CHEMICAL HYGIENE PLAN

KENTUCKY WESLEYAN COLLEGE

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FORWARD

On January 31, 1990 the Occupational Safety and Health Administration (OSHA) promulgated the final rule for occupational exposures to hazardous chemicals in laboratories. The basis for this standard is the determination that laboratories typically differ from industrial operations in their use and handling of hazardous chemicals and that a different approach than that found in OSHAS substance specific health standards is warranted to protect workers.

The final standard, called the Laboratory Standard, applies to all laboratories that use hazardous chemicals in accordance with the definitions of “laboratory use” and “laboratory scale” provided in the standard (see Glossary, Appendix I). Laboratories covered by this standard have the obligation to maintain employee exposures at or below permissible exposure limits (PELs) specified by OSHA. However, the manner in which this obligation is achieved will be determined by each employer through the formulation and implementation of a Chemical Hygiene Plan (CHP).

Because colleges contain facilities and programs that meet the “laboratory use” and “laboratory scale” criteria in the final standard, they must be covered under an appropriate Chemical Hygiene Plan. Moreover, college employees whose assignments include working in a laboratory area must receive appropriate training and information about the HP and the practices it prescribes.

In order to obtain background information for the preparation of this chemical hygiene plan the author attended a workshop on laboratory safety given by a faculty member from Curry College, Milton, Massachusetts. Subsequently a copy of *A Model Hygiene Plan for Kentucky School Districts* was obtained to use as a guide for the preparation of this hygiene plan. Additional information was obtained from the booklet *Developing* a *Chemical Hygiene Plan* published by the American Chemical Society.

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A. COLLEGE POLICY REGARDING CHEMICAL HYGIENE

Kentucky Wesleyan College (KWC) is committed to provide a safe working environment for its employees and students and believes that they have a right to know about health hazards associated with their work.

The Occupational Safety and Health Administration (OSHA) has developed rules concerning occupational exposure to hazardous chemicals specifically in laboratories on the basis that laboratories typically differ from industrial operations in their use and handling of hazardous chemicals and therefore a different approach is warranted to protect workers.

The "Laboratory Standard" applies to all laboratories that use hazardous chemicals in accordance with the definitions of "laboratory use" and "laboratory scale" provided in the standard (see Glossary, Appendix I). Laboratories covered by this standard have the obligation to maintain employee exposures at or below permissible exposure limits (PELs) specified by OSHA. However, the manner in which this obligation is achieved will be determined by each employer through the formulation and implementation of a Chemical Hygiene Plan (CHP).

Because KWC meets the OSHA "laboratory use" or "laboratory scale" criteria, the College has the responsibility to adopt policies and procedures that minimize exposure of employees to hazardous chemicals present in laboratories. It has further responsibility to provide information and appropriate training to make employees whose assignments include working in a laboratory area aware of potential hazards and safe working practices. The Chemical Hygiene Plan documents how these responsibilities will be discharged.

Employees have the responsibility to participate actively in training programs, to know and follow the policies and procedures contained in the Chemical Hygiene Plan, and to conduct their work activities in a manner which minimizes their risk of exposure. Because the people who work in any given laboratory are best able to detect potential hazards in either the facility or in work procedures, when safety concerns arise, employees are encouraged to discuss their concerns with their supervisor for communication to the proper administrative authority.

This policy statement and the Chemical Hygiene Plan were adopted by the Board of Trustees of Kentucky Wesleyan College on September 16, 1994. The Plan was updated in 2006, 2009, and 2017.

B. GENERAL PRINCIPLES FOR WORKING WITH LABORATORY CHEMICALS

1. Minimize Chemical Exposure

   It is prudent to minimize all chemical exposures because few laboratory chemicals are without hazard. Employees will follow general precautions for handling all laboratory chemicals. Specific guidelines for particular chemicals will also be followed, where applicable.

2. Avoid Underestimation of Risk

   Employees are cautioned against the underestimation of risk. Exposure to substances of unknown risk should be minimized. The decision to use certain substances in the college laboratory should be based on the best available knowledge of each chemical's particular hazard and the availability of proper handling facilities. Substitutions, either of chemicals or experiments, often can be made to reduce hazards without sacrificing instructional objectives. When the risk outweighs the benefit and no substitute chemical is available, then the experiment or procedure should be eliminated.

3. Provide Adequate Ventilation

   The best way to prevent exposure to airborne substances is to prevent their escape into the working atmosphere by use of fume hoods and other ventilation devices. Such devices must be kept in good working condition in order to provide employees and students with a safe working area.

4. Follow the Chemical Hygiene Plan

   The Chemical Hygiene Plan specifies laboratory practices designed to minimize employee exposure to hazardous chemicals. Because of the large number of chemicals that may be stored and used in college laboratories, employees must follow the practices specified in the Chemical Hygiene Plan in order to minimize health and safety risks.

C. CHEMICAL HYGIENE MANAGER - POSITION DESCRIPTION

Chemical Hygiene Manager

Classification: Additional duties for a qualified science faculty member
Reports to: VP of Academic Affairs and Dean of the College Supervises:
none

Position Summary:
The Chemical Hygiene Manager is responsible for overseeing the storage and handling of chemicals related to academic functions.

Job Functions:
1. Maintains compliance with applicable federal, state, and local regulations for chemical handling and storage.
2. Maintains a current inventory of chemicals and wastes, with an annual report submitted in May or June.
3. Observes safety precautions to prevent leaks, fires, and explosions, making corrections and changes as necessary.
4. Monitors chemical storage and related areas to detect leaks, equipment malfunctions, and potential hazards, and notifies the Director of Facilities Services for repairs, when necessary.
5. Coordinates with the Director of Facilities Services to contract for the disposal of chemicals and chemical by-products through external agencies as necessary.
6. Assist with other responsibilities as directed by the VP of Academic Affairs and Dean of the College.

Position Qualifications:
The Chemical Hygiene Manager must have a demonstrated knowledge of chemical handling and storage regulations and of safety procedures regarding such. S/He should be a skilled observer with the ability to pay close attention to details.

D. ADMINISTRATIVE ORGANIZATION: RECORD-KEEPING

1. Chemical Inventory Records

   An inventory of all chemicals stored in each program shall be conducted annually by the Chemical Hygiene Manager. Inventory information shall include the following: chemical name, quantity, and storage location. A sample page from a previous inventory is included in Appendix II as an example.

2. Inspection Records

   Reports of required inspections (see Appendix III) must be completed and retained by the Facilities Service Director (hoods, eyewash-shower stations, fire extinguishers and fire alarms). In addition, equipment should be tagged to indicate the date and the results of the last inspection. The Facilities Services Director will maintain records documenting maintenance performed on equipment not operating up to standards.

3. Chemical Hygiene Training Records

   Records documenting the dates and content of chemical hygiene training sessions (see Appendix IV) must be completed for each employee and retained by the Chemical Hygiene Manager.

4. Accident Reports

   An accident is defined as any situation in which a health care profession is consulted. Accident reports (Appendix V) must be completed for any accident and retained by the Chemical Hygiene Manager.

   Less serious occurrences in which a health care professional is not consulted are termed incidents. Each instructor must keep a brief log of incidents (see Appendix VI) in laboratory courses including the date, student's name, minor injury and treatment.

5. Medical and Exposure Records

   Records concerning air concentration monitoring, exposure assessments, medical consultations, and medical examinations will be maintained in accordance with OSHA regulations (29 CFR Part 1910.20) as required.

E. MINIMIZING EMPLOYEE EXPOSURE: FACILITIES AND EQUIPMENT

1. Laboratory Design and Use

a. General Guidelines

The design of the laboratory facility will provide sufficient space for safe work by the number of persons to be in the laboratory. Exit doors will be clearly marked and free of obstructions to permit quick, safe escape in an emergency.

Furniture will be arranged for maximum use of available space while maintaining safe conditions.

Laboratory facilities will be used only by persons with proper qualifications and training. The number of persons (students and instructors) assigned to a laboratory room at any given time should not exceed the number of laboratory stations available in the room.

The type of class or other activity scheduled into a laboratory room should be appropriate to the design of the facility and the safety equipment available.

The use of laboratory facilities for purposes such as teaching classes outside the subject area, or other non-laboratory-based College functions is to be avoided.

The design of new laboratories and renovation of existing laboratories will incorporate safety features as specified in this Chemical Hygiene Plan. Deficiencies in existing facilities will be addressed in the normal schedule of renovation.

b. Current Facilities

The science laboratories are located on the first and second floors of the Yu Hak Hahn Center for the Sciences (see Appendix VII).

Fire alarms and extinguishers are located at the north and south ends of the 1st and 2nd floor hallways. Electrical and gas turn-offs are located in each laboratory (red = electrical, black = gas) breakers are located in each laboratory. These turn-offs also affect the adjacent prep rooms. Only faculty and other designated individuals can reset the gas breakers. There is an electrical (breaker) room (Rm 118) adjacent to the Student Research Laboratory (Rm 116). Only Facilities personnel can access the electrical room

2. Chemical Storage

a. Chemistry Progam

The majority of chemicals are stored in the Chemistry Stockroom (Rm 213) located on the second floor of the Hahn Center for the Sciences. Inorganic chemicals, indicators, organic solid chemicals and biochemicals are segregated and stored in metal cabinets. Flammable organic liquids, acids and bases are stored in separate vented metal cabinets. When labels recommend, certain chemicals are stored in an explosion proof refrigerator.

b. Biology Program

A locked preparation room (Rm 111) and appropriate shelves in the Microbiology Laboratory (Rm 113) and cabinets in the student research lab (Rm 116) contain the majority of the stock chemicals used within

the Biology Program. Additionally, a desiccator in a refrigerator (Rm 116) and an explosion-proof refrigerator (Rm 122a) are used to store chemicals requiring such conditions.

3. Ventilation

a. Chemistry Program

Air from laboratories is exhausted outdoors by means of fume hoods. The General Chemistry Laboratory contains five hoods, Organic Chemistry Laboratory contains eight hoods, the Analytical Laboratory contains two hoods and the Physical Chemistry and Student Research Laboratories contain one each. One hood in each of these laboratories in an ADA hood.

b. Biology Program

The Biology Program maintains a fume hood in the Student Research Lab (Rm 116) in which noxious/hazardous chemicals are handled.

4. Personal Protective Equipment and Apparel

a. Chemistry laboratories

Safety glasses and laboratory aprons or coats are required. Gloves are worn when required in the laboratory procedure.

All laboratories are equipped with a safety shower-eye wash station. This safety equipment is inspected on a regular schedule. Each laboratory is also equipped with a first-aid kit.

b. Biology laboratories

Microbiology laboratory (Rm 113) and the Student Research Laboratory (Rm 116) have white wall-mounted cabinets in which are stored safety glasses. Laboratory coats and disposable gloves are worn when appropriate.

All laboratories are equipped with a safety shower-eye wash station. Prep room sinks adjacent to laboratories also have eye wash stations. This safety equipment is inspected on a regular schedule. Each laboratory is also equipped with a first-aid kit.

