Chapter 8: EMERGENCY PLANNING AND RESPONSE

This chapter of the CHP describes how this institution will meet its responsibilities to prepare for laboratory-related emergencies. Described below are emergency safety equipment and materials required in every laboratory, guidelines for responding to chemicals spills, fires and medical emergencies, and procedural and educational steps to ensure that laboratories and laboratory personnel are prepared for chemical spills and emergencies.

Preparing for Emergencies

Operating Procedures for Responding to Spills, Fires, and Medical Emergencies

The Chemical Hygiene Committee will periodically review and update the College's guidelines for responding to chemical spills, fires and medical emergencies. Principal Investigators and designated department personnel of academic programs maintain responsibility to develop written operating procedures for responding to emergencies involving extremely hazardous chemicals they currently or intend to work with. The CHO and Committee will review these procedures.

Building Evacuation Procedures

The Chemical Hygiene Committee members and the CHO will formally establish emergency protocols for evacuating laboratory facilities in the event of a fire, chemical release or other emergency. Already existing protocol will be periodically reviewed and updated by the Chemical Hygiene Committee. The written evacuation protocol will be specifically checked for proper coordination between principal investigator's laboratories, departmental laboratories, teaching labs and the Chemical Hygiene Office.

Establishment of Outside Technical Assistance and Response Capability

The Chemical Hygiene Committee and CHO must establish off-site resources (e.g. hazardous waste disposal contractor, FDNY, EMS) to be called upon to perform functions beyond the ability, scope or permitted actions of this institution's staff. Emergency resources have been established for the following events:

- Fires;
- Large chemical spills (more than 6 liters) and extremely toxic chemical spills that cannot be handled by laboratory employees;
- Toxic chemical releases (compressed gases, cryogenic gases);
- Medical emergencies.

The table below, or one substantially similar should be posted in each laboratory near a telephone, or in another prominent location at eye level.

CONTACTS FOR LABORATORY EMERGENCIES

EMERGENCY TYPE	CONTACTS	TELEPHONE
FIRES OR EXPLOSIONS	Facilities Contact	Public Safety Tel: x7777

	Fire Department	Tel: 911
LARGE CHEMICAL SPILLS	Facilities Spill Outside Responders	CHO, Shaldon Watson, x8978 Triumvirate Environmental
COMPRESSED GAS CYLINDER / CHEMICAL RELEASES	Facilities Spill Outside Responders	CHO, Shaldon Watson, x8978 Public Safety, x7777 Triumvirate Environmental
MEDICAL CONTACTS		
First Aid	Facilities Contact	Public Safety, x7777
Ingestion	Poison Control	Public Safety, x7777 EMS Tel: 911
Acute Chemical Exposure	Emergency Medical Services EMS	Public Safety, x7777 EMS Tel: 911
Emergency Care	Nearest Hospital Emergency Room	Public Safety, x7777 EMS Tel: 911

Development of On-site Emergency Response Capability

The Chemical Hygiene Committee members should develop the capacity to efficiently and quickly respond to first reports of laboratory emergencies and provide assistance and guidance in selecting a course of action. Each will be familiar with the above-named contacts, their telephone numbers, and understand the capabilities and limitations of the College to respond to problems. Committee members are free to call upon each other for advice in anticipation of a problem, or during/following an incident. For this reason, a list of current Chemical Hygiene committee members is included below.

NAME	DEPARTMENT	Campus Phone
Shaldon Watson (CHO)	Environmental Health & Safety	X8978
Raymundo Pegollo	Buildings & Grounds	X8180
John Belardo	Art	X8889
Christina West	Biology	X8654
Brian Morgan	Earth, Environmental and Geospatial Sciences (EEGS)	X5742
Sharif Elhakem	Chemistry	X7124
Ryan Raaum	Anthropology	X8845
Fausto Ramirez	Public Safety	X8593
Ilona Linins	Environmental Health & Safety	X8988

Review and Investigation of Incidents

The College's established incident-review protocol includes review by the CHO of all incident reports to identify and understand factors which contributed to its occurrence, and help prevent future occurrences. Recommendations for improvements will be presented and discussed at Chemical Hygiene Committee meetings and with appropriate department personnel.

