Chemical Hygiene Plan

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Purpose

This Chemical Hygiene Plan has been developed by the Office of Environmental Health and Safety (EH&S) to assist New College in the recognition, evaluation and control of hazards associated with laboratory chemical operations, and is intended to meet the requirements of the OSHA Laboratory Standard, 29CFR1910.1450.

The primary focus of this core Chemical Hygiene Plan (CHP) is to provide guidance to the laboratory staff to safely use chemicals in the laboratory. The plan shall be made site specific for each laboratory to ensure that compliance with this regulation is maintained. To make this CHP site specific, each individual lab must perform a "Hazard Assessment" of the lab and of the procedures involved with the storage, use and disposal of chemicals.

These Hazard Assessments shall be used to develop Standard Operating Procedures (SOPs) for each chemical use process in the lab. The SOPs will provide specific information on how to handle, use, store or dispose of each potentially hazardous chemical found in the laboratory. The site specific Hazard Assessment and SOP must be attached to this core CHP and used in: identifying potential chemical hazards, instructing laboratory personnel the potential hazards, training employees in safe practices, correcting work errors or dangerous conditions and requiring the proper personal protective equipment.

This Chemical Hygiene Plan minimally addresses the use of biological or radioactive materials or the disposal of chemical, biological or radioactive wastes. Individuals having questions are urged to call EH&S for assistance.

The CHP must be made readily available to all employees, their designated representatives and regulatory officials. The core CHP will be reviewed annually by EH&S, and will be revised as necessary. Records of the review will be kept on file at EH&S. Notice of any revisions will be sent to each department using chemicals for distribution to laboratories and staff. Lab staff shall review the Hazard Assessments and SOPs as needed, for each lab. The lab shall retain records of this review and revision.

The NCF Chemical Hygiene Plan applies to all locations where hazardous chemicals are used in experiments and investigations. Those laboratories which meet the following criteria will be subject to the requirements of the chemical hygiene plan:

1. Chemical manipulations are carried out on a laboratory scale. That is, the work with chemicals is in containers of a size that could be easily and safely manipulated by one person.

2. Multiple chemical procedures or chemicals are used.

3. Protective laboratory practices and equipment are available and commonly used.

4. The procedures involved are not part of a production process whose function is to produce commercial quantities of materials, nor do the procedures in any way simulate a production process.

Definitions

Action Level - A concentration designated in OSHA 29 CFR 1910 for a specific substance, calculated as an 8 hour time weighted average, which initiates certain required activities such as exposure monitoring and medical surveillance.

Carcinogen - Any substance which meets one of the following criteria:

a) It is regulated by OSHA as a carcinogen; or

b) It is listed under the category, "known to be carcinogens," in the Annual Report on Carcinogens published by the National Toxicology Program (NTP); or;

c) It is listed under Group 1 ("carcinogens to humans") by the International Agency for Research on Cancer Monographs (IARC) or;

d) It is listed in either Group 2A or 2B by IARC or under the category, "reasonably anticipated to be carcinogenic" by NTP, and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:

   i) After inhalation exposure of 6-7 hours per day, 5-days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m3.

   ii. After repeated skin application of less than 300 mg/kg of body weight per week.

   iii. After oral dosages of less than 50 mg/kg of body weight per day.

Combustible - Any liquid having a flashpoint at or above 100F (37.8C) but below 200F (93.3C) Liquid except any mixture having components with flashpoints of 200F, or higher, the total volume of which make up 99% or more of the total volume of the mixture.

Compressed -

a) A gas or mixture of gases having, in a container, an absolute Gas pressure exceeding 40 psi at 70F (21.1C); or

b) A gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 130F (54.4) regardless of the pressure at 70F (21.1C); or

c) A liquid having a vapor pressure exceeding 40 psi at 100F (37.8C) as determined by ASTM D-323-72.

Designated - An area which may be used for work with carcinogens, reproductive toxins or Area 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.

Emergency - Means any occurrence, such as, but not limited to, equipment failure, rupture of containers or failure of control equipment which results in an uncontrolled release of a hazardous chemical into the workplace.

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

Explosive - A chemical that causes a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature.

Flammable - Means a chemical that falls into one of the following categories:

a) **Aerosol**, flammable means an aerosol that, when tested by the method described in 16 CFR 1500.45, yields a flame protection exceeding 18 inches at full valve opening or a flashback (a flame extending back to the valve) at any degree of valve opening;

b) **Gas**, flammable means:

i) A gas at ambient temperature and pressure, forms a flammable mixture with air at a concentration of 13% by volume or less; or

ii) A gas that, at ambient temperature and pressure, forms a range of flammable mixtures with air wider than 12% by volume regardless of the lower limit.

c) **Liquid**, flammable means any liquid having a flashpoint below 100F (37.8C), except any mixture having components with flashpoints of 100F or higher, the total of which make up more than 99% or more of the total volume of the mixture.

d) **Solid**, flammable means a solid other than a blasting agent or explosive, as defined in 1910.109(a), that may potentially cause fire through friction, absorption of moisture, spontaneous chemical change, or retained heat from manufacturing or processing, or which can be ignited readily and when ignited burns so vigorously and persistently, as to create a serious hazard.

Flashpoint - Means the minimum temperature at which a liquid gives off a vapor in sufficient concentration to ignite.

