252(d)(2)(xv):

> "Cutting or welding shall be permitted only in areas that are or have been made fire safe. Within the confines of an operating plant or building, cutting and welding should preferably be done in a specific area designated for such work, such as a maintenance shop or a detached outside location. Such areas should be of noncombustible or fire-resistant construction, essentially free of combustible and flammable contents, and suitably segregated from adjacent areas. When work cannot be moved practically as in most construction sites, the area shall be made safe by removing combustibles or protecting combustibles from ignition sources."

* Welding must be separate from combustible materials which could be exposed to sparks flying through open doors, windows, cracks in walls or floors. Walls, floors, and all furnishings should be non-combustible or furnished with fire resistant shields or guards. Floors with combustible shavings or sawdust should be swept clean for 35 feet. Combustibles within 35 feet must be removed or protected with flameproof coverings or metal shields.
* Welding, cutting, brazing, or hot work may be done only on materials that are thoroughly cleaned of any flammable or combustible material.
* Goggles, or helmets with eye protection, and hand shields must be used during welding and cutting. Arc welders should wear clean fire-resistent gloves and closed long-sleeved clothing.
* Individuals in nearby areas must likewise be protected, or shielded from heat, sparks, and ultraviolet rays.
* Gas cylinders must be stored according to the regulations stated in the section on Compressed Gases. Acetylene must not be stored at a pressure greater than 15 psi gauge or 30 psi absolute, since above this pressure, acetylene may become unstable. Indoor storage of fuel gas may not exceed 2,000 cubic feet or 300 pounds.
* The welding machine for electric arc welding must be kept dry during use.

* Welding cable should be spread out during work, and neatly stored afterwards. The ground lead must be attached securely to the work. Any damaged cable must be replaced. There should be regular inspection of cable.

* Connectors between ground and electrode cables must be specifically designed for that purpose. Spliced cables should never be within ten feet of the operator. Welders should never coil cables around their bodies. Electrode holders not in use should be stored separate from conductive objects.

REFERENCES

1. Babin, A., and McCann, M. (1989). Fire Prevention. Center for Safety in the Arts, New York, NY. *

2. McCann, M. (1992). ***Artist Beware***. 2nd ed., Lyons and Burford Publishers, New York, NY. *

3. National Fire Protection Association, Quincy, MA

NFPA 10-1988. *Portable Fire Extinguishers.*

NFPA 13-1969. *Standard for the Installation of Sprinkler Systems.*

NFPA 30-1987. *Flammable and Combustible Liquids Code.*

NFPA 45-1986. *Fire Protection for Laboratories Using Chemicals.*

NFPA 51B1962. *Standard for Fire Prevention in Use of Welding and Cutting Operations.*

NFPA 70-1987. *National Electrical Code.*

4. Occupational Safety and Health Administration. ***Occupational Safety and Health Standards 29 CFR 1910.*** U.S. Department of Labor, Washington, DC.

1910.38 *Employee emergency plans and fire prevention plans*

1910.157 *Portable fire extinguishers*

1910.106 *Flammable and combustible liquids*

1910.107 *Spray finishing using flammable and combustible liquids*

1910.101 *Compressed gases (general requirements)*

1910.102 *Acetylene*

1910.104 *Oxygen*

1910.251-254 *Welding, cutting and brazing.*

CHAPTER 9. WASTE MANAGEMENT

Art teachers and students often produce solid waste and sometimes liquid waste as a result of their art processes. Much of this waste can be hazardous, leaving the problem of how to dispose of it safely and legally. Some waste, while non-hazardous, can be bulky and use up space in our overloaded landfills. Certain non-hazardous wastes can be storage or fire hazards. The section on the Environmental Protection Agency in Chapter 5 discusses waste management laws.

The most important concept in safe waste management is to know the materials, and the hazards involved. The primary step is defining if the material in question is actually a hazardous waste or not. Understanding materials, including the ingredients, chemical reactivities, physical properties, and hazards involved in using, handling, storing, treating, or transporting is crucial.

WASTEWATER

The federal Water Pollution Act of 1972, and the Clean Water Act were enacted with the goal to "restore and maintain the chemical, physical and biological integrity of the nation's waters". Regulations promulgated to enforce these laws require that publicly-owned treatment works (POTWs) establish local pretreatment programs to ensure compliance. The actual pretreatment requirements are given in 40 CFR 403. These include general and specific discharge limitations and prohibitions to all POTWs, categorical pretreatment standard programs, requirements for POTW pretreatment programs, and the reporting requirements for industrial users.

Under these regulations, it is forbidden to discharge pollutants with certain characteristics into a POTW, including:

* pollutants that will cause fire or explosion hazard;
* pollutants that will cause corrosive damage to the POTW;
* solid or viscous pollutants that can obstruct flow;
* pollutants released at flow rates that interfere with the POTW flow;
* high temperature discharges that inhibit biological activity;
* petroleum oil, cutting oil, or mineral oil products;
* pollutants that can generate toxic gases, at levels that may cause health and safety problems; and
* trucked or hauled pollutants, not at specific discharge points identified by the POTW.

Industrial users must notify their local POTW of all discharges, that may cause problems with operation and flow. All "significant industrial users" also have to notify the POTW, and their regional EPA office of any discharge of hazardous substances. Significant industrial users are those that discharge at least 25,000 gallons per day of wastewater (excluding sanitary wastewater), or contribute a waste stream that accounts for 5 or more percent of the hydraulic or organic capacity of a publicly owned treatment works (POTWs), or as especially designated by the municipality.

Sewer Codes

All POTWs are required to develop local sewer use codes. These limits are designed to reflect the particular local environmental conditions of the area. Sewer codes will vary according to where POTW discharges are made.

It is impossible to present all the municipal sewage regulations here. Those concerned must contact their municipal Public Works Offices for details on the regulations. Given below is a sample toxic substances list supplied by the New York City Department of Environmental Protection, Bureau of Clean Water, Industrial Wastes Control Section. Sewer codes do restrict certain constituents, and some of the requirements include pH, temperature, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), suspended solids, and temperature.

Materials that cannot be put into the sewer system include:

* construction materials, ashes, cinders, straw, shavings, tar, plastic, wood, punch manure, coffee grounds, fur, wax, or obstructive solids;
* flammable or explosive liquids, solids or gases;
* petroleum hydrocarbons,at levels greater than 50 mg/L.;
* paints and waste from paint manufacturing;
* wastewater with a pH < 5.0 or > 9.5; and
* toxic substances exceeding permissible concentration (cadmium, hexavalent chromium, copper, cyanide, lead, mercury, nickel, and zinc).

TYPES OF HAZARDOUS WASTE

What is hazardous waste? There are several categories of chemicals used by artists in colleges that come under the heading of hazardous waste. While RCRA designates specific categories of hazardous waste, one can also define hazardous waste colloquially as a material that is of no further use, and cannot be safely returned to the environment, in original form. Types of hazardous waste are listed below.

Toxic Wastes

This category includes toxic chemicals, such as solvents, formaldehyde, lead compounds, mercury, chromates, etc., which are listed in 40 CFR 261.33. Table 9-1 contains selected chemicals used by artists that are listed as toxic wastes. See the EPA regulations for the complete list.

Table 9-1. Selected Toxic Wastes Regulated by 40 CFR 261.33

Acetone
Benzene
para-Benzoquinone
n-Butyl alcohol
Carbon tetrachloride
Chloroform
Creosote
Cyclohexane
Cyclohexanone

Dibutyl phthalate
ortho- and para-Dichlorobenzene
Dichloroethylene
Diethylhexyl phthalate
Diethyl and dimethyl phthalate
Di-n-octyl phthalate
para-Dioxane
2-Ethoxyethanol (Cellosolve)
Ethyl acetate
Ethylene dichloride
Ethylene glycol monoethyl ether
Ethylene glycol monomethyl ether
Ethylene oxide
Ethyl ether
Formaldehyde
Freons
Hydrofluoric acid
Hydrogen sulfide
Isobutyl alcohol
Mercury
Methyl alcohol
Methyl bromide
Methylene dichloride
Methyl chloroform
Methyl ethyl ketone
Methyl ethyl ketone peroxide
Methyl isobutyl ketone
Methyl methacrylate
Naphthalene
Pentachlorophenol
Perchloroethylene
Phenol
Resorcinol
Selenious acid
Selenium dioxide
Tetrahydrofuran
Thiourea
Toluene
Toluene diisocyanate (TDI)
1,1,1-Trichloroethane
Trichloroethylene
Xylene

Acutely Hazardous Waste

This is hazardous waste that is very dangerous even in small amounts. One has to follow EPA regulations if one generates more than 1 kilogram (2.2 pounds) of these materials in a month. Table 9-2 contains selected acutely hazardous wastes listed in 40 CFR 161.33 which may be generated by artists and schools. See the EPA regulations for the complete list.