F. MINIMIZING EXPOSURE: PRACTICES

1. Standard Laboratory Procedures

a. Planning

Generally, current textbooks and laboratory manuals designate the safety precautions needed for a particular laboratory activity. Additional references, including Material Safety Data Sheets (MSDS's) should also be consulted. The scale of the procedure, when appropriate, should be adjusted to reduce generation of used chemicals.

b. Conduct

Eating, drinking, smoking, application of cosmetics, manipulation of contact lenses, or other such activities are not to be done in the laboratory.

Activities using unauthorized chemicals are not to be performed.

Avoid working alone in the laboratory whenever possible. Otherwise, inform another person where you will be and what you will be doing. Students are not allowed to work alone especially in the evenings and on weekends without the supervision of a faculty member.

Do not leave the laboratory unattended while operations are ongoing.

Use laboratory equipment only for its designed purpose.

Wash promptly whenever a chemical has contacted the skin.

Wash areas of exposed skin well before leaving the laboratory.

c. Apparel

Confine long hair and loose clothing. Wear shoes at all times. Sandals, open-toed or perforated shoes are not appropriate apparel for lab.

Contact lenses normally should not be worn in the laboratory. If contact lenses are worn, safety glasses must be worn at all times.

Appropriate protective apparel, particularly safety glasses and laboratory aprons or laboratory coats, should be worn at all times in the laboratory. Use additional protective gear when called for by the specific procedure.

d. Avoiding Exposure

Use only those chemicals for which the quality of the available ventilation system is appropriate. Use the hood for operations which might result in release or toxic vapors or dust. The hood fan should be kept on whenever chemicals are present in the hood.

Do not allow chemicals to come into contact with skin. Do not smell or taste chemicals.

Use gloves when handling materials known or believed to be corrosive, irritants, allergens, or toxic through dermal contact.

Do not store food or beverages in areas used for laboratory operations. Do not use laboratory containers or utensils for food or beverages.

Do not use mouth suction to pipet or to start a siphon; use a suction bulb.

Check labels on containers carefully before dispensing reagents.

e. Inspecting Laboratory and Equipment

Be alert to unsafe conditions and see that they are corrected. Ensure that aisles, exits, and paths to safety equipment are unblocked. Check that equipment is in good operating condition.

2. Housekeeping

Housekeeping plays an important role in reducing the frequency of laboratory accidents. Rooms should be kept clean and in orderly condition. Floors, shelves, and tables should be clear of chemicals not in use.

Clean-up the work area on completion of an operation or at the end of the day.

All chemical containers must be labeled with at least the identity of the contents and any particular hazards noted. Place excess reagents and reaction products in proper used chemical containers.

Used chemicals should be properly labeled and kept in separate containers according to type.

Promptly clean-up spills, using appropriate protective apparel and proper procedures. Use a universal spill cleanup absorbent, such as HAZMATPAC absorbent A-900, to absorb major chemical spills.

Aisles and passageways to all exits and safety equipment should be kept clear.

Chemicals must be stored in proper storage location.

Before leaving the laboratory, all services (gas, water, electricity) should be turned off. Lower all fume hood sashes. Lock the laboratory door.

Laboratories and chemical storage areas should be cleaned on a regular basis.

3. Inspections and Maintenance

Equipment inspections will be performed regularly (see Appendix III) for fume hoods, eyewash-shower stations, fire extinguishers, and any other equipment for employee protection. The following general standards will apply:

hood - face velocity of 60 - 100 lfm
shower - continuous flow of clean water
eyewash - continuous gentle flow of aerated water to both eyes
fire extinguisher - fully charged

Inspections records for hoods, eyewash-shower stations and fire extinguishers will be kept by the Facilities Services Director. Equipment will be tagged following the inspection, showing the date and results.

Employees will perform a visual inspection of safety equipment prior to beginning a chemical procedure in the laboratory. The purpose of such visual inspections is to check for obvious problems with equipment. It is not intended to substitute for thorough periodic inspections. Any safety equipment not operating to the standards above will be taken out of service and reported to the College Chemical Hygiene Officer. Deficient or inoperative equipment will either be repaired by qualified technicians or replaced.

4. Environmental Monitoring

Highly toxic substances are not commonly identified as part of a college laboratory program, and regular instrumental monitoring of airborne concentrations is not justified or practical. Initial monitoring may be necessary for laboratories under renovation involving changes in general ventilation or hood installation.

Monitoring for specific airborne substances shall be performed in cases of suspected or known employee exposure. If the measured concentration exceeds the Permissible Exposure Limit (PEL), Threshold Limit Value (TLV), or other specified action level, the all laboratory employees will be notified of the results of the measurement within fifteen days, and further monitoring will be undertaken in compliance with 29 CFR 1910.1000 through 1910.1199.

5. Chemical Procurement

Prior to ordering any chemical, need should be determined, based on the desired use of the chemical. Amounts ordered should not exceed what is expected to be used in one year if possible.

G. KEEPING EMPLOYEES INFORMED

1. Chemical Hygiene Training Program

In addition to the science faculty's extensive knowledge of laboratory procedures from their training, they will partake in a chemical hygiene training program. The aim of the employee training and information program is to assure that all individuals at risk are adequately informed about: the physical and health hazards associated with hazardous chemicals present in the laboratory; the proper procedures to minimize risk of exposure; and the proper response to accidents.

The general content of the training and information program will include:

1. The federal and state chemical hygiene standards, including the contents of 29 CFR Part 1910.1450
2. Location and contents of the KWC Chemical Hygiene Plan
3. Safe practices for handling hazardous chemicals and transporting them within the facility
4. Location and content of MSDS's for chemicals
5. Location and proper use of available protective apparel and equipment
6. Appropriate procedures for responding to and reporting accidents involving chemical exposures.
7. Viewing an appropriate videotape on safety such as "Starting with Safety" produced by the American Chemical Society or "Practicing Safe Science" by Howard Hughes Medical Institute.

The training program will be a regular, continuing activity, not simply a one-time initial orientation for new employees. The Chemical Hygiene Manager will maintain records documenting the ongoing training received by employees (see form Appendix IV).

2. Material Safety Data Sheets

The current Material Safety Data Sheets (MSDS) received for all laboratory chemicals will be kept in a location readily-accessible to employees. Sheets will be kept in the Chemistry Program, the Biology Program, as well as Facilities Services (see Appendix VIII for a MSDS sample).

3. Signs and Labels

Prominent signs of the following types must be clearly posted in all laboratory, preparation, and chemical storage areas:

a. Emergency telephone numbers of fire department, ambulance, college nurse, nearest hospital, and poison control (these are also posted in areas where telephones are located);

b. Location signs for exits, evacuation routes and safety shower-eyewash stations.

c. Warnings at areas or equipment where special or unusual hazards exist, including designated areas for use of particularly hazardous chemicals.

Labels on stock bottles will not be removed or altered. Identity labels will be placed on all reagent containers and used chemical receptacles, listing contents and associated hazards.

4. Other Reference Materials

An information library will be accessible to all employees. The library contains reference materials pertinent to safe laboratory practices, chemical storage, and chemical disposal. Refer to Section J - References. The safety library is located in Room 210 of the Hahn Center for the Sciences.

H. RESPONDING TO EXPOSURES AND ACCIDENTS

1. Emergency Procedures

a. General Accident Procedures

While the practices and procedures specified in the Chemical Hygiene Manual will help to minimize risk of exposure to hazardous chemicals, employees must be knowledgeable about what to do should an accident occur. Types of emergencies that should be anticipated are thermal and chemical burns, chemicals in the eye, skin contact and irritation by chemicals, inhalation, ingestion, or skin absorption of chemicals, and cuts and puncture wounds.

The College's Emergency Preparedness Plan which includes fire prevention, spill control, earthquake and emergency evacuation procedures is included in the document Campus Safety and Security Plan.

In the event of an accident:

(1) Report the nature and location of the emergency to the appropriate fire or medical facility. Give your name, telephone number, building, and room number. If individuals are involved, report how many, whether they are unconscious, burned, or trapped, whether an explosion has occurred, and whether there has chemical or electric fire. Do not make other phone call unless they directly relate to the control of the emergency.

(2) Notify others in the area about the nature of the emergency.

(3) Meet the emergency personnel at the indicated location, or send someone to meet them.

(4) Do not move any injured person unless they are in further danger. Use general first aid techniques, if appropriate.

b. Chemical Accidents

(1) Remove all contaminated clothing immediately and wash the skin with soap and water. Flush the skin for at least five minutes.

(2) If chemicals are in the eyes, irrigate with plenty of water for at least 15 minutes. Check for and remove contact lenses.

(3) If chemicals are ingested, encourage the victim to drink large amounts of water en route to medical assistance. Inform the medical staff and poison control center for further instructions. Be sure to note which chemical(s) is believed to have been ingested and obtain the appropriate MSDS sheets for reference.

c. Chemical Spills

(1) If there is no fire hazard and the material is not particularly volatile or toxic, clean it up using procedures listed on the Material Safety Data Sheet (MSDS). Wear appropriate gloves and clean the contaminated area with soap and water after removing the spill.

(2) If a volatile, flammable material is spilled, immediately extinguish any flames and turn off electrical apparatus. Evacuate the area by established routes. Consult the MSDS for appropriate clean-up procedures. If the quantity exceeds the employee's ability or training to handle, seal the area until appropriately-trained personnel arrive.

(3) If a volatile, toxic material is spilled outside the hood, evacuate the area by established routes and

seal until personnel trained to use appropriate breathing apparatus arrive.

(4) If a nonvolatile, toxic material is spilled, isolate the area of the spill and consult the MSDS for appropriate clean-up procedures. If the quantity or toxicity of the chemical exceeds the employee's ability or training to handle, evacuate the area until appropriately-trained personnel arrive.

(5) Use care in cleaning spills involving multiple chemicals, so that reactive combinations do not occur in waste receptacles. Do not dispose of absorbing material in open trash cans.

d. Fire Accidents

(1) A fire contained in a small vessel can often be suffocated by covering the vessel with an inverted container. Do not use dry towels or cloths. Remove nearby flammable materials.

(2) In fires that appear controllable, direct the discharge from a carbon dioxide or dry-chemical fire extinguisher at the base of the flames. Do not discharge a fire extinguisher at a pool of burning liquid. Avoid breathing gases and smoke from the fire. Always fight the fire from a position of escape.

(3) If the fire is too large to be suffocated quickly and simply, or if it is believed to produce toxic fumes, vacate the area following established evacuation routes, sound the fire alarm, and notify the fire department. On arrival, inform fire fighters what chemicals are involved, or may become involved.

(4) If a person's clothing is on fire, douse the individual with water or wrap the person in a coat, blanket, or whatever is immediately available. Quickly remove any clothing contaminated with chemicals. Douse with water to remove heat and place clean, wet, ice-packed cloths on burned areas. Get medical attention promptly.

(5) Immediately after the fire, all extinguishers used will be replaced with full ones.

e. Accident Reporting

All accidents will be reported on the approved form (Appendix V). Copies of accident reports will be kept by the President and the Chemical Hygiene Officer. These reports will be carefully analyzed to prevent recurrence, with the results distributed to all who might benefit. A periodic review of accident reports will look for problem areas that need special attention.