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

Laboratory - A device located in a laboratory, enclosure on five sides with a moveable sash or type hood fixed partial enclosure on the remaining side; constructed and maintained to draw air from the laboratory and to prevent or minimize the escape of air contaminants into the laboratory; and allows chemical manipulations to be conducted in the enclosure without insertion of any portion of the employees body other than hands and arms. Walk-in hoods with adjustable sashes meet the above definition provided that the sashes are adjusted during use so that the airflow and the exhaust of air contaminants are not compromised and employees do not work inside the enclosure during the release of airborne hazardous chemicals.

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

Physical - Means a chemical for which there is scientifically valid evidence that it is a Hazard combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable (reactive) or water-reactive.

Responsibility

There are a number of areas on campus that have laboratory settings. Each area presents a different set of chemical and physical hazards to the laboratory occupants. Due to this variation it is not possible for one individual to implement a comprehensive laboratory safety program. It takes the participation and cooperation of many different people.

This section sets forth the various responsibilities of individuals involved in the process of implementing and maintaining the NCF Chemical Hygiene Plan.

A. The President of The NCF has the ultimate responsibility for ensuring that a chemical safety plan is implemented and adhered to on campus. The individuals listed below are to act as the President's representatives and handle the day to day issues associated with the chemical hygiene plan.

B. Vice-Presidents, Deans and Department Heads are responsible for ensuring that principal investigators and laboratory managers have implemented and are maintaining a laboratory safety plan in their respective laboratories.

C. The Director of the Office of Environmental Health and Safety has been designated as the NCF Chemical Hygiene Officer (CHO) and as such will assist in the development and implementation of CHP's for individual areas, provide general laboratory safety training and guidance to principal investigators, laboratory managers and laboratory occupants. Additionally, the CHO will conduct periodic inspections to ensure compliance with the program, conduct annual audits of the CHP to ensure its effectiveness and monitor the waste disposal program. The CHO shall have enforcement authority if unsafe work practices are discovered.

D. The Principal Investigator (PI) or Laboratory Manager has the primary responsibility for safety in their respective areas. They are responsible for assessing the hazards within the laboratory and with that information prepare standard operating procedures and lab-specific CHP relevant to safety and health considerations which must be followed when laboratory work involves the use of hazardous chemicals. They are responsible for ensuring that their employees follow the general policies outlined in the College's CHP.

E. Laboratory workers are individually responsible for following safety procedures as

outlined in the CHP and always using the appropriate personal protective equipment which will be provided to them. Additionally, lab workers must report all accidents, injuries and illnesses to their supervisor so that the circumstances of these incidents can be investigated and corrective actions taken.

Training

Providing information and training to laboratory employees is a key element of the College's Chemical Hygiene Plan. The purpose is to ensure that all individuals are apprised of the hazards of the chemicals and processes present in their laboratory.

Basic laboratory safety training will be provided at the time of initial assignment to all employees where hazardous chemicals are present. Additional information and training will be provided to laboratory employees prior to assignments involving new hazardous chemicals or new laboratory work procedures.

The information and training will at minimum inform the employee about:

1. The contents and requirements of the OSHA Laboratory Standard.
2. The content, location and availability of the NCF Chemical Hygiene Plan.
3. The recommended exposure limits for hazardous chemicals used in their labs.
4. Signs and symptoms associated with exposures to the hazardous chemicals used in their laboratory.
5. The location and availability of MSDSs and other reference materials.
6. The methods and observations that may be used to detect the presence or release of a hazardous chemical.
7. The measures employees can use to protect themselves from these hazards, including specific procedures such as appropriate work practices, personal protective equipment to be used, and emergency procedures.

Refresher training will be conducted on at least an annual basis.

Training record forms must be filled out to document any training conducted. The training record forms will be kept on file at the Office of Environmental Health and Safety.

Practices Having Prior Approval

Prior approval must be obtained by persons conducting laboratory activities which present specific, foreseeable hazards to employees. Some of the activities include:

1. Off-hours work procedures - Unauthorized personnel are not permitted to work in the lab after hours.
2. Lone Occupancy - Research work involving chemicals shall not be performed in the laboratory when the worker is the sole occupant of the building unless:
    a. The work is not considered extremely hazardous and is permitted by the supervisor/principal investigator.

b. The College Police have been contacted upon entry of the building and upon leaving the premises.

3. Hazardous Work - All hazardous operations (working with chemicals on the EPA's extremely hazardous substance list), are to be performed during a time when at least two persons are present at the laboratory. At no time shall a laboratory person, while working alone in the laboratory, perform work which is considered to be extremely hazardous. The determination of these conditions shall be made by the P.I. or the Lab Manager.

4. Unattended Operations - The Principal Investigator or Lab Manager will review the work procedures to ensure the operation can be completed safely.

5. If the experiment procedure is new.

6. If there is a change or substitution of ingredient chemicals in a known procedure.

7. If any equipment used in the procedure fails, especially safeguards such as fume hoods or clamped apparatus.

8. If there are any unexpected results.

9. If members of the laboratory staff become ill and suspect that they or others have been exposed, or otherwise suspect a failure of any safeguards.

Standard Operating Procedures

This chapter is designed to provide information of a general nature regarding safety related issues and procedures to be followed when handling chemicals before, during, or after use in an experimental procedure.

Signs and Labels

1. Emergency Telephone Numbers - A sticker shall be affixed on the outside door of every laboratory and chemical storage area. The sticker must list the names and phone numbers of individuals to contact in the event of an emergency. A list of telephone numbers for emergency services shall be posted near each phone in the laboratory.

2. Hazard Warning Signs - Signs which are clearly visible should be posted on the entrance door to the laboratory or storage area indicating the nature of any hazard, such as, biohazards, carcinogens, radioactive materials, lasers, etc.