Table 9-2. Selected Acutely Hazardous Wastes Regulated by 40 CFR 261.33

Arsenic oxides
Beryllium
Carbon disulfide
Cyanides
Hydrogen cyanide
Nitrogen oxides
Phenylmercuric acetate
Phosphine
Strontium sulfide
Vanadium pentoxide

Flammable Waste

This category includes:
* flammable and combustible liquids (flash point less than 142E F or 61E C);
* solids capable of causing fire through friction, moisture absorption, or spontaneous combustion (e.g. turpentine, d-limonene, and oil-soaked rags);
* ignitable, compressed gases (e.g. acetylene); and
* oxidizing substances (e.g. potassium chlorate, concentrated nitric acid, dichromates, etc.).

Corrosive Waste

Wastes with a pH less than 2 or greater than 12 are considered corrosive. Examples include nitric acid etching baths, photographic developing baths, anodizing and electroplating baths, ammonia, and acid dyebaths.

Reactive Waste

Reactive waste includes:
* normally unstable compounds that can undergo violent change without detonating (e.g. methyl ethyl ketone peroxide and benzoyl peroxide);
* cyanide or sulfide wastes which can generate dangerous amounts of toxic gases at pHs between 2 and 12.5 (e.g. cyanide electroplating solutions);

* compounds that react violently with water;
* compounds that can form potentially explosive mixtures with water; and
* compounds that can detonate at room temperature and pressure.

Leachable Toxic Waste

EPA has defined a Toxicity Characteristic Leaching Procedure (TCLP) to determine if a hazardous waste could leach toxic amounts of certain metals, pesticides and organic chemicals into the ground water. This test is specified in Appendix 2 of 40 CFR 261. Table 9-3 lists selected chemicals restricted under this regulation. See the EPA regulations for the complete list.

Table 9-3. Selected Chemicals Regulated Under the TCLP Rule (40 CFR 261.24)

Arsenic
Benzene
Barium
Cadmium
Carbon tetrachloride
Chloroform
Chromium
ortho-dichlorobenzene
para-dichlorobenzene
1,2-dichloroethylene
Lead
Mercury
Methyl ethyl ketone
Pentachlorophenol
Perchloroethylene
Selenium
Silver
Trichloroethylene

Other Hazardous Waste

Other classes of hazardous waste, not normally encountered by artists, include radioactive materials and pathological waste.

WASTE MANAGEMENT METHODS

There are many waste management methods available. Obviously some are better than others. The following list the common ones in order of priority:

1. Waste elimination or reduction at the source
2. Waste separation and concentration
3. Waste exchange
4. Energy and material recovery
5. Incineration or treatment
6. Secure land disposal

Sometimes, a combination of these methods will be needed. While the two most commonly used options of hazardous chemical waste management are secure chemical landfill storage and incineration, they may not be the most preferable.

Waste Elimination or Reduction

The best way of managing hazardous waste is to actually eliminate or minimize its production. The first step is to understand the hazards of the materials used. Then the substitution of lesser toxic materials can be investigated. Waste minimization pays particular attention to reducing the environmental toxicity - which is often reflected in the health hazards of the materials. Using lead-free glazes instead of leaded glazes results in the reduction in the amount of lead that enters the environment, via kiln fumes (health and air hazard), and also in

discarding unwanted or waste material (as hazardous waste). Also, lead-glazed pottery is often not safe with food, and lead glazes cannot be donated to many art programs because of the hazards involved. Another example of waste minimization is the use of water-based screen printing inks instead of solvent-based ones.

Waste Separation and Concentration

If one cannot reduce the actual amount of hazardous waste being produced, the next step is to keep hazardous waste from "contaminating" regular garbage. In this way, these different waste streams remain separated. An example of this is separating used and unwanted solvent-based paint from water-based paint. Sometimes wastes can in fact be combined in an advantageous manner. For example, mixing dilute solutions of spent
photographic developer (basic pH) with dilute solutions of spent photographic stop baths (acidic pH) can result in neutralization of both to nonhazardous waste solutions.

Small amounts of solvents or solvent-containing materials (less than a pint) can be evaporated if no other better alternative is available. Of course, this evaporation should take place outside, or inside a local exhaust hood where no one will be exposed to the solvent vapors.

Waste Exchange and Recycling

One of the most exciting methods of waste management is exchange and recycling of products. There are two types of recycling methods, which can be described as internal or external approaches.

Internal recycling: This method involves individual reuse of material. Oil-painting solvents used during painting can be allowed to settle, and then strained through cheesecloth (to remove the solids), and finally, reused either in actual painting or during cleanup. Internal recycling is usually going to be beneficial in terms of cost. We encourage artists and colleges to look at their extra materials and unwanted materials for possible reuse and recycling at another time. The inventory of materials can help in this evaluation.

External recycling: This method involves actually passing unwanted materials on to someone else who can use them. What is refuse to one may be usable to another. For example, leftover art materials can be donated to an art center or secondary school. Note that hazardous materials should never

be donated to elementary schools, and highly toxic materials like lead glazes should not be recycled.

There are increasing numbers of actual waste exchange programs. For example, the Northeast Industrial Waste Exchange, Inc. (NIWE) is one non-profit information clearinghouse for the resale of waste. They put out a quarterly catalog on both wanted and available resources.

ENERGY AND MATERIAL RECOVERY

Sometimes a waste cannot be put to good use in the form that it is generated, and must be treated to access beneficial qualities. Reclamation involves pick-up and handling of hazardous wastes by licensed

companies. Large printmaking departments, which generate many solvent- or oil-soaked rags can contract pick-up, laundry and return of their rags for re-use.

Incineration or Treatment

It is sometimes impossible to reuse a material, and in this case it must be either destroyed by a process such as incineration, or treated in some manner to convert it into a less toxic material can be reused in the environment. There are three types of treatment options that are available:

1. Volume reduction refers to water removal, or concentration of chemicals that really doesn't result in a more acceptable waste, but a form of waste that is easier and safer to handle. While concentration of wastes conserves space, it rarely results in a more environmentally acceptable waste. Instead, concentration normally is practiced to conserve space in a chemical landfill.

2. Detoxification can involve several processes. Neutralization of acids and bases is a traditional example. Spraying materials removes volatile toxins from aqueous waste. Sometimes, toxic metals can be converted to highly insoluble and thus less biologically accessible compounds; for instance, highly toxic and soluble barium salts can be converted to the less toxic sulfates. Certain biodegradable wastes can be treated in surface impoundments.

3. Solidification involves converting waste into a solid form, usually by incorporation into a matrix. The purpose of solidification is to trap the waste in order to control the rate at which ground or surface water that contacts the waste can dissolve the hazardous components. This might be a solution for waste ceramic glazes that cannot be recycled.

Secure Land Disposal

The least favorable option, placed at the bottom of the waste management hierarchy is secure land disposal. There are two techniques of secure land disposal. The first is similar to the operation of a sanitary landfill facility, where waste is placed in contact with soil or buried under soil, to encourage biological degradation. A very high degree of ground and surface water isolation is required. Another approach to secure land disposal is perpetual storage.

Secure land disposal and perpetual storage is placed last in the hierarchy of management options because of the many uncertainties regarding long-term success and safety, and maintenance complexities. Landfill design, transportation safeguards, labeling, surveillance, leachate management, disease control, barrier development and land use are just some of the safety concerns.

WASTE DISPOSAL SERVICES

Hazardous materials that can't be properly disposed of in other ways should be taken, in compliance with EPA and DOT requirements, to a licensed hazardous waste disposal company or picked up by a licensed hazardous waste transporter. Often this can be expensive. Once a contract is open with a waste management firm, the contractor will often help the client meet transportation and recordkeeping requirements. Specific contractors may have additional container labeling or marking requirements, or require specific waste analyses, or special packaging

beyond that which is specified by the regulations. When wastes are shipped off-site, they are usually consolidated or lab packed.

Lab Packs

Many companies, because of the high costs of insuring the transportation vehicles, have set up special services, such as lab packs, that are very helpful in areas where there may be a great variety of chemicals, but the quantities that actually accumulate may be small. Smaller containers of similar and compatible materials can be placed in larger DOT-approved containers (e.g. a steel or fiber drum), provided that there are enough cushioning and absorbent material (e.g. vermiculite) surrounding each container. A chemical inventory is made as the containers are added to the drum. When the drum is full, it is sealed and shipped to the disposal facility, for processing, along with a copy of the inventory sheet. This system is called a lab pack, and is particularly useful when actual quantities of hazardous wastes generated are small. Lab packs are often put together at the time of shipment of hazardous waste. A lab pack must contain compatible wastes, even though the individual identities may vary.

Disadvantages of lab packing include the fact that actual disposal is expensive since adsorbents make up the majority of the material disposed. When the inner containers are not full, actual space in the drum is wasted. Advantages include the fact that lab packs are generally safe, and simple, in that there is little chance of personnel exposure from transferring wastes or of hazardous mixing of incompatible chemicals.