Completion of Laboratory Safety Equipment Checklists

Each Laboratory (in consultation with its Department and the CHO) will develop a check-list indicating the number and types of safety and spill control equipment required to protect employees in that lab during spill clean-up, fire, or evacuation procedures. This list must be kept current and updated after each incident.

Required Emergency Equipment and Facilities

It is the College's responsibility to identify and purchase spill control and personal protective equipment for employees working in laboratories and other workplaces. This College will provide necessary fire extinguishers, eyewash and shower facilities, [respiratory protective devices], and first aid kits in all laboratories. It is the responsibility of supervisors, Principal Investigators and others to alert Department Heads about the absence of/deficiencies in safety equipment and facilities in their laboratory room(s).

Emergency Telephones and Posted Telephone Numbers

Every lab should have a clearly marked phone with emergency telephone numbers listed next to it. If there is no phone in the lab, there must be an alternative written plan for contacting emergency or other personnel. This alternative plan must be clearly posted in the laboratory. Specific telephone numbers to be posted are indicated above.

Deluge Showers and Eyewash Stations

Showers must be located within 25 feet of every laboratory, storage area, or chemical preparation room wherever corrosives, dehydrating agents, solvents, and other hazardous chemicals are stored or used (FDNY). Eyewash stations should be installed and functional in each lab, storage area or chemical preparation room. Instructions for activating the shower and eyewash should be clearly posted and all lab personnel must be trained to use these facilities.

Eyewash stations should be centrally placed in a lab along a normal path of egress and should take no longer than 15 seconds to reach from any point in the laboratory.

The shower and the eyewash should ideally be next to each other, since incidents involving facial splashes are likely to involve other part of the body as well. The eyewash water supply must provide 0.4 gallons/minute of water at $\leq$25 psi to flood the eyes and face with potable, aerated, water for at least 15 minutes. The best design is 2 nozzles facing upward and aimed slightly inward.

The water supply should run until it is turned off. Deluge showers should be able to deliver 50-60 gallons of water at one time.

Valves on eyewash and safety showers should be easily turned on in one second or less and designed so that water flow stays on without requiring the operator to keep it on.

Ideally, the water temperature should be at 90-95 degrees F (32- 35^{O}C) but not over 100^{O}F. A flow of extremely cold water on a person for any length of time can cause them to go into shock.

Small squeeze bottles containing a pint or quart of water are prohibited. The water may be contaminated and there is not sufficient volume to be of any use.

Fire Alarm System

All laboratory facilities must be capable of notifying all personnel in the vicinity of a fire so that they may evacuate the building. Locations which have no alarm system must have alternative ways of notifying employees and other persons. These alternative methods must be communicated to all necessary personnel.

Fire Extinguishers

Portable extinguishers must be present in all laboratories, chemical storage and preparation areas. They must be of the right type and the right capacity (volume) to be able to extinguish the amount of material that may be involved in a fire. The following table shows the uses for different types of extinguishers and is a guide for the choice of the proper extinguisher in any laboratory.

Fire extinguishers should be located near entrances to storage/work areas, or just inside or outside of the entrance so that when an occupant attempts to get the extinguisher, he/she will be moving toward the exit. The fire extinguisher maintenance program (Chapter 9) ensures proper maintenance.

USES FOR VARIOUS TYPES OF FIRE EXTINGUISHERS

TYPE OF EXTINGUISHER	EFFECTIVE AGAINST	DO NOT USE ON
Water	**Class A fires**: burning paper, wood, coal, rubber, textiles	electrical, liquid or metal fires
Carbon Dioxide	**Class B fires**: petroleum hydrocarbons (flammable solvents, motor oil, grease)	metal fires (including lithium aluminum hydride)
Dry Powder or Dry Chemical	**Class C fires**: burning liquids, large quantities of flammable solvents, electrical fires	metal fires, fires involving delicate instruments
Met-L-X and other Class D extinguishers with special granular formations	**Class D fires**: burning metal (e.g. lithium, magnesium, potassium, sodium, alloys of reactive metals, metal hydrides, metal alkyls, and other organometallics)	paper, trash, liquid, electrical fires
Halon Substitute fire extinguishing media	**Class A**, **B**, and **C** fires	Class D fires

Multipurpose extinguishers are good for areas where fires may involve different classes of materials. Dry powder extinguishers, for example, would be good for a fire involving all or one of the following: solvents (Class B), and electrical (Class C). If a laboratory also uses combustible metals (magnesium and sodium) a second extinguisher for Class D fires (e.g., Met-L-X) is required.