3. Safety and Emergency Equipment - Signs shall be posted identifying the locations of eyewash stations, safety showers, exits, fire extinguisher, first-aid stations, etc.

4. Chemical Containers - All containers in the laboratory or storage area shall be labeled as to their contents. This includes chemical containers and waste containers (biological, radiation, chemical, etc.). The labels should be durable and at a minimum will identify the contents, source, date of acquisition, storage location and an indication of the hazard.

Personal Hygiene

1. Hands should be washed often, even when using gloves. Avoid using solvents

for washing.

2. Wash promptly whenever a chemical has contacted the skin.

3. Avoid inhalation of chemicals; do not sniff to test chemicals.

4. Do not drink, eat, smoke or apply cosmetics in the laboratory.

5. Do not bring or store food, beverages, tobacco, or cosmetic products into laboratory or storage areas.

Personal Work Practices

1. Supervisors must ensure that each employee knows and follows the rules and procedures established in this plan.

2. All employees must remain vigilante to unsafe work practices and conditions in the laboratory. The unsafe practices or conditions must be reported to the laboratory supervisor. It is the responsibility of the individual in-charge of the lab to correct the unsafe practices or conditions.

3. Do not mouth pipette.

4. Do not smell or taste any chemical.

5. Use only those chemicals appropriate for the ventilation system.

6. Inspect personal protective equipment prior to use and wear the appropriate protective equipment when ever necessary to avoid exposure.

7. Know the location and how to use the emergency equipment in your area and how to obtain additional help in an emergency.

Housekeeping

1. Access to emergency equipment, showers, eyewashes and exits should never be blocked not even temporarily.

2. Keep all work areas clean and free of clutter, this includes lab benches and aisles.

3. All chemicals must be properly labeled.

4. All old or outdated chemicals must be disposed of properly through the Office of Environmental Health and Safety (EH&S).

5. Wastes must be stored and labeled and dated, until arrangements can be made to properly dispose of the material through EH&S.

6. All spills and broken glass must be cleaned up immediately.

7. All working surfaces and floors should be cleaned regularly.

8. At the end of each workday, all chemicals should be placed in their assigned storage areas.

Personal Protective Equipment

1. At a minimum, safety glasses are required to be worn in situations where other than purely instrumental studies are being conducted. Ordinary prescription glasses will not fulfill this requirement as they do not provide adequate protection to the eyes.

2. Chemical safety goggles, and/or full face shields shall be worn as procedures dictate or where there is a possibility of splashing chemicals, violent reactions, or flying particles. Specialized goggles are necessary for protection against laser hazards, ultraviolet or other intense light sources. Contact lenses are prohibited except as authorized by the lab supervisor.

3. Appropriate chemical resistant gloves shall be worn at all times when there may be skin contact with chemicals. Gloves will be selected on the basis of the material being handled and their suitability for the particular laboratory operation. Used gloves shall be inspected prior to re-use. Damaged or deteriorated gloves will be replaced immediately.

4. Thermal-resistant gloves shall be worn for operations involving the handling of heated materials, exothermic reaction vessels and during the handling of cryogens. Thermal-resistant gloves shall be non-asbestos and must be replaced when damaged or deteriorated.

5. Due to the risk of having chemicals spilled on a lab workers feet; sandals, perforated shoes or bare feet are not allowed when experiments are underway.

6. Lab coats or rubberized aprons are required when there is a risk of contamination of personal clothing. The lab coat will be laundered on a periodic basis. The apron should be cleaned after each use. Laboratory coats shall be removed immediately upon discovery of significant contamination.

7. Use of respirators is highly restricted and shall be worn only after consultation with the Office of Environmental Health and Safety.

Spills and Accidents

1. Chemical spills of a minor nature can be cleaned up by trained lab personnel providing they have the necessary equipment. For spills of a somewhat larger nature, call personnel from the Office of Environmental Health and Safety for assistance. However, should a major spill occur immediately call 2911 for emergency assistance.

2. If an accident of a minor nature occurs, inform your supervisor. Medical attention will be provided if needed. An accident investigation must then be conducted to determine the cause of the accident and measures taken to prevent a reoccurrence.

Waste Disposal

1. No regulated chemicals shall be disposed of in an improper or illegal fashion, such as flushing them down the sanitary sewer system or placing them in normal refuse containers.

2. All regulated chemicals shall be properly stored in a pre-approved location until picked up by personnel from the Office of Environmental Health and Safety.

The Office of Environmental Health and Safety is charged with the responsibility of disposing of chemical wastes in a safe and legal manner.

General Chemical Safety Procedures

All laboratories must produce specific written safety practices for the procedures performed in their lab. However, this section will provide some generally accepted safety practices to be used when handling or using certain categories of chemicals.

Transporting Chemicals

Transporting chemicals can produce, in the right circumstances, the greatest chance of experiencing a spill situation. It can be dangerous not only to the individual transporting the chemicals but to innocent bystanders unaware of the potential hazard.

When chemicals are carried, they should be placed in a safety container, acid carrying bucket or other appropriate container to protect against breakage and spillage. When they are transported on a wheeled cart, the cart should have wheels large enough to negotiate uneven surfaces without tipping or stopping suddenly.

If chemicals are transported on passenger elevators the chemicals should be labeled and carried in safety containers. Additionally, the chemicals should if at all possible not be transported during busy times, such as change of classes.

Flammable Liquids

Flammable substances are generally the most common hazardous material found in the laboratory setting. The tendency of the materials to vaporize, ignite, burn, or explode varies with the specific type or class of substance.