2. Exposure Assessment

It is the policy of the College to investigate in a prompt manner all employee-reported incidents in which there is a possibility of overexposure to a toxic substance. Circumstances include: leakage or spill of a hazardous chemical, direct skin or eye contact with a hazardous chemical, manifestation of symptoms (headache, rash, nausea, coughing, tearing, irritation of eye, nose, or throat, dizziness) that disappear upon leaving the exposure area and reappear upon returning to it, more than one person in the same laboratory with similar complaints.

If evidence is sufficient, investigation of an incident may result in the decision to conduct a formal exposure assessment.

It is not the purpose of an exposure assessment to place blame for the incident on any person or source. It is to gather facts regarding the possible exposure and the chemical(s) involved.

The exposure assessment will include: interviews with involved persons; environmental monitoring results; and determinations regarding chemicals involved and control measures in use at the time of the incident.

3. Medical Consultations and Examinations

College laboratory workers do not regularly handle significant quantities of materials that are acutely or chronically toxic. Therefore, regular medical surveillance is not justified. In the event that an employee is exposed to levels of a hazardous chemical exceeding the established PEL or TLV, or should the employee exhibit signs or symptoms of such exposure, then the employee shall have a medical consultation within 24 hours of the accident and report to supervisor. All medical examinations and consultations shall be performed by or under the direct supervision of a licensed physician and shall be provided at a reasonable time and location without cost to the employee since coverage is provided through workman's compensation insurance. The physician will be provided with: the identity of the chemical(s) to which the employee may have been exposed; exposure conditions; and the employee's signs and symptoms of possible exposure.

A record of the results of the consultation including tests performed and conclusions reached, will be provided to the employee and to the College.

I. OTHER PROCEDURES

1. Procedure for Working with Particularly Hazardous Chemicals

Faculty should use their professional training and experience when determining if acute or chronic hazards associated with certain chemicals justify their use in laboratory experiments. All laboratory procedures used should contain a written description incorporating the applicable precautions described in this section.

a. Toxic Chemical

The Material Safety Data Sheet (MSDS) for a chemical states the recommended or OSHA-mandated limits for exposure to that chemical. These are most often expressed as PEL or TLV values. They assist the instructor in determining the safety precautions, control measures, and safety apparel needed when working with the chemical.

Substances having one of the following characteristics:

(1) TLV or PEL less than 50 ppm or 100 mg/m^3

(2) LC50 less than 200 ppm or 2000 mg/m^3 should be used only in a fume hood. See Appendix VIII for a list of common highly toxic substances.

b. Flammable Chemicals

The flammability of a chemical is determined by its flash point, the lowest temperature at which an ignition source can cause the chemical to ignite momentarily under certain controlled conditions. Chemicals with flash points below 200ºF (93.3ºC) should be used in areas away from any source of ignition.

c. Reactive Chemicals

Oxidizers, organic peroxides and explosives are defined by the Department of Transportation (DOT) as reactive chemicals. Reactivity information about chemicals is often found in MSDS's or on labels. Handle reactive chemicals with proper safety precautions, including proper storage, use, and personal protection. See Appendix VIII for a list of common explosives.

d. Corrosive Chemicals

A corrosive chemical is defined as having a pH greater than 12.5 or less than 2.0. Corrosivity information is often found on MSDS or on labels. Corrosive chemicals should be handled with proper precautions including gloves and laboratory apron or coat.

e. Allergens and Sensitizers

A variety of allergens may be encountered in the laboratory. Exposure of skin or the respiratory tract to these agents may elicit dermatitis, asthma, or other responses. The special problem with allergic responses is one of sensitization, and difficulties arise because the cause of the allergic response may not be readily identifiable. Usually there is no physical reaction at the time of initial exposure, but this is the point where sensitization occurs. The reaction takes place upon a subsequent exposure to the allergen. For a list of common allergens and sensitizers, see Appendix X.

Because of the wide variety of chemicals that may produce allergic responses or adverse reactions in sensitive individuals, and because of the varying response of individuals to such substances, it is essential to minimize exposure of eyes, hands and forearms, and lungs by working with adequate ventilation and appropriate protective apparel, resistant to permeation by the chemical.

f. Carcinogens, Reproductive Toxins, Substances That Have a High Degree of Acute Toxicity and Chemicals of Unknown Toxicity

Substances belonging to these classes are identified as such on MSDS or on labels. These substances should be handled in a clearly marked designated area such as a fume hood, glove box or a portion of a laboratory using proper safety precautions. The smallest possible amounts of these substances should be used. They should be stored in a restricted area and ultimately disposed by a licensed chemical disposal company. See Appendix IX for a list of common carcinogens.

2. Used Chemical Collection and Waste Disposal

KWC has one building containing laboratories covered under this plan. This building is considered a limited quantity generator according to the Environmental Protection Agency (EPA) because it generates less than 100 kilograms per month of non-acutely hazardous waste and less than 1 kilogram of acutely hazardous waste per month.

The aim of the used and waste chemical program is to assure that minimal harm to people, other organisms, and the environment will result from the disposal of waste laboratory chemicals. The first priority in the disposal program is to reduce the amount and variety of wastes generated. This is achieved by:

- planning experiments to reduce types of used chemicals generated;
- reducing the scale of experiments to limit the amounts of used chemicals generated;
- purchase of chemicals only in the amounts needed;
- recovery of chemicals from the reaction products; and
- reuse chemicals when possible.

a. Used Chemicals

Each laboratory will have specially marked containers for used chemicals. Leftover reagents and reaction products should be placed in marked containers at the end of each laboratory session. Broken glass should be placed in its own marked container. Broken thermometers should be placed in a separate, marked container.

Used chemicals shall be classified into the following categories: flammable, reactive, water reactive, air reactive, inorganic acid, organic acid, base, toxic, oxidizer, and other.

Containers shall be labeled with the following information: used-chemical category, name of the chemical(s) in the container, approximate percentage of each chemical (if mixed), date produced, and name of instructor.

Used chemicals will be maintained in their containers in a secure storage area until such time that they are used in a laboratory procedure or reclassified as waste for disposal.

b. Waste Chemicals

Certain chemicals are permissible for drain disposal. The drain system connects to a sanitary sewer system that ultimately flows to a waste-water treatment facility. The local waste water treatment plant, located in Owensboro, Kentucky, was contacted to determine what was and was not acceptable for drain disposal. Appendix XI lists common chemicals which may be disposed down the drain with excess water. Appendix XII lists the industrial (non-domestic) discharge concentration limits established by the EPA. These limits should not be exceeded since the quantities of chemicals used in the laboratories are often in the semi-micro range. Faculty should constantly strive to design experiments that will insure discharges of chemicals to be below these limits.

If used chemicals become reclassified as hazardous waste, their containers will be relabeled as such and segregated into the following classes for disposal (following EPA categories):

(1) Ignitable - materials capable of causing fire.
(2) Oxidizer - substances that readily yield oxygen, such as permanganates, nitrates, etc.

(3) Corrosive - aqueous solutions with pH < 2 or > 12.5.
(4) Reactive - substances that are unstable, explosive, water reactive, or generate toxic gases.
(5) EP Toxic - substances containing arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver, or any of six specified chlorinated organic substances.
(6) Other wastes not falling into one of the above classes.

Segregated waste will be stored in approved containers, which will be clearly labeled as to their contents and hazards. Waste will be inventoried annually. Disposal of waste by licensed chemical disposal companies will be arranged at regular intervals.

Reduction of waste by recycling, reclamation, or chemical decontamination of used chemicals will be performed when possible.

Indiscriminate disposal of waste chemicals by pouring down the drain, adding them to mixed refuse for landfill burial, or evaporating volatiles in the hood is unacceptable.

3. General Safety Procedures to Minimize Hazards to Physical Safety

a. Hazards to Physical Safety

The Laboratory Standard promulgated by OSHA pertains to minimizing employee exposure to the health risks associated with hazardous chemicals. The laboratory environment contains numerous hazards to the physical safety of employees as well. Because physical injury accidents can sometimes have the secondary effect of toxic exposures, this section outlines general precautions and procedures to minimize risks associated with physical hazards in the laboratory.

b. Handling Glassware

Glassware should be stored on well-lighted stockroom shelves designed to prevent the pieces from falling off.

Select glassware that is designed for the type of work planned. In particular, be sure that glassware to be used in vacuum apparatus is constructed for that purpose.

When cutting glass tubing or rod, place a towel over the strike mark and break away from the body. Fire polish all glass before use. After heating glassware, allow ample time for cooling to occur.

Glass containers of acids, alkalis, or flammable chemicals should be transported in safety bottle carriers to protect from breakage and to contain leaks.

c. Electrical Hazards

All electrical outlets should carry a grounding connection requiring a three prong plug. All electrical equipment should be wired with a three prong plug. Never remove the ground post.

The condition of wiring, plugs, and cords should be checked regularly.

Laboratory lighting should be on separate circuits from electrical outlets, in case electric service must be cut off in an emergency.

All laboratories should have circuit breakers readily accessible. Employees should know how to cut off electrical service to the laboratory in case of emergency.

If electrical equipment shows evidence of undue heating, unplug it immediately.

When unplugging electrical equipment, grasp the plug instead of pulling on the chord.

d. Compressed Gases

Always use the minimum-sized cylinder adequate to perform the desired laboratory activity.

Cylinders of compressed or liquefied gases should be securely restrained by straps, chains, or a suitable stand. Do not expose cylinders to temperatures above 50ºC.

When a cylinder is empty or before moving replace the protective cap. Do not bleed a cylinder completely empty. Leave a slight pressure to keep contaminants out.

Do not interchange gauges, regulators, or fittings, especially with oxygen cylinders.

Do not use a cylinder that cannot be positively identified.

Always wear safety goggles when handling or using compressed gases.

e. Other Hazards

Cryogenic liquids must be handled in properly vented containers.

When using lasers, never look directly at the beam or laser opening. Do not shine the beam on objects that cause specular reflections.

REFERENCES

The following references are recommended as part of the Information Library available to school employees.

1. Howard, M. and Howard, F. *A Model Chemical Hygiene Plan for Kentucky School Districts.* Kentucky Department of Education.

Order from: Science Consultant; Division of Curriculum Development; Kentucky Department of Education; 1829 Capital Plaza Tower; Frankfort KY 40601

2. Young, J., Kingdley, W., and Wahl, G., Jr. *Developing a Chemical Hygiene Plan*. Washington, D.C.: American Chemical Society. 1990.

Order from: American Chemical Society; Distribution Office, Dept 348; P.O. Box 57136, West End Station; Washington, D.C. 20037.

3. U.S. Department of Labor. Final rule part II "29 CFR Part 1910. Occupational Exposure to Hazardous Chemicals in Laboratories." *Federal Register*, Volume 55, Number 21, Wednesday, January 31, 1990.

Order from: U.S. Government Printing Office; Washington, D.C. 20402

4. American Chemical Society. *Safety in Academic Chemistry Laboratories, fifth edition.* Washington, D.C.: American Chemical Society. 1990.