Consolidation of Wastes

The alternative to lab packing is the consolidation of compatible waste materials into bulk form. Consolidation of wastes, however, presents different advantages and disadvantages. Utilization of space in consolidation is very efficient since chemicals are removed from their original containers and combined. About 3 or 4 times the amount of chemicals can be placed in a consolidated drum as compared to a lab pack. The total costs for disposal are lower, but there is a much greater risk of a chemical reaction or spill.

Sometimes a facility may not accept a lab pack or consolidated waste drum if certain wastes included are not allowed under their permits. For example, the inclusion of wastes containing mercury in a container of other wastes could prevent incineration of the entire waste stream in the container, thus making it impossible to dispose of the waste. Also, the improper mixing of solvents, might prevent certain reclamation, reuse, or land disposal of the material.

Transportation of Hazardous Waste

Shipments of hazardous wastes off-site are regulated by both the EPA and Department of Transportation (DOT). DOT requires that wastes be segregated by hazard class.

EPA requires that off-site shipments of hazardous waste must be accompanied by a "Uniform Hazardous Waste Manifest", which is a shipping paper used to track the waste. The manifest documents the "cradle-to-grave" requirements, and contains the name and address of the generator, the receiving facility site, and all transporters, along with a listing of all hazardous wastes in the shipments. All personnel handling the wastes

must sign the manifest. Large quantity generators must have certification regarding waste minimization including programs to reduce the volume, quantity and the toxicity of the wastes. Similarly, small quantity generators must sign such a statement.

All containers used for transporting the wastes over public streets and highways must meet DOT requirements for construction, compatibility with contained material, and tightness.

RECOMMENDATIONS FOR TREATMENT OR DISPOSAL

These recommendations are for actual treatment or disposal of art materials. If possible, leftover or waste art materials should be recycled or handled by other methods as listed above, especially since recycling of hazardous waste materials exempts waste generators from EPA regulations.

Whenever pouring or neutralizing chemicals, wear proper, approved personal protective equipment including:

* chemical splash goggles approved by the American National Standards Institute (ANSI);
* protective clothing (impermeable gloves, aprons, etc.);
* exhaust ventilation for hazardous, volatile gases or solvent vapors; and/or
* appropriate respirators approved by the National Institute for Occupational Safety and Health (NIOSH).

In addition, all routine chemical handling should be done in areas that are equipped with:

* emergency spill control kits for large spills;
* fire extinguishers for flammable and combustible materials;
* eyewash fountains in case of splashes in the eyes; and
* emergency showers for concentrated acids and alkalis.

Acids

Examples: acetic acid, boric acid, hydrochloric acid, hydrofluoric acid, oxalic acid, nitric acid, phosphoric acid, sulfuric acid, para-toluenesulfonic acid.

Dilute Acids

1. Neutralize dilute acid solutions by slowly adding baking soda (sodium bicarbonate) until bubbling stops. Check the pH with pH paper (neutral being pH 7).
2. Pour neutralized acid down the sink with lots of water.
3. Wear appropriate personal protective equipment.
4. Hydrofluoric and chromic acid solutions should never be poured down the sink. Dispose of as hazardous waste.

Concentrated Acid Solutions

1. Less than a cup of concentrated acids can be diluted by slowly pouring into 10 parts of water to one of acid, and then neutralized as above. Always add the acid to the water to avoid production of large amounts of heat and boiling.
2. Wear appropriate personal protective equipment.
3. Larger amounts of concentrated acids should be disposed of as hazardous waste.

Solid Acids
Solids such as oxalic acid should be disposed of as hazardous waste.

Aerosol Spray Cans

Examples: spray adhesives, spray fixatives, spray paints

1. Empty aerosol spray cans completely by spraying (outside or in a spray booth), and then placing in the garbage. Spray cans with residues are fire and explosive hazards.

Alkalis

Examples: ammonium hydroxide, calcium hydroxide (slaked lime), calcium oxide (lime), lithium oxide, potassium hydroxide (caustic potash), potassium carbonate (potash), potassium oxide, sodium carbonate (soda ash, washing soda), sodium hydroxide (caustic soda), sodium oxide, sodium silicate, trisodium phosphate.

Dilute Alkaline Solutions
1. Neutralize by slowly adding citric acid or white vinegar using pH paper to indicate when neutral (pH 7). 2. Pour the neutralized alkali down the drain with lots of water.
3. Wear appropriate personal protective equipment.

Concentrated Alkaline Solutions
1. Small amounts (less than a cup) can be diluted by slowly pouring into 10 parts of water to one of alkali, and then neutralizing as above. Always add the alkali to the water.
2. Wear appropriate personal protective equipment.

3. Larger amounts of concentrated alkaline solutions should be disposed of as hazardous waste.

Solid Alkalis
1. Dispose of as hazardous waste.

Chlorine Bleach

1. Chlorine bleaches (sodium hypochlorite) are alkaline, and can produce chlorine gas when mixed with acid, or other poison gases if mixed with ammonia.
2. Less than a cup of household strength chlorine bleach can be poured down the drain with lots of water.
3. More than a pint of household bleach and stronger bleach solutions should be disposed of as hazardous waste.

Clay

1. Place in garbage in sealed plastic bags. Clay is not listed as a hazardous waste by RCRA.

Dyes

Powders

1. Place in garbage in sealed plastic bags. Most dyes are biodegradable and are not listed as hazardous waste.

Dye Solutions

1. Pour dye solutions down the drain with lots of water.
2. If the dyebath is acidic or alkaline, neutralize as discussed under Acids and Alkalis.
3. Mordant baths containing dichromates must not be poured down the drain since they are oxidizing agents and probable carcinogens. They should be disposed of as hazardous waste. Evaporation can reduce the volume of hazardous waste.

Enamels - See Glazes and Glaze Chemicals

Etches and Pickling Solutions

1. These are acidic and should be neutralized. See Acids.
2. Acid etching on zinc and copper dissolve zinc and copper, which are regulated under local sewer codes. These codes do not normally apply to small waste generators. If desired, zinc and copper can be precipitated by adjusting to pH 8, by the addition of sodium carbonate (washing soda) and filtering the solution. The precipitate can be placed in the garbage and the solution poured down the drain with lots of water.
3. Wear appropriate personal protective equipment.

Glazes and Glaze Chemicals

1. Glaze chemicals, glazes, and glazed pottery are considered hazardous waste if they can not pass the acid leaching tests specified by EPA for arsenic, barium, cadmium, chromium, lead, nickel, or selenium.
2. Other glaze chemicals, glazes and glazed pottery can be placed in the garbage. Glazes should be allowed to dry before disposal.
3. Recycle glazes when possible. Residual glazes and glaze scrapings from spray booths can be combined, homogenized, tested, and used as a glaze. If needed, they can be adjusted with fluxes, colorants, etc.
4. Do not pour any glazes down the sink.

Glues and Cements

1. Allow water-based glues and cements to dry, and place in garbage.
2. Small amounts of solvent-based glues and cements (e.g. less than a cup) should be allowed to dry in a laboratory hood, spray booth, or outside in a location which will not expose anyone to solvent vapors. Keep away from sparks, flames, or other sources of ignition since most solvent-based glues are flammable.
3. See Plastics Resins for epoxy glues and methyl methacrylate glues.

Metals

1. Scrap metals are not considered hazardous waste if they are recycled or reclaimed.
2. If they are not recycled, then scrap metals would be considered hazardous waste if they can not pass the acid leaching tests specified by EPA for arsenic, barium, cadmium, chromium, lead, nickel, or selenium.
3. Beryllium is an acutely hazardous waste.
4. Mercury is a hazardous waste. Never mix mercury-containing waste with other hazardous waste.

5. Scrap solders containing lead, cadmium or silver are considered hazardous waste unless recycled or reclaimed.
6. Other scrap metals can be placed in the garbage (unless they are coated with hazardous paints).

Metal Compounds

1. Arsenic oxides, arsenic acid, phenyl mercuric acetate, strontium sulfide, and vanadium pentoxide are acutely hazardous wastes.
2. Calcium chromate, lead acetate, lead phosphate, selenious acid, selenium dioxide, and selenium sulfide are toxic hazardous wastes.
3. Metallic compounds would be considered hazardous waste if they can not pass the acid leaching tests specified by EPA for arsenic, barium, cadmium, chromium, lead, nickel, or selenium.

Minerals

1. Minerals such as carving stones, feldspars, flint, silica, talc, etc. are not considered hazardous waste, and can be placed in the garbage.

Oils, Organic

Examples: linseed oil, safflower oil, tung oil, turpentine, d-limonene

1. Oil-soaked rags are ignitable due to the risk of spontaneous combustion.
2. If oil-soaked (or solvent-soaked) rags are sent for laundering to laundries equipped to handle them, they are not considered hazardous waste.
3. Oil-soaked rags can also be hung up to dry individually so that heat can't accumulate, and then reused.

Organic Peroxides

Examples: methyl ethyl ketone peroxide, benzoyl peroxide

1. Organic peroxides can burn or explode if heated.
2. Organic peroxides should be dated and kept in original containers, since many contaminants can react with them. If they dry out, call the fire department for help since they can explode if heated (even from friction).
3. Small amounts of organic peroxides can be reacted with the plastic resin they were bought with to give a nonhazardous solid waste.
4. Large amounts of residual organic peroxides should be disposed of as hazardous waste. Keep separate from other hazardous wastes.
5. Wear appropriate personal protective equipment.