Fire Blankets

Fire blankets must be readily available in each laboratory to use to cover an injured victim who may be in shock until emergency medical help arrives. NEVER USE FIRE BLANKETS TO COVER A VICTIM IN A STANDING POSITION WHOSE CLOTHING IS ON FIRE. This increases the amount of hot gases and smoke, and potentially cause face and head burns. Procedures for clothing fires are described below.

Chemical Spill Control Equipment

The College will ensure that all instructional and research laboratories will have sufficient spill control equipment either in the laboratory itself or readily available to respond to spills involving the chemicals used in the laboratory. Chemical spill supplies must be capable of dealing with a spill of up to two gallons. The minimum equipment should include:

- neutralizing materials;
- absorption materials;
- broom and dustpan;
- bags, large, 6 millimeter polyethylene;
- mop;
- bucket (polyethylene);
- containers (5 gallon plastic);
- Mercury spill kit.

The specific types of neutralizing and absorbent materials and containers will depend on the types of chemicals used in a laboratory.

Goggles (not safety glasses) that make a close seal with the face should always be worn when cleaning up spilled chemicals as well as the appropriate gloves. Use manufacturer's permeation and resistance glove charts to choose appropriate gloves when cleaning up spills. MSDSs also contain glove-selection information. Laboratory personnel should make themselves familiar with the best choice of gloves for the types of spills they are most likely to encounter.

Shoe covers. Rubber boots or plastic shoe covers should be worn to avoid exposure of shoes (and feet) to corrosives or large quantities of solvents in clean-up operations. Foot protection such as shoe covers should be used in emergency situations only because of the risk of static spark.

Coveralls, Light Weight, Chemical Resistant (e.g. Tyvek) and Duct Tape. These may be necessary depending upon the extent of the spill and the toxicity or corrosivity of the chemical(s) involved. Duct tape is used to seal openings in the coveralls (wrists, ankles, etc.).

Disposable Full Length Coveralls. Use when cleaning up particularly hazardous materials such as carcinogens. Disposable full-length coveralls for high risk situations, offer protection from vapor and/or liquid penetration from head to toes.

Respiratory Protection. Emergency situations may require the use of positive pressure self-contained breathing apparatus, or negative pressure half-face respirators, or emergency escape air packs. Each Department must determine, with assistance from the CHO and Committee, the types and number of respirators which should be made available in each department for emergency situations. Situations requiring respirators include:

- large chemical spills;
- spills involving extremely toxic chemicals;
- releases of compressed toxic gases or gases which rapidly displace oxygen;
- escape from uncontrolled fires.

Respiratory protective equipment shall be used only by persons who have been properly trained in their use, medically cleared for respirator use, and fit tested for a specific respirator as required by the OSHA Respiratory Protection Standard (Title 29, Code of Federal Regulations, Part 1910.134).

First Aid Kit

Every laboratory must have a first aid kit containing a variety of bandages; adhesive tape, alcohol swabs, gauze, cold and hot packs, burn spray, abrasion ointment, tweezers, scissors and a first aid manual.

Standard Operating Procedures for Chemical Spills

Each department must consider the types of emergencies that may arise within its laboratories and develop written procedures describing the series of steps that should be taken in the event that these emergencies occur. Any laboratories handling extremely hazardous materials (including known and suspected carcinogens, reproductive hazards, acutely toxic chemicals or sensitizers) must have a written protocol for their use. Biological and radioactive materials require distinct protocols, depending on quantities used and the severity of their hazards. All laboratory employees must be trained in emergency procedures for these materials.

It is important to consider the specific location of the release to determine the proper response. A chemical release inside a properly operating fume hood would be different from releases in an open laboratory, the hallway of a building, an elevator, or a connecting tunnel between buildings.