Order from: American Chemical Society; 1155 16th Street, NW; Washington, D.C. 20036
Single copies free; multiple copies $2.00 each

5. American Chemical Society. *The Waste Management Manual for Laboratory Personnel*. Washington, D.C.: American Chemical Society. 1990.

Order from: American Chemical Society; 1155 16th Street, NW; Washington, D.C. 20036

6. Council of State Science Supervisors. School Science Laboratories: A Guide to Some Hazardous Substances. Washington, D.C.: U.S. Consumer Product Safety Commission. 1984.

Order from: State Science Supervisor; Kentucky Department of Education; 1829 Capital Plaza Tower; Frankfort KY 40601

7. Occupational Safety and Health Administration booklets:
OSHA 3110 Access to Medical and Exposure Records
OSHA 3112 Air Contaminants – Permissions Exposure Limits
OSHA 3077 – Personal Protective Equipment
OSHA 3048 Chemical Hazard Communication
OSHA 30111 Hazard Communication Guidelines for Compliance

Order from: U.S. Department of Labor – OSHA; Publications Office, Room N3101; 200 Constitution Avenue, NW; Washington, D.C. 20210
Single copies free if request is accompanied by a self-addressed mailing label

8. Armour, M.A. *Hazardous Laboratory Chemicals* – Disposal Guide. CRC Press, 1991.

Order from: CRC Press, Inc.; 2000 Corporate Blvd NW; Boca Raton, FL 33431

9. National Institute of Occupational Safety and Health (NIOSH). *Pocket Guide to Chemical Hazards*. U.S.

Department of Health and Human Services. 1990.

Order from: Publications Disseminations, DSDTT; National Institute of Occupational Safety and Health; 4676 Columbia Parkway; Cincinnati OH 45226; 513.533.8287

APPENDIX I: GLOSSARY OF CHEMICAL HYGIENE TERMS

Acute - An adverse effect with symptoms of high severity that develop over a short period of time.

Allergen - An agent capable of producing an immunologic reaction.

Carcinogen - A substance capable of causing cancer.

Chemical Hygiene Officer - An employee who is designated by the employer, who is qualified by training experience, to provide technical guidance in the development and implementation of the provisions of the Chemical Hygiene Plan.

Chemical Hygiene Plan - A written program developed and implemented by the employer which sets forth procedures, equipment, personal protective equipment and work practices that are capable of protecting employees from the health hazards presented by hazardous presented by hazardous chemicals used in that particular workplace and meets the requirements of CFR 1910.1450.

Chronic - An adverse effect with symptoms that develop slowly over a long period of time or that frequently recur.

Combustible - Able to catch fire and burn; liquids with a flash point between 100 and 200^{o}F.

Designated Area - An area which may be used for work with select carcinogens, reproductive toxins, or substances which have a high degree of acute toxicity. A designated area may be the entire laboratory, an area of a laboratory, or a device such as a laboratory hood.

DOT - Department of Transportation

Emergency - Any occurrence which results in an uncontrolled release of a hazardous chemical into the workplace.

Employee - Any individual employed in a laboratory workplace who may be exposed to hazardous chemicals in the course of his or her assignment.

EPA - Environmental Protection Agency

Flammable - Capable of being easily ignited and of burning with extreme rapidity; liquids with a flash point below 100^{o} F.

Hazardous Chemical - A chemical for which there is statistically significant evidence that acute or chronic health effects may occur in exposed persons.

Laboratory - A facility where the "laboratory use of hazardous chemicals" occurs; a workplace where relatively small quantities of hazardous chemicals are used on non-production of chemicals for sale.

Laboratory Scale - Work with chemicals that in which containers used can easily and safely be manipulated by one person, excluding commercial production of chemicals for sale.

Laboratory Use - Handling or use of chemicals which satisfy the following conditions: 1) manipulations are carried out on a "laboratory scale"; 2) multiple chemicals or procedures are used; 3) procedures involved are not part of a production process; and 4) protective laboratory practices and equipment are available in common use to minimize the potential for employee exposure to hazardous chemicals.

LC_{50} - The concentration of a substance in air that causes death in 50% of the animals exposed by inhalation. A measure of acute toxicity.

LD_{50} - The dose that causes death in 50% of the animals exposed by swallowing a substance. A measure of acute toxicity.

Medical Consultation - A consultation which takes place between an employee and a licensed physician for the purpose of determining what medical examinations or procedures, if any, are needed in cases where a significant exposure to a hazardous chemical may have taken place.

MSDS - Material Safety Data Sheet

Mutagen - Chemical which causes chromosomal damage (mutations).

Neoplastigen - Chemical capable of causing non-cancerous tumors.

OSHA - Occupational Safety and Health Administration

PEL - Permissible Exposure Limit. The legally allowed concentration in the workplace that is considered a safe level of exposure for an 8-hour shift, 40 hours per week.

Protective Laboratory Procedures, Practices, and Equipment - Those laboratory procedures, practices, and equipment accepted by laboratory health and safety experts as effective, or that the employer can show to be effective, in minimizing the potential for employee exposure to hazardous chemicals.

Physical Hazard - A chemical for which there is scientifically valid evidence that it is combustible, flammable, explosive, an oxidizer, unstable, or highly reactive.

Select Carcinogen - Any substance that meets one of the following criteria:

1. regulated by OSHA as a carcinogen
2. listed as a "known carcinogen" in the latest Annual Report on Carcinogens published by the National Toxicology Program (NTP)
3. listed in Group 1 ("Carcinogenic to humans") by the latest International Agency for Research on Cancer (LARC) monographs; or
4. listed in either Group 2A or 2B by LARC, or "reasonably anticipated to be carcinogenic" by NTP, and causes statically significant tumor incidence in experimental animals through: inhalation dosages of less than 10 mg/m^3 for 6-7 hr/day, 5 day/week; repeated skin application of less than 300 mg/kg body weight per week; or oral dosages of less than 50 mg/kg body weight per day.

Sensitizer - Chemical capable of creating an allergic reaction in certain individuals after an initial exposure.

Teratogen - Chemical which affects fetal development.

TLV - Threshold Limit Value. The amount of exposure allowable for an employee in an 8-hour day.

Appendix II: Chemical Inventory - Sample Page

INVENTORY-2006-06

M - MSDS
L - LOCATION:

O	213	STOCKROOM
I	213	STOCKROOM
R	213/216	REFRIGERATOR
B	213	STOCKROOM - BIOCHEMICALS

M	L	AMOUNT			CHEMICAL
=	=	=====			=========
M	O	2.5	L		ACETALDEHYDE
M	R	200	ML		ACETALDEHYDE
M	O	2	KG		ACETAMIDE
M	B	200	G		ACETAMINOPHEN
M	O	1.5	KG		ACETANILIDE
M	I	5	L		ACETIC ACID
M	O	15	L		ACETIC ACID
M	O	15	PT		ACETIC ANHYDRIDE
M	O	25	L		ACETONE
M	O	10	ML		ACETONITRILE
M	O	0.75	KG		ACETOPHENONE
M	O	1.5	L		ACETYL CHOLRIDE
M	O	500	ML		ACETYLACETONE
M	O	1	KG		ACETYLSALICYLIC ACID
	O	75	G		ACRELOLIN
M	B	25	G		ADENINE
M	R	5	G		ADENOSINE MONOPHOSPHATE
M	O	3.5	KG		ADIPIC ACID
M	O	90	G		ADIPOYL CHLORIDE
M	B	100	G	BETA-	ALANINE
M	B	200	G	DL-	ALANINE
M	B	300	MG	L-	ALANINE
M	R	500	MG		ALANYLALANINE
M	R	500	MG		ALANYLPHENYLALANINE
M	R	250	MG		ALANYLPROLINE
M	R	250	MG		ALANYLVALINE

Appendix III: Inspection Forms

Fire Extinguisher Systems Check

Yu Hak Hahn Science Center		Date Checked/ Serviced	Initials
1st floor North entrance	(ABC)		
1st floor South entrance	(ABC)		
2nd floor North hallway	(ABC)		
2nd floor South hallway	(ABC)		
Lab #204	(ABC)		

PERIODIC FIRE ALARM INSPECTION & TESTING REPORT

DATE OF INSPECTION: 5-24-06

INSPECTOR: JAMES WILLOCKSON PAR#: 354
INSPECTION COMPANY: LANHAM ELECTRIC
ADDRESS: 401 BOLIVAR STREET
CITY: OWENSBORO STATE: KY
ZIP: 42303 PHONE: (270) 685 2921

NAME OF FACILITY: SCIENCE BUILDING
ADDRESS: 3000 FREDRICA STREET
CITY: OWENSBORO KY ZIP: 42301
OCCUPIED AS: EDUCATIONAL
SEND REPORT TO:

REASON FOR REPORT: ( ) QUARTERLY INSP.; ( ) SEMIANNUAL INSP.; (✓) ANNUAL INSP.; OTHER (specify):
CONTROL PANEL MANUFACTURER AND MODEL: EDWARDS QSA

1. TYPE(S) OF SYSTEM: (✓) LOCAL; ( ) AUXILIARY; ( ) REMOTE STATION; ( ) PROPRIETARY; ( ) EMERGENCY VOICE/ALARM

2. INITIATING DEVICES:

	NUMBER INSTALLED	NUMBER TESTED	CONDITION SAT	CONDITION UNSAT
A. HEAT SENSING:				
1. FIXED TEMPERATURE	2	2	✓	
2. RATE COMPENSATION				
3. RATE-OF-RISE				
4. COMBINED FT/ROR				
5. OTHER (specify)				
B. SMOKE SENSING:				
1. IONIZATION				
2. PHOTOELECTRIC	3	3	✓	
3. CLOUD CHAMBER				
4. DUAL ION/PHOTO				
5. H.V.A.C.	3	3	✓ (1)	
6. COMBINED w/HEAT				
7. OTHER (specify)				
C. FLAME SENSING:				
1. FLAME				
2. FLAME FLICKER				
3. INFRARED				
4. PHOTOELECTRIC				
5. ULTRAVIOLET				
6. OTHER (specify)				
D. GAS SENSING:				
1. SEMICONDUCTOR				
2. CATALYTIC ELEMENT				
3. OTHER (specify)				
E. MANUAL STATIONS	10	10	✓	
F. WATER FLOW	3	3	✓	

3. INDICATING DEVICES:

	NUMBER INSTALLED	NUMBER TESTED	CONDITION SAT	CONDITION UNSAT
A. BELLS	1	1	✓	
B. HORNS	24	24	✓	
C. CHIMES				
D. VISUAL				
1. COMBINED	24	24	✓	
2. SEPARATE	33	33	✓	
E. OTHER (specify)				

4. CONTROL FUNCTIONS:

A. ELEVATOR RECALL	1	1	✓	
B. FAN SHUTDOWN	3	2		✓
C. DOOR HOLDER				
D. SMOKE CONTROL SYSTEM				
E. OTHER (specify)				

5. TROUBLE DEVICES: 2 2 ✓

6. REMOTE ANNUNCIATORS: 1 1 ✓

7. SUPERVISORY SERVICE:

A. CONTROL VALVES				
1. SPRINKLER	7	7	✓	
2. STANDPIPE				
3. OTHER (specify)				
B. AIR PRESSURE				
1. HIGH				
2. LOW				
C. FIRE PUMP				
D. GENERATOR				
E. OTHER (specify)				

8. EMERGENCY VOICE/ALARM: ____ LOUDSPEAKERS ARE INSTALLED AND WORK PROPERLY (YES); (NO). 2 TELEPHONE JACKS ARE INSTALLED & WORK PROPERLY (YES); (NO). AUTOMATIC OPERATION OF SYSTEM IS SATISFACTORY (YES); (NO). MANUAL OPERATION OF SYSTEM IS SATISFACTORY (YES); (NO). SYSTEM HAS ZONED EVACUATION FEATURE (YES); (NO).