Oxidizing Agents

Examples: dichromates, chlorates, chromates, hypochlorites, nitric acid (concentrated), periodates, permanganates, persulfates

1. Oxidizers can react with organic materials such as sawdust, solvents, organic resins, starch, etc. to cause fires and explosions.
2. Oxidizers should be disposed of as hazardous waste. Keep them separate from other hazardous waste.

Paints and Other Coatings

Examples: Paints, varnishes, stains, finishes, sealants

Water-based Coatings
1. Paints containing lead, cadmium, or chromate pigments should be disposed of as hazardous waste.
2. Other water-based paints and coatings should be allowed to dry, and then placed in the garbage.
3. Paints containing mercury preservatives should be disposed of as hazardous waste.

Solvent-based Coatings
1. Small amounts of solvent-based paints and coatings (less than a cup) can be allowed to evaporate in a laboratory hood, spray booth or outside (if permitted) where no one is exposed.
2. If the residue contains lead, cadmium, or chromate pigments, it should be disposed of as hazardous waste; otherwise the residue can be placed in the garbage.
3. Larger quantities of solvent-based materials should be disposed of as hazardous waste. See also Solvents.
4. Stains containing wood preservatives are considered hazardous waste. See also Pesticides and Preservatives.

Patinas - See Metallic Compounds

Pesticides

1. Pesticides should be disposed of as hazardous waste.
2. Completely use up pesticides; empty pesticide containers should be triple rinsed. The rinse water should be used as a pesticide.
3. Pesticide spray cans - See Aerosol Spray Cans
4. Wear appropriate personal protective equipment.

Photochemicals

1. Old or unused concentrated photochemical solutions or powders, toning solutions, chromium solutions, color processing solutions containing high concentrations of solvents, and platinum/palladium printing solutions should be recycled or disposed of as hazardous waste.
2. Neutralize the alkaline developer by mixing with the stop bath and pouring down the sink with lots of water. Wear appropriate personal protective equipment.
3. Do not treat the fixing bath with acid (e.g mixing with stop bath), since fixing baths usually contain sulfites and bisulfites which will produce sulfur dioxide gas, a respiratory irritant. Mix small amounts of fixer with wash water, and pour down the drain.
4. Many local authorities regulate the amount of silver that can be present in waste water. You should contact your local sewer authorities for informatoin. Silver can be recovered from the fixer by several types of silver recovery systems. The simplest uses steel wool or another source of iron. The iron dissolves and silver is precipitated out. The precipitated silver must be sent to a company that can recover the silver. Kodak has a test kit to test for silver levels in effluent.

5. Replenishment systems, where fresh solutions are added regularly to replace solutions carried out by film or paper, reduce the daily volume of solution needing disposal. Ultimately, you will have to dispose of these

replenished systems, using the above guidelines.
6. In most areas, permits are needed to dump photographic wastes into septic systesms. Because of local variations in laws, Kodak no longer recommends dumping photographic wastes into septic systems without checking with local authorities. Previously, they recommended that photographic solutions (including wash water) constitute a maximum of 1/3 of the amount of household sanitary waste going into the septic system, and not to release more than a few pints at any one time. In some areas you need a permit to dump photographic wastes into septic systems.

Pigments

1. Lead, chromate, and cadmium pigments should be disposed of as hazardous waste.
2. Other pigments can be placed in the garbage. Dry pigments should be placed in sealed plastic bags.

Plaster

1. Plaster is not considered a hazardous waste. Place in the garbage in sealed plastic bags.

Plastics

1. Solid plastics are not considered hazardous waste.

Plastics Resins

Examples: epoxy, methyl methacrylate, phenol- or urea-formaldehyde, polyester, polyurethane.

1. Leftover resins can be reacted with the hardener to form a solid plastic, which can be then be placed in the garbage.
2. Old or large amounts of plastics resins should be disposed of as hazardous waste.
3. Wear appropriate personal protective equipment.

Solvents

Examples: turpentine, acetone, mineral spirits, methyl ethyl ketone, xylene, toluene, glycol ethers.

1. Small amounts of solvents or solvent-containing materials (e.g. less than a cup) can be evaporated inside a laboratory hood, spray booth, or outside (if permitted) so no one would be exposed.
2. Large amounts of solvents can be mixed together and disposed of as hazardous waste.

3. Chlorinated solvents (e.g. perchloroethylene, methylene chloride, 1,1,1-trichloroethane), or mixtures containing them, should be kept separate from other solvents since hazardous waste containing even small amounts of chlorinated solvents can be considered chlorinated waste and is thus more expensive to dispose of.
4. Waste cleaning solvents containing solids can often be reused by allowing the solids to settle, and filtering. If the solids are toxic, then they should be disposed of as hazardous waste. Otherwise, place them

in the garbage.

Wood

1. Ordinary wood or wood waste can be recycled, burned as a fuel, or placed in the garbage.
2. Wood that has been treated with wood preservatives such as chromated copper arsenate or other toxic chemicals should be disposed of as hazardous waste.

REFERENCES

1. Babin, A., and McCann, M. (1992). ***Waste Management and Disposal for Artists and Schools***. Center for Safety in the Arts, New York.

2. Environmental Protection Agency. (1989). ***40 CFR 260-267. Hazardous Waste Management Regulations***. Government Printing Office, Washington, DC.

3. Environmental Protection Agency. (1991). ***40 CFR 403424 Effluent Guidelines and Standards***. Government Printing Office, Washington, DC.

4. Environmental Protection Agency. (1989). ***40 CFR 425471 Effluent Guidelines and Standards***. Government Printing Office, Washington, DC.

5. Environmental Protection Agency. (1990). ***RCRA Orientation Manual - 1990 Edition***. Office of Solid Waste, Washington, DC.

6. Rules of the City of New York. (1992). ***Use of the Public Sewers, Including Sewer Discharges. Title 15, Chapter 19***. New York, NY.

7. New York State Department of Environmental Conservation, Division of Hazardous Substances Regulation. (1988). ***Are You a Small Quantity Generator?*** NYSDEC, Albany, NY.

8. Northeast Industrial Waste Exchange, Inc. ***Listings Catalog, Issue 44, Spring 1992***. 90 Presidential Plaza, Suite 122, Syracuse, NY 13202. Tel: (315) 4226572.

9. Society of Photo Finishing Engineers (SPFE). (1992). ***Wastewater Regulation Overview***. Photo Marketing Association International, Harrison, NY.

CHAPTER 10. SAFETY

This chapter discusses a number of safety areas that can be causes of accidents. Many of these areas are covered by OSHA regulations.

WORKING AREAS

Walking and Working Surfaces

* Source: 29 CFR 1910.22
* All work areas, including passageways, storerooms, and service-rooms should be kept neat, clean, sanitary, and dry. Spills must be cleaned up safely and promptly.
* The floors should be free of scraps, garbage, debris, oil or coolant spills, chips, and other waste. Likewise, floors, passageways, and working areas should be kept free of loose boards, nails, splinters and other protrusions. Machinery and excess equipment or storage shouldn't hazardously crowd the floor space.
* There should be nonslip surfaces or mats on the walking and work areas in wet spaces.
* Permanent aisles must be recognizable, and clear of obstruction.

Ladders and Scaffolding

* Source: 29 CFR 1910.24, 1910.25, 1910.26, 1910.27, 1910.28, 1910.29, 1910.
* A fixed ladder should be able to hold a 200 pound load. There are OSHA specifications for the size and type of rungs that are acceptable for ladders. Ladders should be free of splinters and burrs. Wood ladders should be made with preserved wood where needed, since paint alone doesn't adequately preserve wood.
* The preferred angle for descent is 75 - 90 degrees. Vertical ladders require cages or safety devices if they are longer than 20 feet.
* All portable ladders should be maintained in good condition, and inspected frequently. Dangerous ladders should be repaired or discarded. Metal ladders should not be used near energized electrical equipment. Ladders should be placed on secure nonslip surfaces or footing. All ladders should meet OSHA standards, and purchase orders should include this requirement.
* A standard guardrail is required at every open-sided platform, catwalk, or runway that is 4 or more feet above the floor. Stairways floor openings require standard guardrails on all sides except at the stair entrance. There are precise requirements for the construction of the standard guardrail.

* Scaffolds should be able to support at least four times the maximum intended load, while wire or rope should be able to support at least six times the intended load. The scaffold should solid enough to hold the intended load without settling or shifting. Unstable objects such as bricks, blocks, or boxes should not be used to support scaffolds or planks.