Laboratory employees witnessing chemical spills or emergencies must never take it upon themselves to clean up a chemical spill, put out a fire, or administer medical assistance if they are not familiar with emergency or spill control protocol, don't know what chemicals are involved or don't have the proper protection.

NEVER contact Custodial Staff to respond to chemical spills! They are neither trained nor equipped to clean-up chemical spills.

Laboratory employees must wear personal protective equipment (PPE) which will prevent exposure to toxic chemicals.

In the event of any chemical spill, release, injury or illness incident reports must be completed (through the EH&S office and/or Public Safety), signed by either the person involved or an alternate person of their choosing and sent to the CHO.

All laboratory employees witnessing, involved in, or affected by a chemical spill, release or other incident are entitled to medical consultation by a physician experienced in identifying and treating patients experiencing toxic effects of chemicals.

After each incident, designated Department personnel must ensure that all emergency equipment, supplies, and materials are replenished.

Solid Spills

Nonhazardous inert solids can be swept up and placed in a compatible container for disposal as nonhazardous waste. However, spilled solid materials that are toxic, flammable and reactive must be treated as a hazardous materials spill and disposed of as hazardous waste.

Oxidizers: Spilled nitrates, permanganates, and perchlorates must be separated from other types of waste products and kept away from paper and other combustibles.

Extremely toxic solids: beryllium, cadmium, arsenic, barium, mercury and their compounds. Spills of these materials must be picked up by either EH&S personnel or the College's hazardous waste contractor when they occur outside of a chemical fume hood. Respiratory protection is usually required.

Air-reactive solids (pyrophoric):

White (or yellow) phosphorus. Extremely toxic, volatile, pyrophoric; if spilled, it must be kept wet (with water) and covered with wet sand. Any spill residue must be kept under water. Dispose of as a hazardous material. Other pyrophoric solids may be incompatible with water. It is the laboratory supervisor responsibility to research (using MSDSs and applicable texts) appropriate response to other types of spills involving a specific pyrophoric chemical. Note: white phosphorus is currently not used or stored at the College (since 2012).

Water-reactive solids: Group IA metals react with water to form flammable hydrogen gas which may then ignite from the heat of the reaction. Group IA metals become more water-reactive moving down the group (e.g. lithium is least water reactive, cesium will react with moist air). Cover with dry sodium carbonate and disperse and place the mixture in a large steel pan located in an isolated, dry area pending its disposal.

Potentially explosive solids: included in this class of materials are compounds that contain highly unstable functional groups (organic peroxides, metal perchlorates, metal acetylides, multiple nitro groups, etc.). Only trained personnel should attempt to clean up spills involving explosive solids. Immediately notify the CHO in the event that an explosive solid is spilled.

Liquid Spills:

All liquid spills should be diked first (absorbent placed around the spilled material), then generally neutralized and absorbed onto a solid material before being disposed of. There are three major types of absorbents, each appropriate for certain types of chemical spills, while inappropriate or even compounding the hazard of others:

- Organic Absorbents (paper towels, sawdust). Inappropriate for caustics, acids and oxidizers;
- Mineral (granular clay, vermiculite, diatomaceous earth, sand). This is the most inert type of absorbent material to use, but should **not** be used for chemicals that liberate vapors;
- Synthetic (polypropylene fibers). Not good with strong oxidizers. The only appropriate absorbent for hydrofluoric acid spills.

The area of a spill must always be decontaminated after the spilled material is removed (see decontamination issues below).

Never use a mop, wringer or bucket on a hazardous or flammable liquid. Mops should be used for nontoxic, non-corrosive, nonflammable, and inert liquids *only*.

Do not dilute spilled liquid laboratory chemicals with water unless absolutely necessary (i.e. there are no neutralizing materials available) for the following reasons:

- In some cases it is dangerous (e.g. concentrated inorganic acids);
- It does not work for organic solvents and other hazardous liquids;
- It is prohibited to flush chemicals into the sanitary sewer or storm drain. The liquid must be collected and disposed of as hazardous waste;
- It causes the spill to spread further than it might have and may ultimately increase the cost of disposal.