9. POWER SUPPLY: A. PRIMARY (MAIN) 120 VOLTS, 4 AMPS. B. SECONDARY (STANDBY) (✓) STORAGE BATTERIES, # 4 AMP-HR RATING 7AH 12VDC . C. (NONE) D. OTHER (specify) ____

10. SIGNAL TRANSMISSION: ALARM IS TRANSMITTED OFF PREMIS (YES); (NO). ALARM TRANSMITTED TO SIMPLEX AND RECEIVED BY (INDIVIDUAL) OPERATOR . THEY WERE NOTIFIED BEFORE AND AFTER TEST (YES); (NO).

11. SMOKE DETECTOR SENSITIVITY TEST: DATE OF (INITIAL) OR (LAST) SENSITIVITY TEST 7-05

12. REMARKS: EXPLAIN ANY "UNSAT", "NO" OR "OTHER (specify)" ANSWERS

(1) AHU # 2 DID NOT SHUT DOWN - FAN

[redacted]

CUSTOMER SIGNATURE

Press hard - you are making 4 copies.
WHITE - Owner; CANARY - State Fire Marshal; PINK - Inspectors Copy; GOLD - Other

Revised July 2002

APPENDIX IV: CHEMICAL HYGIENE TRAINING FORM

I have read the Chemical Hygiene Manual for Kentucky Wesleyan College and have participated in a training program which involved the following topics:

1. The federal and state chemical hygiene standards, including the contents of 29 CFR Part 1910.1450;

2. Location and contents of the College's Chemical Hygiene Manual;

3. Safe practices for handling hazardous chemicals and transporting them within the facility;

4. Location and content of MSDS for chemicals in the building;

5. Location and proper use of available protective apparel and equipment;

6. Appropriate procedures for responding to and reporting accidents involving chemical exposures;

7. Viewing an appropriate safety videotape, such as "Starting with Safety" produced by the American Chemical Society or "Practicing Safe Science" produced by the Howard Hughes Medical Institute.

I understand the policies that pertain to safety and the use of hazardous chemical and will comply with the described procedures.

_____ _____

Signature Date

_____ _____

Trainer Signature Date

APPENDIX V: ACCIDENT REPORT
To be completed by the KWC employee

1. KWC Employee completing the report: _____

2. Date of accident/incident: _____

3. Time of the accident/incident: _____

4. Location of the accident/incident: _____

5. Employee(s) and/or student(s) involved in the accident/incident:

Employee	Student
_____	_____
_____	_____
_____	_____
_____	_____

Each person involved should complete a Witness Accident Report.

6. Employee description of the accident/incident:

7. Immediate action taken to deal with the emergency:

8. Action taken to avoid a repeat of the accident/incident in the future:

_____ _____
Signature Date

APPENDIX V (CONT.): ACCIDENT REPORT
To be completed by witnesses to the accident.

1. Name of person completing the report: _____

2. Relationship with the College: ☐ Student ☐ Staff ☐ Other

3. Date of accident/incident: _____

4. Time of the accident/incident: _____

5. Location of the accident/incident: _____

6. Description of the accident/incident by witness:

_____ _____
Signature Date

APPENDIX VI: INCIDENT LOG

Date	Student	Course	Injury	Treatment

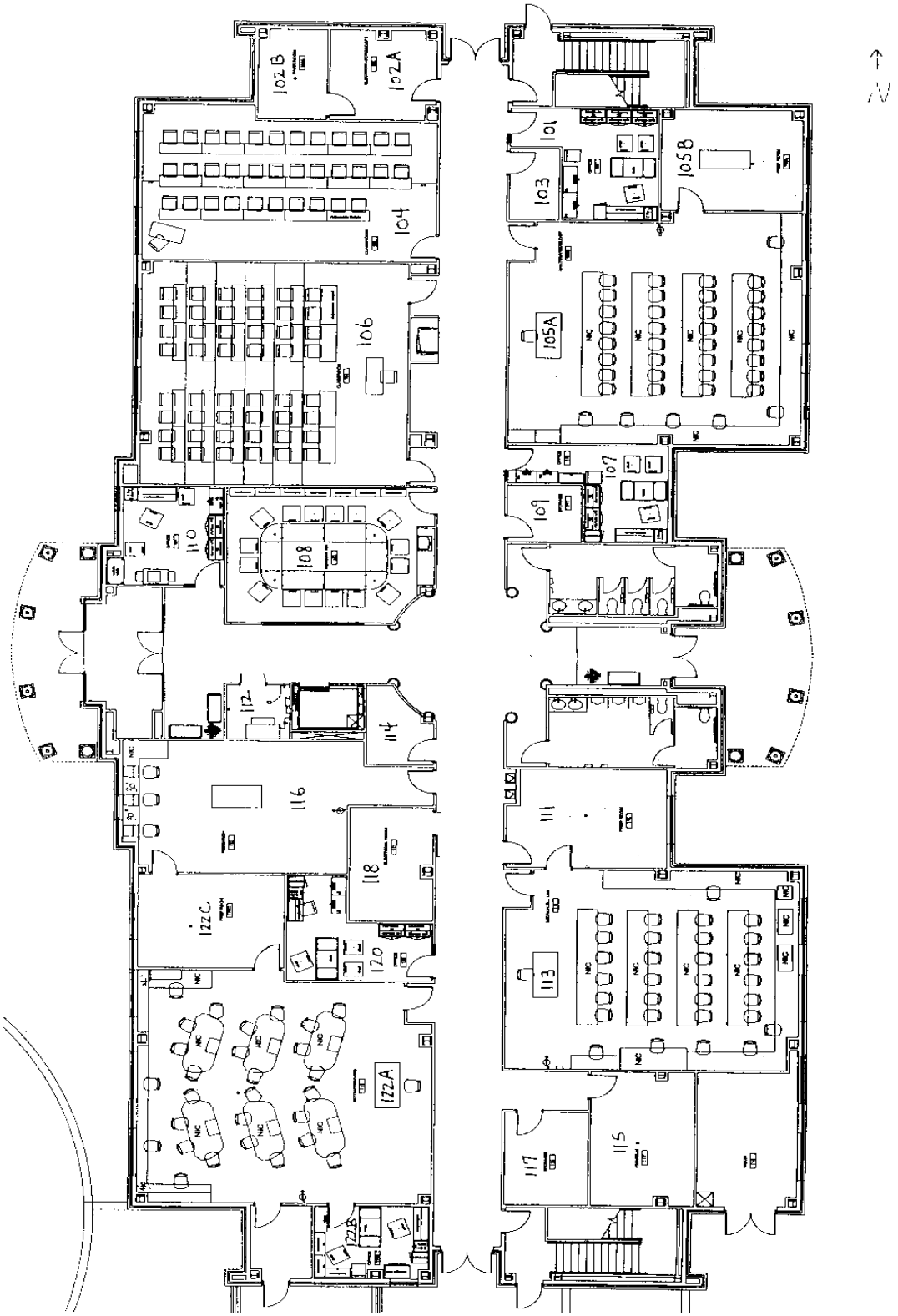
Appendix VII: Building Diagram

HAHN SCIENCE CENTER

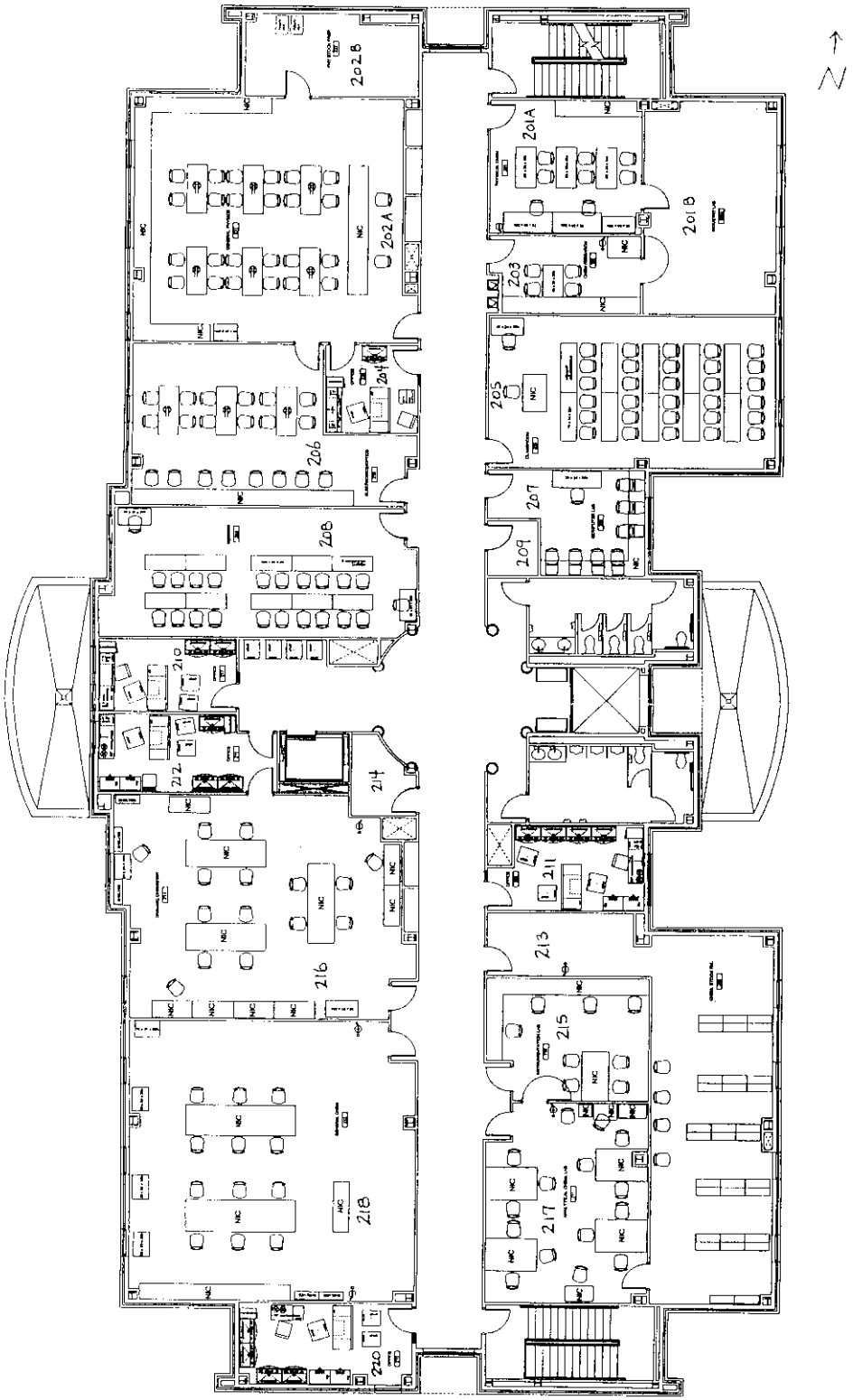
Room Number	Room Type
101	OFFICE
102A	ELECTRON MICROSCOPE
102B	DARK ROOM
103	CUSTODIAL
104	CLASSROOM
105A	LABORATORY - ANATOMY/ZOOLOGY
105B	LAB PREP ROOM - ANAT/ZOOL
106	CLASSROOM
107	OFFICE
108	SEMINAR ROOM
109	STORAGE
110	OFFICE
111	LAB PREP ROOM
112	ELEVATOR EQUIPMENT
113	LABORATORY - MICROBIOLOGY
114	DATA
115	STORAGE
116	STUDENT RESEARCH LAB
117	STORAGE
118	ELECTRICAL
120	OFFICE
122A	LABORATORY - BOTANY
122B	OFFICE
122C	LAB PREP ROOM - BOTANY