* Guardrails and toeboards must be used on all sides of scaffolds that are more than 10 feet above the ground. If the scaffold is less than 45 inches wide, then guardrails are required for scaffolds from 4 to 10 feet high. Planks must be secure from movement or be overlapped a minimum of 12 inches.
* All scaffolds must be maintained and inspected. Dangerous scaffolds should be removed.
* The height of rolling scaffolds should not exceed four times the size of the base. There must be proper cross and horizontal bracing. At least two out of four casters or wheels must be swivel type on rolling scaffolds, and they should all have locking capability. People should not be allowed to ride on manually propelled scaffolds.

Exits

* Source: 29 CFR 1910.36, 1910.37
* There must be an exit route that leads to a public way. The area surrounding the exit and exit route should be clear of any obstruction or debris. This exit route should not pass through high hazard areas unless there is suitable shielding or barriers.
* Doors leading to exit routes should be side-hinged and swinging. If the room to be exited holds more than 50 people, or is an area of high hazard potential, then the door must swing in the outward (from the room) direction. No locks or fasteners should prevent escape from the inside of the building.
* If the exits aren't accessible at all times, then there must be two available exit paths that lead directly to the exit.
* "EXIT", written in clear, plain, legible letters must mark each egress. This signs should not be obscured by any decoration, furnishings or other signs. Doors, passageways or stairways only resembling exits must be marked "NOT AN EXIT", or if applicable "STORAGE ROOM" or "TO BASEMENT" thus clarifying their usage.
* Directional arrows must delineate egress pathways when actual exit signs are not visible. It there is any occupancy at night, or there is reduced lighting during the day, exit signs must be lit with a reliable light source.

MATERIALS HANDLING AND STORAGE

Manual Handling

According to the National Safety Council, nearly one in four disabling injuries is directly related to materials handling activities. Accidents include slips, and falls, back injuries and hernias, chemical and heat injury, as well as hand and foot injury.

The following are recommendations for manual handling of materials:

* People lifting heavy objects should be trained in safe lifting techniques.
* If the object is large, have someone else guide the move. For two person lifting, make sure the individuals are as similar in height and strength as possible to ensure an equal balance of weight.
* Use protective equipment if necessary. For example use heat resistant gloves for hot objects, and heavy work gloves for rough lumber to protect from splinters.

Powered Equipment

* Hazards of different types of fork trucks often depend on the type of fuel used. Only those trained and authorized in the safe operation of fork trucks should be allowed to operate them. Unattended trucks should be parked in neutral, with forks lowered completely.
* Trucks should be inspected before service each day.
* Trucks must have an overhead to protect against falling objects.
* The view from the cabin should always be free. Loads that obstruct clear view must be hauled from behind.
* All loading boards and accessories must be securable.
* "No Smoking" signs are required with the use of battery powered operations.
* See 23 CFR 1910.178 for more detailed regulations.

Safe Storage

* Safe storage is characterized by the maintenance of a neat and orderly area for both temporary and permanent storage. Stored materials must not block any safety equipment (i.e. fire extinguishers, alarm boxes, sprinkler system controls, electric switches, lights or first aid supplies). Clearance must be maintained for exit routes, aisles, loading pathways, and doors.
* Proper drainage must be provided if necessary.
* Storage of hazardous chemicals and of flammable and combustible materials must be in accordance with OSHA regulations.
* OSHA specifies floorload capacity, labeling of floorboard capacity, door size, aisle width, stack clearance, loading facility and dock dimensions (29 CFR 1910.22).
* Floors and stairways should be kept free of debris, spill or fire hazards.
* All drums should remain sealed. Leaking drums should be removed.
* Store objects securely. For example, cylinders that are stored horizontally should be nested and blocked.
* Lack of adequate storage space often leads to unsafe conditions. Each classroom, workshop, studio, or lab should have adequate space for storage of materials used.
* Tool cribs, tool panels, wall cabinets, bench drawers, and tool racks should be constructed in such a way that there is protection from injury from tools falling from overhead and cuts arising from improperly stored sharp tools.

MACHINE AND TOOL SAFETY

Accidents involving machines, particularly woodworking machines, cause a high percentage of injuries in art departments. The following are some basic safety rules for machine and tool safety:
* Everyone using tools and machines should be properly trained in their use according to manufacturing specifications, and general safe and cautious behavior in the woodshop.
* Everyone should wear safety goggles or safety glasses. A face shield may be worn over these but a face shield by itself does not adequately protect the eyes. Eye glasses are not sufficient protection.
* NIOSH-approved toxic dust masks should be available and used when necessary.
* Loose clothing, work gloves, neckties and dangling jewelry should not be worn around powered tools or machines.

* The work area should always be kept clean, swept, and well-lit. Floors should be free of all debris, slippery materials, or water.
* Never leave any machine that is running unattended. Turn off the power, and wait until the machine isn't moving before leaving the work area.
* When energized machines and equipment are being serviced or maintained, OSHA requires a program to ensure the machines are equipped with lockout devices or tagout devices if guards are removed or bypassed, or other safety hazards could exist during the servicing (29 CFR 1910.147).

Machine Guards

Hazards to those working with machinery exist whenever machine parts rotate, reciprocate, move in transverse, Cut, punch, nip, shear or bend. Machinery action can occur at the site of the work-piece and elsewhere. OSHA requires machine guards on all machines with these safety hazards to protect the operator and other employees (29 CFR 1910.211, 1910.213, 1910.215 - .219)

Common methods of guarding against machine hazards include:
* enclosing the operation;
* interlocking devices;
* moving barriers;
* removal devices;
* remote control;
* two-hand tripping devices; and
* electronic safety devices.

Fixed enclosures: Fixed enclosure is the preferred method of machine guarding. Access to dangerous parts is impossible. Flying machine parts would be restrained. Sometimes they are adjustable to different types of machine parts. In this case, they should also be fixable.

Interlocking guards: Interlocking guards provide the second best method of machine guarding. An interlocking enclosure is removable. A mechanical or electric interlocking connection prevents dangerous contact between machine and operator.

Specifically, an interlocking enclosure guard should:
* disengage power preventing start-up of machine when the guard is open.
* guard the danger point before the start of operation.
* maintain the closed guard until the machine is at rest, and likewise stop power during a work cycle if the guard is opened.

Examples of interlocking guards include barrier bars or wires, or electric eye-beams, or magnetic circuitry that activates a braking mechanism.

Automatic guards: Automatic guards are the third best choice. One type of automatic guard operates while the machine is active, and protects by removing the operator's hand or body from the danger zone. Common examples are sweep and pushaway devices.

Remote control placement, feeding and ejecting can protect the operator from contact at the dangerous point in machine operation. Two-handed devices can activate the machine. Hand controls can also be linked with foot controls. The start-up controls should be positioned so that the operator cannot reach the dangerous point of the machine, unless he or she de-activates the machine by releasing the switch.

Woodworking Machines

Woodworking machines requires special consideration because of they are a major cause of accidents in arts programs. This is covered by OSHA under 29 CFR 1910.213.

* Machines should be secured. Belts, pulleys, chains, sprockets and gears must be guarded. V-belts and chain drives must be completely enclosed; if belts, shafting, couplings, keys, collars and clutches are located seven or less feet above the ground, these must be guarded from contact.
* Machine guards should be securely attached to machines, and conform to existing standards, or be specifically designed for the particular machine. (See discussion on machine guards below.)
* Every machine needs an accessible stop switch.
* Machines should have a master switch. It should be possible to lock the machine in the "off" position.
* Cutting blades must be maintained and sharp.

* Scraps and waste should be kept clear of the working surface of the machine.
* All woodworking machines that generate considerable quantities of wood dust should be equipped with dust collectors that exhaust to the outside. Portable dust collectors are available that can be connected to several machines at once.
* Hearing protection may be necessary since noise levels from machinery can be very high. A good rule of thumb is that hearing protection is called for when there is difficulty hearing someone one to two feet away.

Powered Hand Tools

* Source: 29 CFR 1910.241 - .243.
* All electric cords must be in good condition, and inspected and maintained. Special precautions must be taken if the work is damp, or contains flammables or combustibles.
* All guards, shields, and attachments should be in place and functioning.
* Hand held electrical power tools must have a quick-release (dead-man) control that shuts off power when control switch is released.
* The frame of electrical tools must be grounded or double-insulated, and thus labeled.
* Pneumatic tools must be securely fastened to the hose.
Additionally, there must be a tool retainer that restrains the attachment.

Hand Tools

* All hand tools must be maintained in good condition, and replaced if damaged.
* Tools should be stored safely and neatly. There should be procedures for the control of tools.
* Tools should only be used for their intended purpose.

For further information on the hazards and precautions for woodworking machines, powered hand tools and hand tools, see the data sheets prepared by the Canadian Center for Occupational Health and Safety (CCOHS). These are available from the Center for Safety in the Arts.

Electrical Safety

OSHA uses the National Electrical Code (NFPA 70-1971, and ANSI C1-1971) for its standard on electrical safety (29 CFR 1910.301 -

1910.308). Electrical fires are the number one cause of fire.