An indicator of the flammability of a solvent is its flashpoint; the lowest temperature at which a liquid gives off vapor in sufficient concentration to form an ignitable mixture with air. Among the most hazardous liquids are those that have flash points at room temperature or lower, particularly if their range is broad. When flammable materials are being used in a laboratory, close attention should be given to all potential sources of ignition. The vapors of all flammable liquids are heavier than air and are capable of traveling considerable distances. This could be a significant problem if there were an ignition source at a lower level.

The following guidelines should be followed when handling or storing flammable materials:

a. Flammable materials should be handled only in areas free of potential ignition sources.
b. Flammables should not be heated with an open flame. Another type of heat source, such as a steam bath, water bath, or heating mantle should be used.

c. The liquid should be dispensed and used in a hood or well-ventilated area so that flammable vapors do not collect.

d. Transfer flammable liquids carefully. The friction of flowing liquids may be sufficient to generate static electricity which in turn may cause a spark and ignition. All large containers should be grounded or bonded before pouring from them.

e. Non-flammable liquids should be used as substitutes when ever possible.

f. No smoking signs should be posted and obeyed where ever flammable liquids are handled or stored.

g. Storage of flammable materials must comply with rules and regulations of the Office of the State Fire Marshal.

h. Keep only small quantities on hand.

i. Use only approved safety cans with self-closing cover, vent and flame arrester for storing flammable liquids or waste solvents.

j. Refrigerators and cooling equipment used for storing flammable liquids must be explosion proof.

Reactive Chemicals

Reactives refer to chemicals that, when mixed as part of an experiment, because reactions to proceed at such a fast rate and generate so much heat that they may result in an explosion. Care should always be taken, when using reactives, to ensure sufficient cooling and surface area for heat exchange. Many chemical reactions may involve hazards like those mentioned above, but can be handled safely if some preliminary planning is done prior to the start of an experiment.

One specific class of compounds that have unusual stability problems that make them among the most hazardous substances handled in laboratories are organic peroxides. They are sensitive to heat, friction, impact and light as well as to strong oxidizing and reducing agents. All organic peroxides are flammable. Some suggestions for safe use of peroxidizable materials are listed below:

1. All peroxidizable materials should be stored in a cool place, away from light. Metal cans are preferable; do not store ethers in ground glass-stoppered bottles.

2. Order only in small quantities and date the container upon receipt and when it is first opened. They should be properly disposed of within a year after receipt if unopened or within six months of opening.

3. Ethers shall always be handled in a hood to assure proper ventilation. This will protect users from inhaling the vapors and prevent accumulation of explosive concentrations of the vapor.

Great care should be taken to ensure that incompatible chemicals are not combined or stored together. Examples of incompatible chemicals as well as lists of other chemical hazards that may result in explosions or fires can be found in "Prudent Practices for Handling Hazardous Chemicals" (National Academy Press).

Corrosive Chemicals

Corrosives are divided up into four major classes: strong acids, strong bases, dehydrating agents and oxidizing agents. Inhalation of these substances can cause severe respiratory irritation. Contact with the skin or eyes can be particularly damaging.

A. Acid and alkalis should be stored separately in a cool-ventilated area, away from metals, flammables and oxidizing material. Some general suggestions for safe use and storage are listed below:

1. Always pour acids into water, never the reverse.

2. Cap bottles securely and store them securely, but do not store acids and alkalines together.

3. Clean up spills promptly. Do not leave residues on a bottle or lab bench where another person may come in contact with them.

4. Wear protective equipment appropriate to the type of work being performed.

5. If you have been splashed with an acid or alkalis immediately wash it off and seek medical attention if necessary.

Four acids require special mention due to the hazard they present:

1. Nitric Acid - It is very corrosive and its oxides are highly toxic. Because nitric acid is also an oxidizing agent, it may form flammable and explosive compounds with many materials (ethers, acetone and combustible materials). If paper were used to wipe up nitric acid it could potentially ignite spontaneously when dry. Nitric acid should be used in a hood and stored away from combustible materials.

2. Perchloric Acid - This acid forms highly explosive and unstable compounds with many organic compounds and even with metals. Unstable perchlorate compounds may collect in the duct work of fume hoods and cause fire or explosions. Therefore Perchloric acid shall only be used in special hoods intended for that purpose. These special hoods have corrosion resistant duct work and wash down facilities.

3. Picric Acid - This acid can form explosive compounds with many combustible materials. When the moisture content decreases, picric acid may become unstable and may explode if shaken. Picric acid should be dated, stored away from combustible materials and not kept for more than one year.

4. Hydrofluoric Acid - Hydrofluoric acid (HF) is extremely corrosive and will even attack glass. All forms, dilute or concentrated solutions or the vapors, can cause serious burns. Inhalation of HF mist or vapor cause serious respiratory tract irritation that may be fatal. Burns from hydrofluoric acid heal very slowly. Hydrofluoric acid should, therefore, be used only in a fume hood while wearing gloves, safety goggles and a lab coat. Avoid

allowing HF to contact metals or ammonia since toxic fumes may result.

B. Oxidizing Agents present fire and explosion hazards on contact with organic compounds and other oxidizable substances. Some suggestions for safe use and storage are listed below:

1. Oxidizing agents should be stored separately from flammables liquids, organics, dehydrating agents and reducing agents.

2. Strong oxidizing agents should be stored and used in glass or other inert containers. Corks and rubber stoppers should not be used.

3. Oxidizing agents should be used with caution in the vicinity of flammable materials.

C. Dehydrating Agents include concentrated sulfuric acid, sodium hydroxide, phosphorus pentoxide and calcium oxide. In order to avoid violent reactions and spattering, these chemicals should be added to water, never the reverse. Because of their affinity for water, these substances cause severe burns on contact with skin.