Room Number	Room Type
201A	LABORATORY - PHYSICAL CHEMIST
201B	LABORATORY
202A	LABORATORY - GENERAL PHYSICS
202B	LAB PREP ROOM
203	STUDENT RESEARCH LAB
204	OFFICE
205	CLASSROOM
206	LABORATORY - ADVANCED PHYSICS
207	COMPUTER LAB
208	CLASSROOM
209	ELECTRICAL
210	OFFICE
211	OFFICE
212	OFFICE
213	CHEMISTRY STOCKROOM
214	DATA
215	LABORATORY - INSTRUMENTATION
216	LABORATORY - ORGANIC CHEMISTR
217	LABORATORY - ANALYTICAL CHEMISTRY
218	LABORATORY - GENERAL CHEMISTR
220	OFFICE

Appendix VII: Building Diagram – First Floor - Biology



Appendix VII: Building Diagram – Second Floor – Chemistry/Physics



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ACETAMIDE
ACETAMIDE
ACETAMIDE

MATERIAL SAFETY DATA SHEET

FISHER SCIENTIFIC
CHEMICAL DIVISION
1 REAGENT LANE
FAIR LAWN NJ 07410
(201) 796 7100

EMERGENCY NUMBER: (201) 796 7100
CHEMTREC ASSISTANCE: (800) 424 9300

THIS INFORMATION IS BELIEVED TO BE ACCURATE AND REPRESENTS THE BEST INFORMATION CURRENTLY AVAILABLE TO US. HOWEVER WE MAKE NO WARRANTY OF MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED, WITH RESPECT TO SUCH INFORMATION, AND WE ASSUME NO LIABILITY RESULTING FROM ITS USE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION FOR THEIR PARTICULAR PURPOSES

SUBSTANCE IDENTIFICATION

SUBSTANCE: **ACETAMIDE**
CAS-NUMBER 60-35-5

TRADE NAMES/SYNONYMS:
ACETIC ACID AMIDE; ACETIMIDIC ACID; ETHANAMIDE; METHANE CARBOXAMIDE; O-1007; A-4; C2H5NO; ACC00110

CHEMICAL FAMILY:
AMIDE, ALIPHATIC

MOLECULAR FORMULA: C2-H5-N-O

MOLECULAR WEIGHT: 59.07

CERCLA RATINGS (SCALE 0-3): HEALTH=3 FIRE=1 REACTIVITY=0 PERSISTENCE=0
NFPA RATINGS (SCALE 0-4): HEALTH=3 FIRE=1 REACTIVITY=0

COMPONENTS AND CONTAMINANTS

COMPONENT: ACETAMIDE PERCENT: 100
CAS# 60-35-5

OTHER CONTAMINANTS: NONE

EXPOSURE LIMITS:
NO OCCUPATIONAL EXPOSURE LIMITS ESTABLISHED BY OSHA, ACGIH, OR NIOSH.

ACETAMIDE:
SUBJECT TO SARA SECTION 313 ANNUAL TOXIC CHEMICAL RELEASE REPORTING
SUBJECT TO CALIFORNIA PROPOSITION 65 CANCER AND/OR REPRODUCTIVE TOXICITY WARNING AND RELEASE REQUIREMENTS- (JANUARY 1, 1990)

PHYSICAL DATA

DESCRIPTION: COLORLESS, DELIQUESCENT CRYSTALS WITH A MOUSEY ODOR

BOILING POINT: 430 F (221 C) MELTING POINT: 176-180 F (80-82 C)

SPECIFIC GRAVITY: 1.159 VAPOR PRESSURE: 10 MMHG @ 105 C

SOLUBILITY IN WATER: 200%

SOLVENT SOLUBILITY: ETHANOL, CHLOROFORM, PYRIDINE, GLYCEROL, BENZENE (HOT); SLIGHTLY SOLUBLE IN ETHER

FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD:
SLIGHT FIRE HAZARD WHEN EXPOSED TO HEAT OR FLAME

FLASH POINT: 345 F (174 C) (OC)

FIREFIGHTING MEDIA:
DRY CHEMICAL, CARBON DIOXIDE, WATER SPRAY OR REGULAR FOAM
(1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5)

FOR LARGER FIRES, USE WATER SPRAY, FOG OR REGULAR FOAM
(1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5).

FIREFIGHTING:
MOVE CONTAINER FROM FIRE AREA IF YOU CAN DO IT WITHOUT RISK. DO NOT SCATTER SPILLED MATERIAL WITH HIGH-PRESSURE WATER STREAMS. DIKE FIRE-CONTROL WATER FOR LATER DISPOSAL (1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5, GUIDE PAGE 31)

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USE AGENTS SUITABLE FOR TYPE OF SURROUNDING FIRE. AVOID BREATHING HAZARDOUS VAPORS. KEEP UPWIND.

TOXICITY

ACETAMIDE:
7000 MG/KG ORAL-RAT LD50; 10300 MG/KG INTRAPERITONEAL-RAT LD50; 10 GM/KG SUBCUTANEOUS RAT LD50; 2300 MG/KG UNREPORTED-RAT LD50; 1000 MG/KG INTRAPERITONEAL MOUSE LD50; 8300 MG/KG SUBCUTANEOUS MOUSE LD50. MUTAGENIC DATA (RTECS); REPRODUCTIVE EFFECTS DATA (RTECS); TUMORIGENIC DATA (RTECS) CARCINOGEN STATUS: ANIMAL SUFFICIENT EVIDENCE (IARC GROUP 2B). NO CASE REPORTS OR EPIDEMIOLOGICAL STUDIES WERE REPORTED ON HUMAN EXPOSURE. ACETAMIDE PRODUCED BENIGN AND MALIGNANT LIVER TUMORS IN RATS FOLLOWING ORAL ADMINISTRATION.
ACETAMIDE IS AN EYE IRRITANT AND A MILD SKIN IRRITANT

HEALTH EFFECTS AND FIRST AID

INHALATION:
ACETAMIDE:
ACUTE EXPOSURE- MAY CAUSE SLIGHT IRRITATION OF THE RESPIRATORY TRACT, DROWSINESS, FATIGUE, NAUSEA, ACIDOSIS AND SKIN ERUPTIONS
CHRONIC EXPOSURE- NO DATA AVAILABLE.

FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING HAS STOPPED, PERFORM ARTIFICIAL RESPIRATION. KEEP PERSON WARM AND AT REST. TREAT SYMPTOMATICALLY AND SUPPORTIVELY. GET MEDICAL ATTENTION IMMEDIATELY.

SKIN CONTACT:
ACETAMIDE:
ACUTE EXPOSURE- MAY CAUSE MILD IRRITATION
CHRONIC EXPOSURE- NO DATA AVAILABLE.

FIRST AID- REMOVE CONTAMINATED CLOTHING AND SHOES IMMEDIATELY. WASH AFFECTED AREA WITH SOAP OR MILD DETERGENT AND LARGE AMOUNTS OF WATER UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT:
ACETAMIDE:
IRRITANT.
ACUTE EXPOSURE- MAY CAUSE IRRITATION AND CORNEAL DAMAGE.
CHRONIC EXPOSURE- REPEATED AND PROLONGED CONTACT WITH IRRITANTS MAY CAUSE CONJUNCTIVITIS

FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER OR NORMAL SALINE, OCCASIONALLY LIFTING UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY

INGESTION:
ACETAMIDE.
CARCINOGEN.
ACUTE EXPOSURE- MAY CAUSE DROWSINESS, FATIGUE, NAUSEA, ACIDOSIS AND POSSIBLY SKIN ERUPTIONS.
CHRONIC EXPOSURE- ADMINISTRATION TO PREGNANT RATS PRODUCED EFFECTS ON FERTILITY, FETOTOXICITY AND DEVELOPMENTAL ABNORMALITIES. REPEATED ORAL ADMINISTRATION TO RATS PRODUCED BENIGN AND MALIGNANT LIVER TUMORS. TUMORIGENC EFFECTS HAVE ALSO BEEN REPORTED IN MICE

FIRST AID- IF THE PERSON IS CONSCIOUS AND NOT CONVULSING, INDUCE EMESIS BY GIVING SYRUP OF IPECAC FOLLOWED BY WATER. (IF VOMITING OCCURS KEEP THE HEAD BELOW THE HIPS TO PREVENT ASPIRATION). REPEAT IN 20 MINUTES IF NOT EFFECTIVE INITIALLY. GIVE ACTIVATED CHARCOAL. IN PATIENTS WITH DEPRESSED RESPIRATION OR IF EMESIS IS NOT PRODUCED, PERFORM GASTRIC LAVAGE CAUTIOUSLY (DREISBACH HANDBOOK OF POISONING, 12TH ED.). TREAT SYMPTOMATICALLY AND SUPPORTIVELY. GASTRIC LAVAGE SHOULD BE PERFORMED BY QUALIFIED MEDICAL PERSONNEL. GET MEDICAL ATTENTION IMMEDIATELY

ANTIDOTE:
NO SPECIFIC ANTIDOTE. TREAT SYMPTOMATICALLY AND SUPPORTIVELY.

REACTIVITY

REACTIVITY:
STABLE UNDER NORMAL TEMPERATURES AND PRESSURES

INCOMPATIBILITIES
ACETAMIDE
MINERAL ACIDS: FORMATION OF ACETIC ACID.
NITROUS ACID: FORMATION OF ACETIC ACID

DECOMPOSITION:
THERMAL DECOMPOSITION PRODUCTS MAY INCLUDE TOXIC OXIDES OF CARBON AND NITROGEN.

POLYMERIZATION
HAZARDOUS POLYMERIZATION HAS NOT BEEN REPORTED TO OCCUR UNDER NORMAL TEMPERATURES AND PRESSURES.