Basic requirements for electrical safety include:

* In every situation, permanent wires should be used. Extension cords, cube taps, and multiple jacks shouldn't be used. If needed, more outlets should be installed.
* Flexible cords should be inspected, maintained, and replaced if there are any signs of damage, fraying or deterioration. Cords should never be used as a substitute for fixed wiring. There should not be pull on joints or terminal screws of cords.
* It is forbidden to run flexible cords through holes in windows, doors, ceilings, floors, or walls. Cords may not be attached to building surfaces.
* Splices and repairs on flexible cord must be done by welding, brazing or soldering, or splicing devices. Do not tape wires. Both splices and free ends of conductors must be insulated.
* Circuit breakers and fuse boxes must either be recognizable or labeled. Outlets, switches, and junction boxes must be covered. All electrical boxes should be secured to the wall.

* The circuit breaker panel or fuse box should be easily accessible. Each switch should be labeled as to its function. Ground fault interrupters, which shut off the electrical current in the case of shorts should be installed.
* Electrical motor frames must be grounded. If there is any chance of operation in a wet or damp location, electrical contact with metal, voltage reached greater than 150, or operation in a hazardous location, then all exposed metal parts must be grounded, even if noncurrent-carrying. Likewise, noncurrent metal parts of appliances and hand-held motor operated tools must be grounded and labeled. Use only grounded plugs in wet areas.
* Ground fault circuit interrupters, which shut off the electrical current in case of shorts, should be installed whenever machinery or electrical outlets are within 10 feet of the chance of contact with water.
* 220-volt and 110-volt wiring should be separate and identifiable. Don't use compatible plugs.
* Don't let sawdust or other debris build up around motors since the debris may ignite if the motor overheats.
* National Electrical Code requirements for electrical wiring and equipment near flammable and combustible liquids was discussed in Chapter 8.

REFERENCES

1. Canadian Center for Occupational Health and Safety. Infograms:
Hand Tools (16 pp)
Powered Hand Tools (17 pp)
Woodworking (10 pp)
(These are a series of one-page data sheets on various topics that are useful training tools.) *

2. Division of Training and Manpower Development. (1981). ***Safety and Health for Industrial/Vocational Education for Supervisors and Instructors***. DHHS (NIOSH) and DOL (OSHA), Cincinnati, OH.

3. National Fire Protection Association. (1987). ***NFPA 70-1987. National Electrical Code***. NFPA, Quincy, MA.

4. National Institute for Occupational Safety and Health. (1979). ***Occupational Safety and Health in Vocational Education***, DHHS (NIOSH), Cincinnati, OH.

5. Occupational Safety and Health Administration. (1989). ***Occupational Safety and Health Standards For General Industry, 29 CFR Part 1910***. OSHA, U.S. Department of Labor, Washington, DC.

APPENDIX 1. CENTER FOR SAFETY IN THE ARTS

WHAT IS CSA?

The Center for Safety in the Arts provides information on hazards in the visual arts, performing arts, children and school arts programs, museums, and general health and safety information and laws relevant to the arts. The information is primarily intended for artists, performers and others working in the arts, and most of the files are written for people without a health and safety background. It is also a resource for health and safety professionals who want information on hazards in the arts.

From 1977 to the end of 1995, the Center for Safety in the Arts (CSA) operated the Art Hazards Information Center, a national resource center for research and education on hazards in the arts. Loss of funding required closing of the Information Center in 1996.

Many of the data sheets developed by CSA, along with other relevant information, can be found in the CSA Library on the CSA web site (see below).

Other CSA programs had included publishing the newsletter, ***Art Hazards News***, and offering educational programs and consultations on hazards in the arts. CSA continues to publish Art Hazards News. The educational programs and consultations are no longer available through CSA, but are available privately.

ART HAZARDS NEWS

CSA has published the newsletter ***Art Hazards News*** since 1978. It is presently an 8-page, quarterly newsletter edited by Angela Babin. The newsletter covers new hazards, precautions, legislative developments, lawsuits, and special events related to hazards in the arts. We encourage reprinting of articles as long as credit is given and our copyright included. If you wish to submit an article to Art Hazards News, send a message to the editor, Angela Babin at the address below.

The cost of a subscription cost to ***Art Hazards News*** is $24.00 per year. (Canada and PanAm countries add US $2.50 for first class postage; other countries, add US $5.00. Only checks payable on a U.S. bank are acceptable.).

Send payment to:

Center for Safety in the Arts
Mailbox 310
2124 Broadway
New York, NY 10023.

All back issues of Art Hazards News since 1993 (except the present year's issues) can be found in the ***Art Hazards News*** subdirectory on the CSA web site.

CSA WEB SITE

The URL or Internet address for the CSA Home Page is: http:/ artswire.org:70/1/csa

The CSA Library includes CSA data sheets and other relevant information in ASCII format, tables of contents of books on hazards in the arts, and descriptions of videotapes, along with ordering information. There are also links to other Internet web sites concerned with health and safety.

APPENDIX 2. RESOURCES

This Resource List was prepared by Angela Babin, MS.

OCCUPATIONAL HEALTH CLINICS

This list was updated with help from the Association of Occupational & Environmental Clinics (AOEC).

Alabama

UAB Occup Medicine Services
930 20th Street South
Birmingham, AL 35294
(205) 934-7303

California

Irvine Occup Health Center

19722 MacArthur Boulevard
Irvine, CA 92717
(714) 824-8651

Occup and Environ Health Clinic
Univ of California at Davis ITEH
Davis, CA 95616
(916) 752-3317

Occup and Environ Health
Univ California at San Francisco
1515 Scott Street
San Francisco, CA 94115
(415) 885-7770

Colorado

Occup and Environ Medicine Div Immunology and Respiratory Med
National Jewish Center
1400 Jackson Street
Denver, CO 80206
(303) 398-1520

Connecticut

Yale Occupational and Environmental Medicine Program
135 College Street, 3rd Floor
New Haven, CT 06510
(203) 785-5885
University of Connecticut Occupational Medicine Prog
263 Farmington Avenue
Farmington, CT 06030
(860) 679-2893

Lawrence and Memorial Occupational Health Center at Pequot Center
52 Hazelnut Hill Road
Groton, CT 06340
(203) 446-8265

Waterbury Occupational Health
140 Grandview Avenue
Suite 101
Waterbury, CT 06708

(203) 573-8114

District of Columbia

Div Occup and Environ Medicine
George Washington University
2300 K Street, NW
Washington, DC 20037

(202) 994-1734

Georgia

Emory Environ & Occup Program Rollins School of Public Health
1518 Clifton Road
Atlanta, GA 30329
(404) 778-5978

Hawaii

Occupational Medicine
Straub Clinic and Hospital
839 South Beretania
Honolulu, HI 96813
(808) 522-4321

Illinois

Occupational Medicine Clinic
Cook County Hospital
720 South Wolcott
Chicago, IL 60612
(312) 633-5310

Univ IL Occup Medicine Program
914 South Wood
MC 684
Chicago, IL 60612

(312) 996-7420

Iowa

Occup Med Clinic Univ of Iowa
Dept Internal Med SE 318, GH 200 Hawkins Drive
Iowa City, IA 52242
(319) 356-8269

Kentucky

Univ of KY Occup Med Program

2400 Greatstone Point
Lexington, KY 40504
(606) 257-5150

Louisiana

Ochsner Center for Occup Health
1514 Jefferson Highway
New Orleans, LA 70121
(504) 842-3955

Maine

Center for Health Promotion
1600 Congress Street
Portland, ME 04102
(207) 774-7751

Maryland

Johns Hopkins University
Center Occup and Environ Health 5501 Hopkins Bayview Circle
Baltimore, MD 21224
(410) 550-2322

Occupational Health Project
University of Maryland
School of Medicine
405 Redwood Street
Baltimore, MD 21201
(410) 706-7464

Massachusetts

Occupational and Environmental Medical Program
Boston University Medical Center
88 East Newton Street
Boston, MA 02118
(617) 638-8400

Center for Occupational and Environmental Medicine
Mass Respiratory Hospital
2001 Washington Street
South Braintree, MA 02184
(617) 848-2600

Occup and Environ Health Center Cambridge Hospital
1493 Cambridge Street

Cambridge, MA 02139
(617) 498-1580

Occupational Health Service
Dept Family and Community Med University of MA
55 Lake Avenue North
Worcester, MA 01655
(508) 856-2734

Michigan

Div Occup & Environ Medicine
Wayne State - Dept Family Med
4201 St. Antoine, Suite 4J
Detroit, MI 48201
(313) 577-1420

Michigan Univ, Dept of Medicine
117 West Fee
East Lansing, MI 48824
(517) 353-1846

Occupational Health Program University of Michigan
School of Public Health
1420 Washington Heights
Ann Arbor, MI 48109
(313) 764-2594

Center for Occup & Environ Med
22255 Greenfield Rd, Suite 440
Southfield, MI 48075
(810) 559-6663

Occupational Health Service
Work and Health Institute
St. Lawrence Hospital
1210 West Saginaw
Lansing, MI 48915
(517) 377-0309

Minnesota

Occupational and Environmental Health Services
Ramsey Clinic
640 Jackson Street
St Paul, MN 55101
(612) 221-3771