Toxic Chemicals

Toxicity is the capability of a chemical to produce injury. Almost any substance is toxic given a sufficient dose of the material.

The effects of a toxic chemical can be divided into several categories.

1. Local Toxicity - is the effect a substance has on body tissues at the point of contact.

2. Systemic Toxicity - is the effect a substance has on body tissues other than at the point of contact.

3. Acute Toxicity - is the effect a substance has after only one or a few exposures.

4. Chronic Toxicity - is the effect a substance has as a result of many exposures over a long period of time.

Laboratory workers may potentially be exposed to a chemical substance through three major routes of exposure:

1. Inhalation - Inhalation of toxic vapors, mists, gases or dust can result in poisoning through the mucous membrane of the mouth, throat and lungs and can cause serious local effects. The degree of injury from exposure to a toxic substance depends on the toxicity of the material, its solubility in tissue fluids and the concentration and duration of exposure.

2. Ingestion - Ingestion of chemicals in the laboratory may lead result in serious injury. To prevent ingestion of chemicals, lab workers should wash their hands immediately after using any toxic substance and before leaving the laboratory.

3. Skin Contact - This is the most frequent route of exposure to chemical substances. A common result of skin contact is localized

irritation; however, some materials can be absorbed through the skin sufficiently to cause systemic poisoning. All persons in the lab should wear gloves and safety glasses to prevent contact with chemicals.

Highly toxic materials or materials with unknown toxic properties should be worked with only in a designated area using the smallest amount of the chemical that is consistent with the requirements of the work to be done. Only lab workers who have received prior approval of the Principal Investigator or Lab Manager should be allowed to work with these substances.

Metals

Alkali metals (e.g. sodium and potassium) react violently with water and decompose the water to give off hydrogen which may be ignited by the heat of reaction. Alkali metals can also ignite spontaneously in air, especially when the metal is in powdered form and/or the air is moist as here in Florida.

Some suggestions for safe use and storage of alkali metals are listed below:

1. Store alkali metals under mineral oil or kerosene. Avoid using oils containing sulfur since a hazardous reaction may occur.

2. Use only special dry powder Class D fire extinguisher on alkali metal fires.

3. Any waste alkali metals should be placed in a labeled, leak proof container, covered with mineral oil and properly disposed of through the Office of Environmental Health and Safety.

Finely powdered metals that come in contact with acids may ignite and burn. Metal powders can also create a dust explosion hazard when the powders become airborne in areas where a spark or flame is present. Additionally, metal powders are subject to rapid oxidation which may result in a fire or explosion.

Cryogenics

The main hazards associated with cryogenic materials are burns from contact with skin, pressure build up in un-vented spaces and fire, explosion or asphyxiation which can result from the evaporation of cryogens.

Below are listed suggestions for safe use and storage:

1. Eye protection must be worn whenever cryogenic liquids are handled. Where splashing is a possibility, face shields must be worn. Appropriate gloves, shoes and clothing must also be worn.

2. If an employee were to be splashed by the liquid, immediately flood exposed areas and clothing.

3. Avoid wearing jewelry or watches.

4. Due to the fact that cryogenics can cause asphyxiation by displacement of air they should be used only in well ventilated areas.

5. Venting should be provided to avoid quick and violent pressure

changes when cryofliud vaporizes.

6. Handle combustible cryogens such as liquid hydrogen and liquid natural gas in the same way combustible gases are handled: provide adequate ventilation, keep away from open flame and other ignition sources, prohibit smoking and vent gases to a safe location.

7. Exposed glass portions of the container should be taped to minimize the flying glass hazard if the container should break or implode.

Compressed Gas Cylinders

The following rules must be observed when using compressed gas cylinders:

1. All gas cylinders must be labeled to identify their contents. Do not rely on color codes.

2. Know the properties of the chemical contents of the gas cylinders.

3. Handle gas cylinders carefully.

4. Store and use in well ventilated areas, away from heat or ignition sources. Store oxygen away from flammable gases. Reactive gases should be stored separately.

5. Cylinders must be chained or strapped in place to prevent them from falling over. Metal cylinder caps for valve protection should be kept on at all times when the cylinder is not in use.

6. Transport cylinders only with a hand truck. Do not "roll" a cylinder on its end even to move it a short distance.

7. Do not use cylinders without a pressure regulator.

8. Close cylinder valves when not in use. Do not rely on a regulator to stop the gas flow overnight.

9. Close valves on empty cylinders and mark the cylinders "Empty".

10. Never attempt to refill a cylinder.

Allergens

A wide variety of substances, such as diazomethane, isocyanates and bichromates can produce skin and lung hypersensitivity. Because of the varying responses of individuals to allergens suitable gloves must be worn to prevent hand contact with allergens or substances of unknown allergenic activity.

Embryotoxins

Certain dangerous chemicals may act as embryotoxins. Special precautions must be taken when using these chemicals. The lab supervisor must take appropriate measures in order to ensure the safety of those involved with their use.

Chemical safety is achieved by continual awareness of chemical hazards and by keeping the chemicals under control by using precautions, including engineering controls such as ventilation. Laboratory personnel should be familiar with precautions to be taken, including the use of engineering controls and safety equipment. Laboratory supervisors must ensure the engineering controls are adequate and should also be alert to detect the malfunction of the existing controls and safety equipment. All engineering safeguards and controls must be properly maintained, inspected on a regular basis, and never overloaded beyond their design limits. Some examples of the major types of engineering controls and safety equipment will be listed below along with pertinent information on the need and use of each.