Appendix VIII: MSDS Sample (con't)

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STORAGE AND DISPOSAL

OBSERVE ALL FEDERAL, STATE AND LOCAL REGULATIONS WHEN STORING OR DISPOSING OF THIS SUBSTANCE. FOR ASSISTANCE, CONTACT THE DISTRICT DIRECTOR OF THE ENVIRONMENTAL PROTECTION AGENCY.

STORAGE

STORE AWAY FROM INCOMPATIBLE SUBSTANCES.

CONDITIONS TO AVOID

MAY BURN BUT DOES NOT IGNITE READILY. AVOID CONTACT WITH STRONG OXIDIZERS, EXCESSIVE HEAT, SPARKS, OR OPEN FLAME.

SPILL AND LEAK PROCEDURES

WATER SPILL:
THE CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 (PROPOSITION 65) PROHIBITS CONTAMINATING ANY KNOWN SOURCE OF DRINKING WATER WITH SUBSTANCES KNOWN TO CAUSE CANCER AND/OR REPRODUCTIVE TOXICITY.

OCCUPATIONAL SPILL:
SWEEP UP AND PLACE IN SUITABLE CLEAN, DRY CONTAINERS FOR RECLAMATION OR LATER DISPOSAL. DO NOT FLUSH SPILLED MATERIAL INTO SEWER. KEEP UNNECESSARY PEOPLE AWAY.

PROTECTIVE EQUIPMENT

VENTILATION:
PROVIDE LOCAL EXHAUST OR PROCESS ENCLOSURE VENTILATION SYSTEM.

RESPIRATOR:
THE FOLLOWING RESPIRATORS ARE RECOMMENDED BASED ON INFORMATION FOUND IN THE PHYSICAL DATA, TOXICITY AND HEALTH EFFECTS SECTIONS. THEY ARE RANKED IN ORDER FROM MINIMUM TO MAXIMUM RESPIRATORY PROTECTION.
THE SPECIFIC RESPIRATOR SELECTED MUST BE BASED ON CONTAMINATION LEVELS FOUND IN THE WORK PLACE, MUST BE BASED ON THE SPECIFIC OPERATION, MUST NOT EXCEED THE WORKING LIMITS OF THE RESPIRATOR AND MUST BE JOINTLY APPROVED BY THE NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH AND THE MINE SAFETY AND HEALTH ADMINISTRATION (NIOSH-MSHA).

ANY TYPE 'C' SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE OR WITH A FULL FACEPIECE, HELMET OR HOOD OPERATED IN CONTINUOUS-FLOW MODE.

ANY SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:

ANY SELF-CONTAINED BREATHING APPARATUS THAT HAS A FULL FACEPIECE AND IS OPERATED IN A PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE.

ANY SUPPLIED-AIR RESPIRATOR THAT HAS A FULL FACEPIECE AND IS OPERATED IN A PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE IN COMBINATION WITH AN AUXILIARY SELF-CONTAINED BREATHING APPARATUS OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE-PRESSURE MODE.

CLOTHING:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE (IMPERVIOUS) CLOTHING AND EQUIPMENT TO PREVENT REPEATED OR PROLONGED SKIN CONTACT WITH THIS SUBSTANCE.

GLOVES:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE GLOVES TO PREVENT CONTACT WITH THIS SUBSTANCE.

EYE PROTECTION:
EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES TO PREVENT EYE CONTACT WITH THIS SUBSTANCE.

EMERGENCY EYE WASH: WHERE THERE IS ANY POSSIBILITY THAT AN EMPLOYEE'S EYES MAY BE EXPOSED TO THIS SUBSTANCE, THE EMPLOYER SHOULD PROVIDE AN EYE WASH FOUNTAIN WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE.

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ADDITIONAL INFORMATION-
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Appendix IX: Explosive, Carcinogens and Highly Toxic Substances

EXPLOSIVES

Caution: This is not a comprehensive list of all possible explosive chemicals.

The substances in this table are NOT recommended for use or storage in schools, except as indicated, unless an absolute need is determined and appropriate safety procedures are instituted.

Removal: Explosives should be removed by trained fire or police bomb squads, or other qualified officials. Limit movement of containers of such chemicals in order to minimize the change of detonation.

Table 1: Explosives

Substance	CAS #	Notes
Benzoyl peroxide	94-36-0	
Carbon disulfide	75-15-0	The flash point of carbon disulfide (-22ºF) is well below room temperature and small amounts of the vapor in air can be explosive.
Diisopropyl ether	108-20-3	These chemicals become dangerous upon aging. Ethers can form explosive peroxides upon exposure to air. Old opened containers of ether should be treated with great caution.
Ethyl ether	60-29-7	
Picric acid	88-89-1	Picric acid should always contain 10-20% water and bottles should be disposed of after two years. Dry picric acid is explosive.
Perchloric acid	7601-90-3	Although a 70% acid/water mixture is not explosive by itself, the use of perchloric acid often leads to the formation of perchlorates which are very explosive.
Potassium metal	7440-09-7	This chemical can become dangerous upon aging. Potassium metal can form explosive peroxides upon exposure to air. Containers of potassium metal not stored under kerosene should be treated with great caution.

CARCINOGENS

Caution: This is not a comprehensive listing of all chemicals having substantial evidence of carcinogenicity. Further, each substance listed here may have additional health hazards.

These substances are NOT recommended for use or storage in schools unless an absolute need is determined and appropriate use and storage safety procedures are instituted. If it is determined that there is a definite need to use one of these carcinogenic chemicals, obtain additional information on the risk involved. Information on many carcinogenic chemicals can be obtained from NIOSH or CPSC. Ask for the NIOSH criteria document on the chemical of interest by writing NIOSH, Publications Disseminations DSDTT, 4676 Columbia Parkway, Cincinnati OH 45226, or write for additional information to CPSC, Directorate for Health Sciences, Washington, D.C. 20207. (For more information, contact the groups listed in Section 9 of this document.) Remember – some carcinogens are more potent that others and risk increases with level and duration of exposure.

Removal: These substances should be removed by health authorities or a licensed commercial company. All state, local and federal regulations must be adhered to in the removal process. Once removed, the substance should not reenter the school. Instructions should be added to the procedures for ordering chemicals to make sure that, once removed, these chemicals are not reordered.

Table 2: Carcinogens

Known carcinogens		CAS #
	Arsenic powder *	7440-28-2
	Arsenic pentoxide	1303-28-2
	Arsenic trichloride	7784-34-1
	Arsenic Trioxide	1327-53-3
	Asbestos	1332-21-4
	Benzene	71-43-2
	Benzidine	92-87-5
	Chromium powder *	7440-47-3
	Chromium (VI) oxide	1333-82-0
	Lead arsenate	7784-40-9
	Sodium arsenate	7631-89-2
	Sodium arsenite	7784-46-5

Probable carcinogens		CAS #
	Acrylonitrile	107-13-1
	Cadmium powder *	7440-43-9
	Cadmium chloride	10108-64-2
	Cadium tetrachloride	10124-36-4
	Carbon tetrachloride	56-23-5
	Chloroform	67-66-3
	Ethylene oxide	75-21-8
	Nickel powder *	7440-02-0
	o-Toluidine	95-53-4

- Evidence for the carcinogenicity of these materials is derived from occupational exposure studies. Although it is uncertain whether the metal or a metal compound(s) is responsible, only respirable particulates are though to be of concern.

Appendix IX (cont.): Explosive, Carcinogens and Highly Toxic Substances

ANIMAL CARCINOGENS OR MUTAGENS

Animal Carcinogens: Reports on the extent of the hazard to humans are not complete as of this edition. Substances that are animal carcinogens should be regarded as posing carcinogenic risk to humans and should be used with appropriate caution.

Mutagens: The extent of the hazard to humans associated with exposure to mutagens is less clear that it is with carcinogens. However, it is recommended that similar (to that exercised in handling carcinogens) caution should be exercised in handling substances which are mutagenic.

Table 3: Known Animal Carcinogens or Mutagens

Substance	CAS #	Animal Carcinogens	Mutagens
Acetamide	60-35-5	X	
Acridine Orange	494-38-2		X
Ammonium Chromate	7788-98-9		X
Ammonium Dichromate	7789-09-5		X
Ammonium Bichromate			
Aniline (or any of its salts)	142-04-1	X	
Anthracene	120-12-7		X
Antimony Oxide	4327-33-9		X
Beryllium Carbonate	66104-24-3	X	X
Cobalt Powder	7740-48-4		X
Colchicine	64-86-8		X
1,2-Dichloroethane	107-06-2	X	X
1,4-Dioxane (p-Diozane)	123-91-1	X	
Formaldehyde	50-00-0	Xx	X
Hydroquinone	123-31-9		X
Indigo Carmine	860-22-0		X
Lead Diacetate	301-04-2	X	X
Nickel (II) Acetate	373-02-4	X	
Osmium Tetraoxide	20816-12-0		X
Potassium Chromate	7789-00-06		X
Potassium Permanganate	7722-64-7		X
Pyrogallic Acid	87-66-1		X
Silver (I) Nitrate	7761-88-8		X
Sodium Azide	26628-22-8		X
Sodium Dichromate Dihydrate	7789-12-0		X
Sodium Nitrate	7631-99-4		X
Sodium Nitrite	7632-88-3		X
Thioacetamide	62-55-5	X	X
Toluene	108-88-3		X
Urethane (Ethyl Carbamate)	51-79-6	X	X

HIGHLY TOXIC SUBSTANCES

Substances in Table 4 are highly toxic as defined by the Federal Hazardous Substances Act (FHSA). Very small amounts of these chemicals may cause immediate, acutely toxic reactions. All necessary precautions should be taken to limit exposure to these highly toxic chemicals and substitutes for such chemicals should be used whenever possible.

The FHSA uses the LD_{50} and LC_{50} as a measure of the acute toxicity of a substance. The FHSA defines a highly toxic substance as one where the LD_{50} is 50 mg/kg or less when orally administered or where the LC_{50} is 200ppm or less when a gas or vapor is inhaled. The LD_{50} is the dose of a substance that produced death in 50% of a group of laboratory animals. The LC_{50} is the vapor concentration of a substance that produces death in 50% of the animals. Although these measures of lethality can be influenced by a variety of factors, historically they have provided a measure of toxicity which can be used in estimating the comparative safety of substances. The LD_{50} values in this table are determined for the most part following oral administration of the chemical to rats and are expressed in milligrams per kilogram (mg/kg). The LC_{50} is expressed in parts per million (ppm). The lowest LD_{50} or LC_{50} reported in the literature is shown for each substance.