Columbia Park Medical Group
6401 University Ave, NE, #200
Minneapolis, MN 55432
(612) 572-5710

New Jersey

Environmental and Occupational Health Clinical Center - EOHSI
UMDNJ
Robert Wood Johnson Med Schl
P.O. Box 1179
Piscataway, NJ 08855
(908) 445-0123

New Mexico

Presbyterian Occup Med Clinic
5901 Harper, NE
Albuquerque, NM 87109
(505) 823-8450

New York

Mount Sinai-Irving J. Selikoff Center for Occupational and Environmental Medicine
Box 1058
One Gustave Levy Place
New York, NY 10029
(212) 987-6043

Mt. Sinai Occup Medical Clinic
Hudson Valley Division
Phelps Memorial Hospital
701 North Broadway
North Tarrytown, NY 10591
(914) 366-3670; 3000

Mt. Sinai Occup Medical Clinic
Brooklyn Center
Long Island College Hospital
(718) 780-2805

New York Univ/Bellevue Hospital Occup and Environmental Clinic
1 Ave and 27 Street
Room CD349
New York, NY 10016
(212) 561-4572

Union Occupational Health Ctr
450 Grider Street
Buffalo, NY 14215
(716) 894-9366

Eastern NY Occup Health Prog
155 Washington Avenue
Albany, NY 12210
(518) 436-5511

Finger Lakes Occup Hlth Services 980 Westfall Road, Suite 210
Rochester, NY 14642
(716) 256-0853

Occupational and Environmental Health Science Center
Level 3, Room 086
SUNY at Stony Brook
100 Nichols Road

Stony Brook, NY 11794-8036
(516) 444-2167

Central NY Occupational Health Clinical Center
6712 Brooklawn Pkwy, Suite 204
Syracuse, NY 13211
(315) 432-8899

North Carolina

Division of Occupational and Environmental Medicine
Duke Medical Center, Box 2914
Durham, NC 27710
(919) 286-3232
Ohio

Cleveland Clinic Foundation
Section Occup Health Medicine
1 Clinic Center
9500 Euclid Avenue
Cleveland, OH 44195
(216) 444-5707, (800) 223-2273

Greater Cinci Occup Hlth Center
Jewish Hospital at Evandale
10475 Reading Rd, Ste 405
Cincinnati, OH 45241
(513) 769-0561

Center Occup Hlth - Holmes Hospital, Tate Wing
Eden and Bethesda Avenue
Cinci Univ, College of Medicine
Cincinnati, OH 45267
(513) 558-1234

Occupational Health Center
Univ Health Center/Landerbrook
5850 Landerbrook Dr, Suite 100
Mayfield Heights, OH 44124
(216) 646-2210

WorkLink
Occup and Environ Medicine

2500 Metro-Health Drive
Cleveland, OH 44109
(216) 778-8087

Oklahoma

Univ Occupational Health Service
Oklahoma Memorial Hospital
900 NE 10th Street, #2402
Oklahoma City, OK 73104
(405) 271-6177

WorkMed
9330 East 41 Street, #102
Tulsa, OK 74145
(918) 627-4646

Oregon

Legacy Occup Medical Clinic
1650 NW Front, Suite 180
Portland, OR 97209
(503) 226-6744
Pennsylvania

Center Occup & Env Health
Abington Memorial Hospital
2510 Maryland Road, Suite 101
Willow Grove, PA 19090
(215) 881-5904

Occupational and Environmental Medicine Program

University of Pittsburgh
130 DeSoto, Room A729
Pittsburgh, PA 15261
(412) 624-3155

Dept Community and Prev Med Occup Health Service
Medical College of Pennsylvania
1505 Race Street, 6th floor
Bellet Building MS 644
Philadelphia, PA 19129
(215) 842-6540

Rhode Island

Memorial Hospital of RI
Occupational Health Service
Brown University Occup Medicine 111 Brewster Street
Pawtucket, RI 02860
(401) 729-2859

Texas

Texas Institute for Occupational Safety and Health
U.S. Highway 271 and 155
PO Box 2003
Tyler, TX 75710
(903) 877-5900

Univ of Texas Health Services
7000 Fannin, Suite 1620
Houston, TX 77030
(713) 500-3267

Utah

Rocky Mountain Center for Occup and Environmental Health
Univ of Utah, Building 512
Salt Lake City, UT 84112
(801) 581-3841

Washington

Occupational Medicine Program University of Washington Harborview Med Ctr
325 9th Avenue, #359739
Seattle, WA 98104
(206) 731-3005

West Virginia

Div Occup and Env Health
Dept Family and Community Med Marshall University Med School 1801 Sixth Avenue
Huntington, WV 25755
(304) 696-7045

Inst Occup and Env Health
West Virginia Univ
School of Medicine
PO Box 9190 HSS 3801
Morgantown, WV 26506
(304) 293-3693

Wisconsin

OMCA
15465 Howard
New Berlin, WI 53151
(414) 786-4422

CANADIAN OCCUPATIONAL HEALTH CLINICS

Alberta

University of Alberta
Faculty of Medicine
13-103 Clinical Sciences Building
Edmonton, Alberta T6G 2G3
(403) 492-6291

Manitoba

MFL Occupational Health Center
102-275 Broadway

Winnipeg, Manitoba R3C 4M6
(204) 949-0811

Ontario

McMaster University
Occupational Health Program
1200 Main Street West
Room 3H50
Hamilton, Ontario L8N 3Z5
(905) 525-9140, ext 22333

Sandy Hill Community
Health Centre
221 Nelson Street
Ottawa, Ontario K1N 1C7
(613) 789-7752

Evans Health Services
364 Evans Avenue
Toronto, Ontario M8Z 1K5
(416) 252-5885

Lakeshore Area Multi-Services
Occup Health
185 5th Street
Eteobicoke, Ontario M8V 2Z5
(416) 252-6471

Occup & Environ Health Clinic
St. Michael's Hospital
61 Queen Street East, 8th Flr
Toronto, Ontario M5C 2T2
(416) 867-7470

Quebec

Direction de la Sante Publique
1075 Chemin Ste-Soy, 2nd Floor
Quebec, G1S 2M1
(418) 646-3622

REGIONAL POISON CONTROL CENTERS (PCCS)

Accredited by the American Association of Poison Control Centers, 1996. Keep updated telephone numbers in advance of emergencies.

Birmingham, AL

Alabama Children's Hospital PCC
(205) 939-9201,
(800) 292-6678 (AL only)

Tuscaloosa, AL
Alabama Poison Center
(205) 345-0600
(800) 462-0800 (AL only)

Tucson, AZ
AZ Poison & Drug Info Center
(602) 626-6016
(800) 362-0101 (AZ only)

Phoenix, AZ
Samaritan Regional Poison Ctr
(602) 253-3334

Fresno, CA
Central California Regional PCC
(209) 445-1222
(800) 346-5922 (CA only)

Sacramento, CA
Univ of CA at Davis Poison Ctr
(916) 734-3692
(800) 342-9293 (NE CA only)

San Diego, CA
San Diego Regional Poison Ctr
(619) 543-6000, (800) 876-4766

Denver, CO
Rocky Mountain Poison Center
(303) 629-1123

Farmington, CT
Ct Reg Poison Control Center
(203) 679-3056
(800) 343-2722 (CT only)

Washington, DC
National Capital Poison Center
(202) 625-3333, 362-8563 (TTY)

Jacksonville, FL
Florida Poison Info Center
(904) 549-4480

(800) 282-3171 (FL only)

Miami, FL
FL Poison Information Center
(800) 282-3171 (FL only)

Tampa, FL
Florida Poison Information Center
(813) 253-4444
(800) 282-3171 (FL only)

Atlanta, GA
Georgia Reg Poison Control Ctr
(404) 616-9000
(800) 282-5846 (GA only)

Indianapolis, IN
Indiana Poison Center
(317) 929-2323
(800) 382-9097 (IN only)

Louisville, KY
KY PCC/Kosair Children's Hosp
(502) 629-7275,
(800) 722-5725 (KY only)

Monroe, LA
LA Drug and Poison Info Center
(318) 362-5393, (800) 256-9822

Baltimore, MD
Maryland Poison Center
(410) 528-7701
(800) 492-2414 (MD only)

Boston, MA

MA Poison Control System
(617) 232-2120
(800) 682-9211 (MA only)

Detroit, MI
Poison Control Center
(313) 745-5711

Minneapolis, MN
Hennepin Regional Poison Center
(612) 347-3141

(612) 337-7474 (TDD)

St. Paul, MN
MN Regional Poison Center
(612) 221-2113

St. Louis, MO
Cardinal Glennon Children's
Hospital Regional Poison Center
(314) 772-5200
(800) 366-8888

Montana
Rocky Mountain Poison and Drug Center
(303) 629-1123

Charlotte, NC
The Carolinas Poison Center
(704) 355-4000
(800) 848-6946, (800) 84-TOXIN

Omaha, NE
The Poison Center
(402) 390-5555 (Omaha)
(800) 955-9119 (NE)