Ventilation

General laboratory ventilation should always be designed such that the laboratory is under a slightly negative pressure relative to other parts of the building to prevent odors or vapors from being pushed out of the lab due to a positive pressure inside the room. Usually lab ventilation should be about eight air changes per hour. This flow is not necessarily sufficient to prevent accumulation of chemicals vapors.

When working with toxic or other types of chemicals with low air concentration limits or that have a high vapor pressure always use a fume hood. Chemical fume hoods are intended to remove vapors, gases and dusts of toxic, flammable, corrosive or other types of dangerous materials. With the sash lowered to an appropriate level, laboratory fume hoods can also afford workers protection from such hazards as chemical splashes or sprays and fires. However, they are not designed to withstand explosions.

The following are some guidelines which should be observed when using fume hoods:

1. Before performing hazardous operations check to determine that the hood is working; hold a small piece of paper at the face of the hood and see if it is being drawn inward.

2. When work is being performed within the hood, keep the sash at the recommended height. The appropriate sash height needed to obtain the proper airflow is posted on the hood itself. The hood will be certified annually by the Office of EH&S to ensure proper functioning of the unit.

3. Experiments should be conducted well inside the hood. All apparati should be a minimum of six inches from the front of the hood. This simple step can reduce vapor concentrations at the face of the hood by 90%.

4. Fume hoods are not intended for the storage of chemicals. Materials stored in them should be kept at a minimum and in such a way that they will not interfere with the flow of air.

5. Hoods should be considered as backup safety devices that can contain and exhaust toxic, offensive or flammable materials. <u>They should not be considered as a way of disposing of chemicals by means of evaporation.</u>

6. If the ventilation system fails; immediately stop work, drop the sash down all the way and contact the appropriate personnel to have repairs made.

7. Chemicals should not be routinely stored in the hood, however, if a minimal amount of chemicals are left in the hood, leave the exhaust fan running in

order to prevent a build up of vapors in the hood or in the lab area.

The use of perchloric acid requires specially designed wash down fume hoods. Never conduct experiments which heat perchloric acid in a hood not specifically designed for the purpose.

If chemicals of a much more hazardous type are planned for use in a general chemical hood, contact the Office of EH&S to have the hood recertified for more hazardous use.

Another means of removing hazardous materials through ventilation is by the use of biological safety cabinets, glove boxes or isolation rooms. These are usually very specialized pieces of equipment and as such should be certified for use on an annual basis by individuals with the appropriate credentials to perform the inspection. The exhaust from these pieces of equipment must pass through special filters or scrubbers before being released to the atmosphere.

Flammable Storage Cabinets

If relatively large quantities are to be kept in a laboratory they must be kept in a suitable flammable storage cabinet. Some safety practices to follow regarding their use are listed below:

1. Store only compatible chemicals inside a cabinet.

2. Do not store paper or cardboard or other combustible packaging material in a flammable-liquid storage cabinet.

3. Do not overload the storage cabinet.

4. The cabinet should be ventilated as needed.

Refrigerators

Often time small amounts of certain chemicals may need to be stored in a cool location; therefore they are put in a refrigerator. Three types are available for use:

1. The ordinary household refrigerator is not equipped with explosion-safe controls or door switches and should not be used to cool flammable liquids due to the fact that sparks from the controls or switches may ignite the vapor-air mixture.

2. The explosion-safe refrigerator is constructed with its controls mounted outside the storage compartment. This type refrigerator is suitable for storing flammable liquids.

3. The explosion proof refrigerator also has its controls mounted on the outside, but, in addition, the controls are of an explosion proof design. This type is needed only where both the internal and external environment present a fire or explosion hazard.

Every refrigerator should be clearly labeled to indicate whether or not it is suitable for storage of flammable liquids. Flammables liquids stored in a refrigerator shall be in closed containers.

Laboratory refrigerators shall not be used for the storage of food or drink.

Fire Extinguisher

All individuals working in a laboratory must be instructed in the location of fire extinguisher. Each lab must have an appropriate type of adequate size available for immediate use. All employees should be trained in the proper use of fire extinguishers. There are four main types:

1. Water extinguishers are effective against burning paper and trash (class A fire). They should not be used on electrical, liquid or metal fires.

2. Carbon Dioxide extinguishers are effective against burning liquids and electrical fires (Class B&C fires). They are less effective against paper, trash, or metal fires and should not be used against lithium hydride fires.

3. Dry Powder extinguishers are effective against burning liquids and electrical fires and to a lesser extent paper and trash fires (Class A, B&C fires). They are the most commonly found type of extinguisher. These extinguishers are generally used where large quantities of solvents are used.

4. Met-L-X extinguisher and others that have special granular formulations are effective against burning metal (Class D fires). Included in this category are fires involving magnesium, lithium, sodium and potassium; alloys of reactive metals, metal hydrides, metal alkyls and other organometallics. These extinguishers are less effective against paper and trash, liquid or electrical fires.

Eyewash and Safety Shower Stations

All employees who potentially might be splashed by chemicals, during the course of their work activities, must be instructed in the location of the nearest eyewash station and safety shower. Each employee must also be thoroughly familiar with how to use the safety equipment in case they must find and use it with their eyes closed.

The eyewash/safety shower stations will be inspected at least annually by the Office of EH&S. Any problems noticed by lab personnel regarding these pieces of equipment should be immediately brought to the attention of the lab supervisor and appropriate actions taken.