Before responding immediately to a spill, consider the potential vapor concentration and toxicity of the material. Consider the rate of evaporation of the liquid, the environmental conditions of the room (adequacy of ventilation, temperature), and the time elapsed since the spill occurred.

- Always make sure to have the necessary personal protective equipment before attempting to clean up a chemical spill.
- All used spill materials, including disposable personal protective equipment, must be disposed of as hazardous waste. Contents of all containers or plastic bags must be properly labeled.
- Always address an injury first before attempting to respond to a spill.

Guidelines for Specific Hazard Classes

Strong Acids

Don splash protective goggles, acid-resistant gloves. Use MSDS, chemical labels or manufacturer's glove chart to determine in advance the type glove material compatible with the chemical. Coveralls and plastic shoe covering may be necessary if the spill is large. Slowly add proper amounts of a weak base (e.g. sodium bicarbonate, sodium carbonate, calcium carbonate) to the spill area and physically mix the

neutralizing agent slowly and uniformly into the acid with & plastic rod or wooden stick. An eventual lack of foaming or fizzing indicates the point of neutralization.

Add absorbent such as vermiculite and scoop into a polyethylene container.

Hydrofluoric acid spills:

HF is extremely hazardous and requires special mention. The fluoride ion attacks the skin quickly without initial pain and can cause severe delayed effects which require calcium gluconate injections. NEVER ATTAMPT TO CLEAN UP HYDROFLUORIC ACID SPILLS, NO MATTER HOW SMALL UNLESS YOU ARE ABSOLUTELY CERTAIN YOU HAVE THE PROPER GLOVES AND THAT THEY HAVE NO HOLES.

DO NOT USE MINERAL ABSORBENTS (silicates react with HF to produce silicon tetrafluoride, a highly toxic gas). Special synthetic absorbents (polypropylene fibers) are required. *Simply absorbing liquid hydrofluoric acid still leaves the fluoride ion free and is not recommended.* The fluoride ion must first be captured with magnesium sulfate (creating insoluble MgF_2 and sulfuric acid), and the resulting sulfuric acid must be neutralized with sodium bicarbonate, sodium carbonate, or calcium carbonate.

Strong Bases

Don the same protective equipment as for strong acids. Add a weak acid (e.g. citric acid or weak (1-6 molar) hydrochloric acid). Use pH indicator paper to ensure that the material has been neutralized.

Flammable Solvents

Before doing anything, turn off all power supplies and unplug any equipment that may spark. Then follow the basic guidelines for liquid spills above. Flammable vapors may travel distances to ignition sources and flash back to the source of the vapors, rapidly creating a very dangerous environment.

Mercury

All labs where mercury is present must have an acceptable means of cleaning up a mercury spill. Mercury is an odorless, extremely toxic metal, volatile at room temperature and has no warning properties. It easily fills cracks and crevices, and collects in spaces under floorboards and tiles where it continues to evaporate without notice.

Mercury spill kits are commercially available. Kits include a small, hand-operated pump “vacuum”, sponges saturated with mercury- absorbent material, and metallic granules that react with mercury to form an amalgam. The granules should be poured into seams and cracks of the floor if necessary.

Mercury spills may also be picked up with a special powered mercury vacuum. NEVER USE ORDINARY VACUUM CLEANERS TO CLEAN UP MERCURY SPILLS! Mercury vapors will be spewed out of the vacuum's exhaust.

Personal Chemical Contamination and Medical Emergencies

All incidents involving chemical contamination (skin contact, inhalation, ingestion) or injury must be followed up by medical personnel at no cost to the employee. Listed below are initial steps to minimize harm after chemical exposure or injury. All incidents must be reported to the CHO and the Incident Report Form filled out as soon as possible.

Chemical Eye Splashes: IMMEDIATELY rinse the affected eye or eyes at the eyewash station for at least 15 minutes while holding the lids open to ensure proper irrigation.

Contamination of Large Areas of the Body: Immediately remove contaminated clothing while using the safety shower for at least 15 minutes. Wash contaminated areas with a mild soap and water. Do not waste time because of modesty. Do not use neutralizing agents or salves.

Ingestion of Chemicals: Encourage victim to drink large quantities of water, and seek medical attention by calling Public Safety.

Development of Signs or Symptoms of Chemical Exposure: In the event that a laboratory employee develops dizziness, nausea, light-headedness, a burning sensation in the eyes, nose, or throat, or other signs and symptoms of chemical exposure, they must leave the area immediately and get fresh air. Contact your Laboratory Supervisor and/or the CHO.

Thermal and Chemical Burns: Where appropriate, flush the area with cold water. For extreme burns, call Public Safety to call for medical (EMS) assistance.

Cuts and Heavy Bleeding: Apply compression to the wound to slow bleeding. Contact Public Safety (x7777) to call for medical (EMS) assistance.

Fires and Fire Related Incidents

Basic steps to take in the event of a fire (The order of these steps may vary depending on the situation):

- Pull the nearest fire alarm
- Immediately after, contact Public Safety x7777
- Evacuate all persons in the area. Follow building evacuation procedures.
- If there is time and it is safe to do so, shut off all power and close the door of the room where the fire is behind you.

If you are working and you hear a fire alarm, immediately leave the building by taking the nearest stairwell. ALWAYS USE THE STAIRS. NEVER TAKE THE ELEVATOR. Smoke and fire travel through the elevator shaft.

Determining When to Attempt to Put Out a Fire

Judgement must be used to determine whether to attempt extinguishing a fire. Combined circumstances which might encourage an attempt are:

- the fire is small and can be extinguished by a single fire extinguisher;
- chemical(s) and/or processes involved are not potentially explosive;

- fire is isolated (away from other chemicals);
- you have experience using a fire extinguisher;
- the fire extinguisher is the correct type for the chemical involved;
- there is always a clear escape route.

If the fire is in a beaker or other small container, it may be stopped by placing a watch glass over it with a tongs or other tool. NEVER PLACE A WATCH GLASS ON A BEAKER DIRECTLY WITH YOUR HANDS.

Using the Fire Extinguisher

In the event that a fire extinguisher is used, the following four steps should be taken

P A S S:

Pull the pin out on the extinguisher.

Aim the extinguisher at the base of the fire.

Squeeze the nozzle to release extinguishing material.

Sweep: Use a back and forth sweeping motion.

If after a few minutes the intensity or size of the fire has not diminished, GET OUT and close the door behind you. Larger or rapidly growing fires MUST BE EXTINGUISHED BY PUBLIC SAFETY AND FDNY!

When a Person and/or Their Clothing is on Fire

If you are on fire **STOP, DROP, AND ROLL**. Your body weight will smother the fire. DO NOT RUN! Running will fuel the flames. Use the safety shower if it is not far away.

If you are witness to a person on fire, force the person to **STOP, DROP, and ROLL**. Push the person down if necessary. Have someone else pull the fire alarm and contact the fire Department and Emergency Medical Services. DO NOT WRAP A PERSON IN A VERTICAL POSITION IN A BLANKET TO SMOTHER THE FLAMES. This could worsen the situation.

Ensuring Laboratory Preparedness for Emergencies

1. Employee participation in routine drills for fires, chemical spills, and medical emergencies.

All laboratory employees are required to participate in fire drills, chemical spill scenarios, and medical emergency scenarios to prepare them for these events. Fire drills will be coordinated by Public Safety and Buildings & Grounds. Chemical spills and medical emergency scenarios will be coordinated by department personnel. Interactive discussions will follow these scenarios which will be acted out and/or presented.

Laboratory supervisors must write spill response procedures for extremely hazardous chemicals and discuss them with employees before work with these chemicals is begun.

2. Routine laboratory inspections conducted by inspection teams described in Chapter 9 of the Plan will evaluate the adequacy of emergency safety facilities and equipment described in this chapter
3. Emergency facilities and equipment are maintained periodically to ensure they will function properly when they are needed
4. After each incident, designated Department personnel will ensure that all emergency equipment, supplies, and materials are replenished

An Incident Reporting and Follow-up System ensures that the factors responsible for an incident are examined and corrected if possible