Newark, NJ
NJ Poison Information and
Education System
(800) 962-1253

Albuquerque, NM
NM Poison and Drug Information Center
(505) 843-2551
(800) 432-6866 (NM only)

North Tarrytown, NY
Hudson Valley Regional Poison Control Center
(800) 336-6997
(914) 366-3030

Rochester, NY
Finger Lakes Regional Poison Control Center
(716) 275-5151
(800) 333-0542

Mineola, NY
Long Island Regional PCC
(516) 542-2323, 3813
New York, NY
New York City Poison Control Center
(212) POISONS, (212) 340-4494

Syracuse, NY
Central NY Poison Control Center
(315) 476-4766
(800) 252-5655

Cincinnati, OH
Drug and Poison Info Center
(513) 558-5111
(800) 872-5111 (OH only)

Columbus, OH
Central Ohio Poison Center
(614) 228-1323
(800) 682-7625 (OH only)

Portland, OR
Oregon Poison Center
(503) 494-8968
(800) 452-7165 (OR only)

Hershey, PA

Central Pennsylvania Poison Control Center
(800) 521-6110

Philadelphia, PA
Poison Control Center
(215) 386-2100

Pittsburgh, PA
Pittsburgh Poison Center
(412) 681-6669

Providence, RI
Rhode Island Poison Center
(401) 444-5727

Nashville, TN
Middle TN Poison Center
(615) 936-2034, (800) 288-9999

Dallas, TX
North Texas Poison Center
(214) 590-5000

Houston, TX
Southeast Texas Poison Center
(409) 765-1420 (Galveston)
(713) 654-1701 (Houston)

Salt Lake City, UT
Utah Poison Control Center
(801) 581-2151
(800) 456-7707 (UT only)

Charlottesville, VA
Blue Ridge Poison Center
(804) 924-5543
(800) 451-1428 (West VA only)

Seattle, WA
Washington Poison Center
(206) 526-2121
(800) 732-6985

Charleston, WV
West Virginia Poison Center
(304) 348-4211
(800) 642-3625 (WV only)

Wyoming
The Poison Center
(800) 955-9119 (NE and WY)
(402) 390-5555

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

NIOSH conducts research, answers inquiries, and conducts health hazard evaluations for work sites. NIOSH also funds Educational Resource Centers (ERCS) which research on occupational safety and health and provide technical assistance and information to employers.

NIOSH
Mail Stop C-13
4676 Columbia Parkway
Cincinnati, OH 45226

(800) 35-NIOSH, 356-4674 (US)
(513) 533-8328 (foreign)
(513) 533-8576 (publications fax)
Pubstaft@niosdt1.em.cdc.gov
(publications e-mail)
http://www.cdc.gov/niosh/
homepage.html (website)

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA)

OSHA enforces the Occupational Safety and Health Act by promulgating health and safety standards, conducting inspections, and fining violators of OSHA standards.

U.S. Department of Labor
Occup Safety and Health Admin
3rd and Constitution Avenue, NW
Washington, DC 20210
(202) 219-8148

Region I:
(CT, ME, MA, NH, RI & VT)
US DOL - OSHA
John F. Kennedy Federal Building
Room E-340
Boston, MA 02203
(617) 565-9860

Region II:
(NJ, NY, PR, & VI)
US DOL - OSHA
201 Varick Street, Room 670
New York, NY 10014
(212) 337-2330

Region III:
(DE, DC, MD, VA, PA, & WV)
US DOL - OSHA
Gateway Building, Suite 2100
3535 Market Street
Philadelphia, PA 19104
(215) 596-1201

Region IV:
(AL, FL, GA, KY, MS, NC, SC, & TN)
US DOL - OSHA
Atlanta Federal Center
100 Alabama Street SW
Room 6T50
Atlanta, GA 30367
(404) 562-2300

Region V: (IN, IL, MI, MN, OH, & WI)
US DOL - OSHA
230 South Dearborn Street, Room 3244
Chicago, IL 60604
(312) 353-2220

Region VI:
(AR, LA, NM, OK, & TX)
US DOL - OSHA
525 Griffin Street, Room 602
Dallas, TX 75202
(214) 767-4731

Region VII:
(IA, KS, MO, & NB)
US DOL - OSHA
1100 Main Street, Suite 800
Kansas City, MO 64105
(816) 426-2750

Region VIII:
(CO, MT, ND, UT, & WY)
US DOL - OSHA
1999 Broadway, Suite 1690
Denver, CO 80202
(303) 844-1600

Region IX:
(American Samoa, AZ, CA, Guam, HI, NV, & Pacific Island Trust Territory)
US DOL - OSHA
71 Stevenson Street, 4th Floor
San Francisco, CA 94105
(415) 744-6670

Region X:
(AK, ID, OR, & WA)
US DOL - OSHA
1111 3rd Avenue, Suite 715
Seattle, WA 98101
(206) 553-5930

EPA REGIONAL HOTLINES

The Environmental Protection Agency (EPA) issues regulations on the environment, and has many publications and services.

(202) 260-2090 General EPA services and personnel locator

(800) 262-7937 Hazardous Waste Ombudsman
website: http:\\www.epa.gov
e-mail: http:\\rtk.net

Environmental Assistance Division
US EPA
TSCA Assistance Information Services
401 M Street, SW
Washington, DC 20024
(202) 554-1404

EPA Regional Offices

Region I
Boston, MA
(617) 565-3420

Region II
New York, NY
(212) 637-3000

Region III
Philadelphia, PA
(215) 566-5000

Region IV
Atlanta, GA
(404) 562-9900

Region V
Chicago, IL
(312) 353-2000

Region VI
Dallas, TX
(214) 665-6444

Region VII
Kansas City, KS
(913) 551-7000

Region VIII

Denver, CO
(303) 312-6312

Region IX
San Francisco, CA
(415) 744-1305

Region X

Seattle, WA
(206) 553-1200

RCRA, CERCLA, Superfund
(800) 535-0202

Superfund
Office of Emergency and Remedial Response
US EPA
401 M Street, SW
Washington, DC 20460

CERCLA, RCRA
Office of Waste Programs Enforcement
US EPA
401 M Street, SW
Washington, DC 20460
(800) 424-9346

SAFETY SUPPLY SOURCES

There are many excellent full-line distributors for safety equipment. These are usually listed in the Yellow Pages Telephone Directory under safety suppliers.

Birmingham, AL
Wyatt Safety Supply Co Inc
(205) 9420050

Hayward, CA
Safety Supply America
(510) 7840104

Los Angeles, CA
Safety Supply America
(213) 6038788

New Haven, CT
Connecticut Safety Supply
(203) 9323641

Tampa, FL
Safety Equipment Company
(813) 6214921

Atlanta, GA
Safety Supply America
(404) 3556323

Indianapolis, IN
ORR Safety Equipment Company
(317) 2488331

Kansas City, KS
Day Star Corporation
(816) 2211401

Baltimore, MD
Maryland First Aid
(301) 5611820

Detroit, MI
Argus Supply Company
(313) 7748900

St Louis, MO
Wise El Santo Company
(314) 4283100

Hackensack, NJ
Olympic Glove Company
(800) 5260122

New York, NY
Eastco Industrial Safety Corp
(800) 2210224

Uniondale, NY
Global Safety
(516) 7941234

Cincinnati, OH
ORR Safety Supply Company
(513) 4890800

Akron, OH
TwymanTempleton Company

(216) 9293388

Portland, OR
Sanderson Safety Supply Co
(503) 2385700

Philadelphia, PA

Industrial Products Company
(215) 5474400

Philadelphia, PA
Arbill Industries
(215) 2284011

Pittsburgh, PA
Safety First Supply
(412) 7878600

Grand Praire, TX
Dantack Corporation
(214) 9888200

Houston, TX
Vallen Safety Supply Company
(713) 4628700

Seattle, WA
Rice Safety Supply
(206) 7674500

Janesville, WI
Lab Safety Supply Company has a very good technical support line and catalog mail-order service.
Lab Safety Supply, Inc.
P.O. Box 1368
Janesville, WI 53547
(800) 356-0783 Phone Orders
(800) 356-2501 Safety Techline
(800) 543-9910 Fax Orders
(800) 356-0722 Customer Service

Milwaukee, WI
Lyons Safety
(414) 2557300

Canada

Ackland's Safety Supply has 25 branches throughout Canada.
Richmond Hills, Ontario
(905) 731-5516

OTHER RESOURCES

American Industrial Hygiene Association (AIHA)
2700 Prosperity Avenue, Ste 250
Fairfax, VA 22031
(703) 849-8888

Consumer Product Safety Commission (CPSC)
Office of Information and Public Affairs
4330 East-West Highway
Bethesda, MD 20814

(800) 638-2772
(301) 504-0580

National Fire Protection Association (NFPA)
1 Batterymarch Park
Quincy, MA 02269
(800) 344-3555

National Safety Council (NSC)
1121 Spring Lake Drive
Itasca, IL 60143-3201
(630) 285-1121