Chemical Inventory

A complete chemical inventory of all chemicals found at the worksite is required to be maintained at all times. This shall be updated annually, made available for staff or compliance officer review and provided to EH&S when requested.
This is inventory form is found in Appendix D

Exposure Assessment

There may be times when employees or supervisors suspect that an employee is being or has been exposed to a hazardous chemical to a degree and in a manner that might cause harm to the individual. It is extremely important to promptly investigate such incidents.

Events or circumstances that might reasonably constitute overexposure include:

1. A hazardous chemical leaked or was spilled or was otherwise released in an uncontrolled manner.

2. A laboratory employee had direct skin or eye contact with a hazardous chemical.

3. A laboratory employee manifests symptoms, such as headaches, rash, nausea, coughing, tearing, irritation or redness of eyes, nose or throat, loss of motor dexterity and;

    a. Some or all of the symptoms disappear when the person is taken away from the exposure area and breathes fresh air.

    b. The symptoms reappear soon after the employee returns to work with the same hazardous chemicals.

4. Two or more persons in the same laboratory work area have similar complaints.

Given the set of circumstances just mentioned the Office of EH&S will initiate an exposure assessment. Information regarding the situation will be collected and if necessary exposure monitoring will be conducted. All such complaints and their disposition must be documented.

In certain situations medical surveillance programs will be established where monitoring reveals an exposure level above the action level for an OSHA regulated substance for which there are exposure monitoring and medical surveillance requirements.

When monitoring is performed, the employee will be notified within 15 working days of receipt of the results.

Medical Consultation

If the circumstances mentioned in the Section IX are relevant to any laboratory employee they will have an opportunity to receive a medical consultation with a licensed physician. The purpose of the medical consultation will be to determine whether a medical examination is warranted. Both the consultation and the examination, including any follow-up, will be provided to the employee without cost. The employee should, however, obtain a list of physicians designated by the College.

Students working in laboratories on a volunteer basis should seek attention at the Counseling and Wellness Center located in PKV.

Where possible, the principal investigator, lab manager or other responsible party should provide the following information to the physician:

1. The identity of the hazardous chemicals to which the employee may have been exposed.

2. A description of the conditions under which the exposure occurred including exposure data, if available.

3. A description of the signs and symptoms of exposure that the employee is experiencing, if any.

For any consultation or examination provided under this program the physician must provide a written opinion to the Director of Environmental Health and Safety that, at a minimum, includes the following:

1. Any recommendation for further follow-up.

2. The results of the medical examination and any associated tests.

3. Any medical condition that may be revealed in the course of the examination that may place the employee at increased risk as a result of exposure to a hazardous chemical found in the workplace.

4. A statement that the employee has been informed by the physician of the results of the consultation or medical examination and any medical condition that may require further examination or treatment.

The written opinion should not reveal specific findings of diagnoses that are unrelated to the occupational exposure.

Record Keeping

In order for the New College of Florida's Chemical Hygiene Program to be successful, it is essential that accurate records be kept. The necessary documentation must be concise, legible and signed by the appropriate individuals. It may be necessary to refer to these records many years after they were originated. Departments may wish to establish a central location for maintaining laboratory safety records.

The following records will be maintained by the Office of Environmental Health and Safety:

1. Laboratory Safety Training Records

2. Employee Medical Surveillance Records

3. Exposure Assessment Records

4. Ventilation and Safety Equipment Evaluation Records

The following records should be kept by either departmental or laboratory supervisory personnel:

1. Copies of Laboratory Standard Operating Procedures that the P.I. or Lab Manager has prepared regarding hazardous chemicals or processes.

2. Records regarding amounts of extremely hazardous substances stored and used.

3. Records of any laboratory safety meetings

The following records should be kept by the Human Resources Department:

1. Accident/Injury Reports

The following records should be kept by the Physical Plant:

1. Repair and Maintenance Records for repairs made to any ventilation or safety equipment.

2. Records of utility or mechanical upgrades made on building.

References

29 CFR 1910.1045 Laboratory Standard

Appendix A

GUIDELINES FOR PREPARING LABORATORY SPECIFIC STANDARD OPERATING PROCEDURES

Laboratories must provide employees with standard operating procedures to follow when laboratory work involves the use of laboratory chemicals.

Standard operating procedures (SOP's) are required written safety and health guidelines for work with hazardous chemicals. "Hazardous Chemicals" are chemicals which, based on at least one study conducted in accordance with established scientific principles, have statistically significant evidence that exposure may result in acute or chronic health effects.

Standard operating procedures are required for chemicals currently in use in the laboratory. New chemicals introduced must be included in existing SOP's or in a new SOP.

Standard Operating Procedures should be written using one or more of the following approaches:

1. By process, such as distillation, organic synthesis or glove box use.

2. By individual hazardous chemical, such as, benzene.

3. By hazardous chemicals class, such as, organic solvents or peroxidizable chemicals.

SOP's should include the following required elements:

1. Process - If applicable, list the processes or process types which involve hazardous chemical use in the laboratory. Processes may be described in general terms, such as, extraction and distillation, or more detailed terms, such as, spectrophotometric analysis of cholesterol extraction. If processes do not apply in your laboratory, proceed to #2.

2. Hazardous Chemical/Chemical Class - List the hazardous chemicals involved in each phase of the process and the expected by-products produced. If the SOP only involves a chemical, list the chemical, its aliases and the hazard classification.