Table 4: Highly Toxic Substances

Substance	CAS #	LD_{50} (mg/kg) or LC_{50} (ppm)
Adrenaline	51-43-4	50 mg/kg
Barium Hydroxide	17194-00-2	5 to 50 mg/kg
Chlorine	7782-50-5	137 ppm
Colchicines	64-86-8	50 mg/kg
Mercury	7439-97-6	Mercury presents a special type of hazard. Due to acute and chronic neurotoxicity of mercury vapors, the OSHA has set the Acceptable Ceiling Concentration at 100 micrograms per cubic meter.
Mercuric Chloride	7487-94-7	10 mg/kg
Mercuric Iodine	7774-29-0	40 mg/kg
Mercuric Nitrate	7783-34-8	Toxicity is expected to be similar to other mercuric salts.
Mercuric Oxide	21908-53-2	18 mg/kg
Mercuric Sulfate	13766-44-4	Toxicity is expected to be similar to other mercuric salts.
Nicotine	54-11-5	24 mg/kg
Osmium Tetraoxide	20816-12-0	14 mg/kg
Phosphorus (white)	7723-14-0	4.8 mg/kg
Phosphorus Pentoxide	1314-56-3	9.7 ppm
Potassium Cyanide	151-50-8	Toxicity is expected to be similar to Sodium Cyanide.
Potassium Periodate	7790-21-8	48 mg/kg
Silver Cyanide	506-64-9	Toxicity is expected to be similar to Sodium Cyanide.
Sodium Cyanide	143-33-9	4 mg/kg

Tables 1 – 4 were taken from the Council of State Science Supervisors. *School Science Laboratories: A Guide to Some Hazardous Substances*. Washington, D.C.: US Consumer Product Safety Commission. 1984.

Appendix X: Potential Allergens in the Lab

A

acacia
acetyl ethyltetramethyl tetralin (AETT)
5-acetyl-1,1,2,3,3,6-hexammethyl indan
acrylic monomer
alantroot
aldehyde C-10
aldehyde C-11
aldehyde C-12
allylesters
almond oil
almond seed oil
alpha-amyl cinnamaldehyde
alpha amyl cinnamic aldehyde
alpha-amyl cinnamic alcohol
alpha amyl cinnamic alcohol
alpha methyl ionone
alpha pinene
alpha terpineol
aluminum chlorhydroxide
angelica oil
angelica root
(p-)anisaldehyde
anise oil
anise seed oil
anisylidene acetone
anisyl alcohol
arabic, gum

B

balm, oil of
balsam of Peru
balsam of Tolu
bay
bay, oil of
bay rum
benzaldehyde
benzildyene acetone
benzoic acid
benzion
benzopyran
benzoyl peroxide
benzyl acetate
benzyl alcohol
benzyl benzoate
benzyl salicylate
benzylidene acetone
bergamot, oil of
bergamottin
bergapten
bergaptol
bergaptol geranylether
bithionol
bitter almond oil
bitter fennel oil
bitter orange oil (expressed)
blancophor
bromonitroporpanediol
bronopol
(b-)butyl-hydroxyanisol
(b-)butyl-hydroxytoluene
butylated hydroxytoluene
butyl-methyl-hydrocinnamic aldehyde
(p-tert-)butyl-(a-)methylhydrocinnamic aldehyde
(p-t)butyl phenol

C

cade oil
calamus oil
canaga oil
canagan oil
carnation oil
carophyllene
carrot seed oil
carvacrol
carvone oxide
cassia oil
cassie synthetique
cedartone V
cedarwood oil
cetavlon
cetyl alcohol
chloroallythexaminium chloride
5-chloro-2-methyl-4-isothiazolin-3-one+2-methyl-4-isothiazolin-3-one
chlorophyll
cinnamaldehyde (cinnamic aldehyde)
cinnamates (2-ethoxyethyl-p-methoxy)
cinnamic acid
cinnamic alcohol
cinnamic alcohol styrax type
cinnamic aldehyde (cinnamaldehyde)
cinnamic aldehyde methyl anthranilate *Schiff* base
cinnamon bark oil
cinnamon bark oil, Ceylon
cinnamon oil
cinnamly alcohol
cis-beta-terpineol
citracetyl parento
citral
citral oil
citric acid
citron, oil of
citronella oil
citronellal aldehyde
citronellol
citronellyl oxyacetaldehyde
citropten
clove oil
colophony
coniferyl benzoate
coriander oil
costus oil
costusroot (essential oil, absolute, and expressed)
costusroot oil
coumarin
(p-)cresyl salicylate (if previously sensitized to salol)
cumin oil
cuminaldehyde
cyclamen alcohol
(p-)cymene
(p-)cadiene

D

dehydroacetic acid
deltyl extra
3,5 DBS Ac (see below)
3,5-dibromosalicylic acid
dibutyl phthalate
diethyl phthalate
3,7-dimethyl-1-octanol
dimethyl phthalate
diethyl maleate
duhydrocoumarin
5,7-dimethoxy coumarin
4,6-dimethyl-8-t-butyl coumarin
dimethycitraconate
dowicil 200

E

elecampane oil
essential oils
estradiol
ethyl acrylate
ethyl alcohol
ethyl vanillin
eucalyptus oil
eugenol

F

farnesol
formalin (formaldehyde)
furocoumarin

G

galaxolide
geraniol
geraniol, oil of
geranium oil
geranyl acetate
ginger oil
gum(s)
gum arabic
gylan

H

Hamamelis virginiana
heliotropine, oil of
henna
hexachlorophene
hexyl cinnamic aldehyde
(alpha-)hexylcinnamic aldehyde
1,3,4,6,7,8-hexahydro-4,6,6,7,8,8-hexamethyl-cyclopenta-(gamma-)2-benzopyran
hibitane dibluc
4-hydroxy azobenzene carboxylic acid
hydroabietyl alcohol
hydroxycitronellal
5-hydroxypsoralen

I

ionone
(alpha-)irisone
isoamyl salicylate
isobutyl salicylate
isoeugenol
6-isopropyl-2-decalol
isopropyl myristate
isopropyl quinolone
isothiazolin (an isomer of thiazolin)

J

jasmine
jasmine, oil of
jasmine 9140

K

kathon CG

L

laurel oil
1auryl alcohol
1auryl gallate
1auryl sulfate (ammonium)
lavender oil
lemon oil (cold expressed)
lemon, oil of
lemongrass, oil of
lichen (essential oil from)
lilial
lime oil (expressed)
limettin
limonene
(d-)limonene
linaloe
linalool, oil of
linaly acetate
linanene
locust blossom perfume

M

mahogonate dragoco
menthenyl acetate
menthol
merthiolate
methoxycitronella
methoxycitronellal
methoxygeranoxycoumarin
7-methoxycoumarin
5-methoxy, 5-geranoxy coumarin
7-methoxy-5-geranoxycoumarin
5-methoxypsoralen
8-methoxypsoralen
(alpha)methyl anisylidene acetobe
6-methylcoumarin
7-methylcoumarin
methylcrotonate
4-methyl-7-ethoxy coumarin
methyl heptine carbonate
methylionone
(alpha-)methyl ionone
methyl ionone (gamma-pure) IFF
(gamma-)methylionone
methyl (N-)methyl anthranilate dimethyl anthranilate
4-methylphenyl 2-hydroxybenzoate [if sensitized to salol]
4-methylphenyl salicylate [if sensitized to salol]
methyl salicyate
mint oil
mirbane oil (nitrobenzene)
musk ambrette
(beta-)myrcene
myristyl alcohol

N

(b-)naphthol
neroli oil
nitrobenzene (mirbane oil)
nopyl acetate
nutmeg oil

O

oak moss (absolute, nonsynthetic, or synthetic)
orange oil
orange peel, oil of
opponax oil
opponax
origanum, oil of
orris, oil of
orris [not just the oil, but the whole plant]

P

parabens
patchouli oil
pentylidene cyclohexanone
peppermint oil
perillaldehyde
petitgrain oil
phenylacetaldehyde
phenylacetyldehyde dimethyl acetyl
(b-)phenyl alcohol
(b-)phenyl ethyl acetate
phenylethyl alcohol
phenyl salicylate
phyhalic anhydride
Pinacea family, oil from
pine oil
piperonal (methylionone)

potassium dichromate
propylidene phthalide
pseudoionones
pseudomethylionone
psoralens

Q

qyartrenium-15

R

rhodamine
rose, oil of
rose oil Bulgaria
rose 62 ter
rosemary oil
rue oil

S

safrole
salol
salicylic acid [if sensitized to salol]
sandalwood oil
sandella
sassafras, oil of
scorbic acid
sesame oil
spice, oil of
sweet birch oil
styrax
srtrax (Asian)
styrax (essence) GD

T

TCSA [see below]
terpenes
terpineol extra
terpinolene
3,4,4',5-tetrachlorosalicylanilide (TCSA)
tetra hydromuguol
thiazolin (isomers and isomer compounds)
thioglycollate (calcium)
thyme, oil of
(p-)tolyl ester [if sensitized to salol]
(p-) tolyl salicylate [if sensitized to salol]
trans-cinnamic aldehyde
trichlorocarbanilide
3,4,4'-trichlorocarbanilide (triclocarbon)
triclocarbon [see above]
triclosan
triethanolamine

U

V

vanilla (alcohol extract, especially ethyl alcohol)
verbena, oil of
versalide prime
vetivert rectified

W

wintergreen, oil of
wood tar

X

xanthotoxol
xanthotoxin

Y

ylang-ylang oil

Z

Taken from "Allergens in the Lab," *The Science Teacher*, April 1987

Appendix XI: Chemicals Which May Be Allowable for Drain Disposal

The following is a list of low-toxic-hazard cations and anions. Compounds whose cation and anion **both** come from this list typically are suitable for disposal down the drain with excess water in quantities up to about 100g at a time. These compounds are water soluble to at least 3%, and present low toxicity hazard. Strongly acidic or basic compounds should be neutralized before disposal.

CATIONS	ANIONS
$Al^{3}+$	BO_3^{3-}
$Ca^{2}+$	$B_4O_7^{2-}$
$Cu^{2}+$	Br-
$Fe^{2}+$	CO_3^{2-}
$Fe^{3}+$	Cl-
H+	HSO_3-
K+	OCN-
Ll+	OH-
$Mg^{2}+$	I-
Na+	NO_3-
NH_4+	PO_4^{3-}
$Sn^{2}+$	SO_4^{2-}
$Sr^{2}+$	SCN-
$Ti^{3}+$	
$Ti^{4}+$	
$Zn^{2}+$	
$Zr^{2}+$	

Source: National Research Council. *Prudent Practices for Disposal of Chemical from Laboratories*. Washington, D.C.: National Academy Press. 1983.

Appendix XII: Industrial (Non-Domestic) Discharge Limitations

Parameters	Maximum Concetration Mg/L
Aluminum	1.00
Ammonia	200.00
Antimony	1.00
Arsenic	0.10
Barium	1.00
Boron	1.00
Cadium	0.02
Chromium (hexavalent)	1.00
Chromium (trivalent	2.00
Copper	1.00
Cyanide	0.10
Fluoride	10.00
Iron (dissolved)	5.00
Lead	1.00
Manganese	1.00
Mercury	0.10
Nickel	1.00
Phenols	1.00
Selenium	0.05
Silver	0.30
Zinc	1.00
Oil and grease	100.00
Total dissolved liquids	900.00
Temperature – degree C	40.00
pH – maximum (pH units)	9.00
pH – mimimum (pH units)	5.50
Biochemical oxygen demand – 5 day	400.00
Suspended solids	400.00