3. Potential Hazards - Describe the potential hazards for each process or chemical.

4. Personal Protective Equipment - Identify the personal protective equipment and hygiene practices that are needed for each process, class of chemicals or individual chemical.

    a. Personal protective equipment includes gloves, coats/garments, eyeglasses, goggles, face-shields, and air purifying respirators. Include the specific types of glove needed for each phase of the process. If laboratory coats, eye protection or respirators are required, indicate when and why.

    b. For respirator use, include the type of respirator that should be worn, the specific cartridge to be used and how often the cartridge should be changed. (note: before assigning respirators, each lab must comply

with the requirements of the New College of Florida's Respiratory Protection Program)

5. Engineering/Ventilation Equipment - Describe engineering controls which will be used to reduce employee exposures to hazardous chemicals, such as ventilation devices, aerosol suppression devices and safety features on equipment.

6. Special Handling Procedures And Storage Requirements - List storage requirements for hazardous chemicals in your laboratory, including specific storage areas, special containment devices, restricted access plans, ventilation systems used, etc.

7. Spill And Accident Procedures - Indicate how spills or accidental releases will be handled and by whom.

8. Special Precautions For Animal Use - Indicate whether any hazardous chemicals are being administered to animals. Describe safety procedures that apply when working with animals, such as aerosol suppression devices, animal waste disposal, etc.

9. Decontamination - Address decontamination procedures for equipment and glassware: include controlled areas such as glove boxes, restricted access hoods, perchloric acid hoods, or designated portions of the laboratory.

THIS SECTION FOR INDIVIDUAL

LABORATORY SPECIFIC

STANDARD OPERATION PROCEDURES

OSHA

29 CFR 1910.1450, Occupational Exposure

to

Hazardous Chemicals in the Laboratory.

http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=standards&p_id=10106

Appendix D

New College of Florida Laboratory Chemical Inventory Page _____of_____

Name of PI/Supervisor Signature _____ Date:_____

Building:_____RoomNo:_____Deepartment:_____

Address:_____

_____

Product Name	Primary Chemical Name	CAS Number	Quantity on Hand	Frequency of

Appendix E

NEW COLLEGE OF FLORIDA

Environmental Health & Safety

Laboratory Safety Inspection

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I. Laboratory Identification:

Principal Investigator: _____ Department:
Lab Contact: _____ Phone No.:
Building/Room: _____ Date:

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II. General:

1)	Emergency call list posted on door?	Yes___	No___	N/A
2)	Hazard warning stickers on door?	Yes___	No___	N/A
3)	Does lab have a CHP?	Yes___	No___	N/A
4)	Training documentation complete?	Yes___	No___	N/A
5)	Respiratory protection used?	Yes___	No___	N/A
6)	NCF Resp. Prot. Prog. followed?	Yes___	No___	N/A
7)	Does lab have a first aid kit?	Yes___	No___	N/A
8)	Food in lab refrigerator?	Yes___	No___	N/A
9)	Food allowed in work area?	Yes___	No___	N/A
10)	Refrigerator marked "Not for Food Storage"?	Yes___	No___	N/A
11)	Is any of the following emergency response equipment present?			
	a) Fire extinguisher	Yes___	No___	N/A
	b) Safety shower	Yes___	No___	N/A
	c) Eye wash station	Yes___	No___	N/A
	d) Spill clean-up kit	Yes___	No___	N/A
12)	Is access obstructed to any of above?	Yes___	No___	N/A
13)	Fume hood used and functioning properly?	Yes___	No___	N/A
14)	Are any of the following potential hazards found in the lab?			
	a) Chemicals	Yes___	No___	N/A
	b) Radioactive materials	Yes___	No___	N/A
	c) Biohazardous materials	Yes___	No___	N/A
	d) Compressed gases (list)	Yes___	No___	N/A

gas #1 _____	cylinder size _____	chained
gas #2 _____	cylinder size _____	chained
gas #3 _____	cylinder size _____	chained
gas #4 _____	cylinder size _____	chained
gas #5 _____	cylinder size _____	chained

15)	Is Personal Protective Equipment provided or available?		
	a) Safety Glasses	Yes___	No
	b) Gloves	Yes___	No
	c) Lab Coat/Apron	Yes___	No
16)	Are walk ways provided with proper clearance?	Yes	No
17)	Are work surfaces kept clean?	Yes	No
18)	Are sharps separate from regular trash?	Yes	No

19) Electrical system adequate? Yes No N/A
20) All proper guarding in place? Yes No N/A

==========

III. Hazardous Materials:

21) Chemical inventory available? Yes___ No___ N/A
22) MSDS' readily accessible to lab staff? Yes___ No___ N/A
23) Labeling:
    a) all chemicals properly labeled? Yes___ No___ N/A
    b) original product names on labels (no abbreviations) Yes___ No___ N/A
24) Chemicals stored by hazard class? Yes___ No___ N/A
25) Are peroxide-forming chemicals dated upon receipt & disposed of after 6 month shelf life? Yes___ No___ N/A
26) Highly flammable liquids store away from heat sources and ignition? Yes___ No___ N/A
27) Are all chemicals capped except during use? Yes___ No___ N/A
28) Storage:
    a) flammable storage cabinets used? Yes___ No___ N/A
    b) flammable liquids not stored outside of cabinet in excess of 10 gal.? Yes___ No___ N/A

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IV. Hazardous Waste:

29) Waste contained according to NCF guidelines? Yes___ No___ N/A
30) Are containers labeled using NCF hazardous waste labels with all appropriate sections completed? Yes___ No___ N/A
31) Synthesized, unnamed chemical wastes labeled by their reactants and possible products (or by a useful generic description) and with their probable hazards? Yes___ No___ N/A

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V. Comments:

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Completed By: Date:

Laboratory Representative: Date: