University of Massachusetts Lowell

Environmental and Emergency Management (EEM)
Environmental Health and Safety (EHS)

CHEMICAL HYGIENE PLAN

Dates of Annual CHP Review and/or Dates of Revisions

(EEM-EHS will complete this page, annually, after each CHP review or revision)

Name (print)	Signature	Date

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Chapter 1
Introduction

The Occupational Safety and Health Administration's (OSHA's) rule for occupational exposure to hazardous chemicals in laboratories (29 CFR 1910.1450) requires that all laboratories have a written Chemical Hygiene Plan (CHP) which includes laboratory specific hazard and safety information. The laboratory must also designate a Chemical Hygiene Officer (CHO) who is responsible for implementing the provisions of the CHP as well as updating the CHP. (If a CHO is not designated for the laboratory group, the Principal Investigator is the CHO by default.)
[NOTE: A general overview of this Laboratory Standard is available at: http://www.osha.gov/SLTC/laboratories/. After going to this link, you may scroll down and double click on "1910.1450" to view the full standard.]

This CHP applies to all University of Massachusetts Lowell laboratory personnel who handle and may be exposed to hazardous chemicals in research laboratories at the University of Massachusetts Lowell. For those laboratories that do not have hazardous chemicals, the CHP will be used as the laboratory safety manual. Although the CHP is not required for undergraduate students and visitors, the CHP can still be utilized as an administrative control to protect all employees, students, and visitors from potential health hazards associated with the handling, use, and storage of hazardous materials in the laboratories. The CHP does not cover work with radioactive materials or biological agents. Please refer to the Radiation Safety Manual, the Environmental Health and Safety (EHS) Biosafety Manual and/or the EHS Exposure Control Plan for safety information regarding these materials.

The University of Massachusetts Lowell's CHP consists of two main parts: the CHP and the CHP Notebook. The CHP describes general laboratory policies and procedures. It sets forth procedures, equipment, personal protective equipment, and work practices that are capable of protecting employees from the health hazards presented by hazardous materials used in the laboratory.

The CHP Notebook must be customized by the laboratory group. It includes the specific work practices, procedures and policies that are used to ensure that employees are protected from all potential in their specific work area. It also contains documentation of training records and internal laboratory inspections.

Chapter 2

Safety Responsibilities

The Principal Investigator

Each Principal Investigator has the overall responsibility to protect their personnel from occupational hazards. This is an important responsibility and cannot be delegated. The Principal Investigator must assure that the laboratory safety requirements listed below are followed:

- Train all lab workers on the contents of the Chemical Hygiene Plan (CHP) and the CHP Notebook.
- Designate a CHO for the laboratory group. If no CHO is designated, the Principal Investigator is the CHO by default.
- Develop general and laboratory-specific written standard operating procedures (SOPs).
- Enforce safe work practices and oversee day-to-day safety in the laboratory.
- Train all occupants of the laboratory on the specific hazards and controls in their work environment.
- Provide appropriate personal protective equipment (PPE) for all laboratory workers as well as specific training on the PPE.
- Perform internal laboratory safety inspections on a regular basis. Correct any deficiencies and document all the internal inspections along with any corrective actions taken.
- Discuss safety issues during regular research group meetings.
- Maintain all records in the CHP Notebook. (Some of the CHP Notebook sections may not be applicable to all lab groups. If this occurs, please write “Not Applicable” on the appropriate page.)

NOTE: The involvement of the Principal Investigator inside the research lab demonstrates a deep concern for safety. When the Principal Investigator’s attitude towards safety is indifferent, careless attitudes can develop within the laboratory group and this can lead to accidents.

The Chemical Hygiene Officer (CHO)

- Develop, implement, and document specific portions of the CHP and CHP Notebook.
- Enforce safe work practices and oversee day-to-day safety in the laboratory.
- Consult with Environmental and Emergency Management (EEM) – Environmental Health and Safety (EHS) as necessary for assistance with matters of health and safety.
- Keep all lab group members informed of the results of any inspections or monitoring results issued by EEM-EHS.
- Investigate accidents and report as appropriate to EEM-EHS.

The Employee (the lab worker)

- Know and understand the hazards associated with his or her work as well as all necessary controls (engineering, administrative, and personal protective equipment) that must be used to protect themselves from these hazards.

- Training (baseline laboratory safety training offered by EEM-EHS and laboratory-specific training offered by the Principal Investigator or lab manager) must be received before starting to work in the lab.
- Review and know the location of the Chemical Hygiene Plan.
- Report all accidents, injuries and illnesses to the Principal Investigator as well as to EEM-EHS.
- Report chemical barcode information to EEM-EHS.

The Office of Environment and Emergency Management (EEM)-Environmental Health & Safety (EHS)

- Assist departments and individual laboratories in implementing and complying with the CHP.

The University of Massachusetts Lowell Safety Committee

- Assist departments and EEM-EHS with implementing the CHP.
- Review incident reports submitted to EEM-EHS.
- Support EEM-EHS when corrective actions need be taken in a lab to prevent future accidents or exposures.

Chapter 3

Emergency Procedures

Accidents and Emergencies

All accidents within the University, including work-related injuries, must be reported. A special phone extension, **44911**, has been established for this purpose and is manned 24 hours a day in the University Police Office, Ball 125, North Campus. An "outside" line is also available 24 hours a day for calls to the University police: 978-934-2394.

The UMass Lowell Student Health Service is equipped to handle MINOR injuries and illnesses for students. The Health Service Office is located at 71 Wilder Street, McGauvran Building Room 334. The phone extension is 44991 and the office is open from 8:00a.m. to 4:30p.m. Monday through Friday. When the Health Service is closed, students may be seen at the following clinics:

Saints Medical Center Walk In **M-F, 8:00 a.m. to 6:00 p.m.** **Sat 9:00 a.m. to 1:00 p.m.**	**1230 Bridge St, Lowell**	**978-459-2273**
Saints Medical Center Walk-In/ Occupational Health **M-F, 8:00 a.m. to 4:30 p.m.**	**85 Parkhurst Road @ Drum Hill**	**978-458-6868**

Staff members are directed to emergency departments described below as are students when the above-mentioned clinics are closed:

Saints Medical Center
1 Hospital Drive, Lowell MA **978-458-1411**

Lowell General Hospital
295 Varnum Avenue **978-937-6000**

In case of a MEDICAL EMERGENCY, call **44911** and give your name, location, the number of persons involved and the nature of the emergency. Give your telephone number and do not hang up until all necessary questions have been answered. The dispatcher answering the phone will call for medical assistance and an ambulance, if necessary. Someone should stay with the victim and provide first aid if necessary until assistance arrives. The University has 24 hour, seven days a week emergency medical service provided by University of Massachusetts Lowell Emergency Medical Services. The EMTs will be called by the University Police.

If the victim appears emotionally distraught or has attempted suicide, call the Director of Counseling directly at extension 4331 from 8:30a.m. – 5:00p.m. weekdays or through the University Police at other times.

There are emergency outdoor telephones located at:

ID#	Location
1	Emer Alumni Lib.
2	Emer Donahue Circle
3	Emer Bougeois Exterior
4	Emer Broadway Bus Stop
5	Emer Concordia Laundry
6	Emer Coburn Lobby
7	Emer Coburn Parking
8	Emer Costello Lobby
9	Emer Cumnock Lobby
10	Emer Cushing Stadium
11	Emer Donahue Blue Pole
12	Emer Donahue Lobby
13	Emer Dugan Front Walk
14	Emer Dugan Lobby
15	Emer Dugan Rear
16	Emer Durgin Front Lobby
17	Emer Durgin Rear Lobby
18	Emer Eames Front
19	Emer Falmouth Basement
20	Emer Fox Exterior
21	Emer Fox Lobby Res. Life
22	Emer Gar 1st Back
23	Emer Gar 1st Baseball
24	Emer Gar 1st Front
25	Emer Gar 2nd Back
26	Emer Gar 2nd Baseball
27	Emer Gar 2nd Front
28	Emer Gar 3rd Back
29	Emer Gar 3rd Baseball
30	Emer Gar 3rd Front
31	Emer Gar 4th Back
32	Emer Gar 4th Baseball
33	Emer Gar 4th Front
34	Emer Gar 5th Back
35	Emer Gar Grnd Back
36	Emer Gar Grnd Baseball
37	Emer Gar Grnd Front
38	ICC Garage side
39	ICC Loading Dock
40	ICC Lobby
41	ICC Front by Loop
42	ICC Rear 1
43	ICC Rear 2
44	ICC Mens room
45	ICC Womens room
46	ICC 2nd Floor Lobby
47	Emer IPI Lot
48	Emer Kitson1
49	Emer Kitson2
50	Emer Kitson3
51	Emer Leitch Exterior
52	Emer Lovejoy Front
53	Emer Lovejoy Rear

54 Emer Lydon 2nd Floor
55 Emer Lydon 3rd Floor
56 Emer Lydon 4th Floor
57 Emer Lydon Basement
58 Emer Lydon Rear
59 Emer Mahoney Lobby
60 Emer Mahoney 1st Fl. Back
61 Emer Mahoney 2nd Fl. Back
62 Emer Mahoney Basement
63 Emer O'Leary Lobby
64 Emer O'Leary 2nd Floor
65 Emer O'Leary 3rd Floor
66 Emer O'Leary 4th Floor
67 Emer O'Leary 5th Floor
68 Emer O'Leary Mezzanine
69 Emer Olney Basement
70 Emer Olney Lobby
71 Emer Olsen Lobby
72 Emer Olsen 2nd Floor
73 Emer Olsen 3rd Floor
74 Emer Olsen 4th Floor
75 Emer Olsen 5th Floor
76 Emer Olsen 6th Floor
77 Emer Perkins Lot
78 Emer Rec Center Baseball
79 Emer Rec Center Circle
80 Emer Rec Center Lobby
81 Emer Rec Center Men's Rm.
82 Emer Rec Center Women's Rm.
83 Emer Riverview A
84 Emer Riverview B
85 Emer Riverview C
86 Emer Riverside Olney
87 Emer Riverside Sparks St.
88 Sheehy Front
89 Emer Sheehy Link
90 Emer 'Smith' Tunnel
91 Emer Solomont Shack
92 Emer Southwick Exterior
93 Emer Southwick 2nd Fl.
94 Emer Southwick 3rd Fl.
95 Emer Southwick 4th Fl.
96 Emer Southwick Tunnel
97 Emer Uni. Ave. by Eames
98 Emer Weed Lobby
99 Univerity Bridge 1
100 Univerity Bridge 2
101 Salem St
102 Sheehy Front
103 Bellegarde Boathouse

There are Emergency Call Boxes located in the lobbies of all buildings on all campuses. These telephones and boxes reach the University Police directly. For the most effective response, do not call outside agencies directly (i.e. fire department, ambulance, etc). The University Police will coordinate the necessary response.

In case of FIRE, pull the nearest pull station to activate fire alarm system and call **44911** from a safe area. Be prepared to give the location and extent of the fire. Do not hang up until all questions are answered. Follow the Fire Safety Evacuation Plan.

All work-related injuries must be reported immediately to Human Resources (HR) by calling 43560. An Incident/Injury Report Form must be filled out and faxed to EEM-EHS at 934-4018. The original Incident/Injury Report Form must be turned in to HR.

EMERGENCY RESPONSE PROCEDURES FOR HAZARDOUS SUBSTANCE SPILLS

The following describes appropriate actions to be taken by the University staff, faculty and students when spills of hazardous substances occur.

In general, hazardous spills regardless of size, will be abated/corrected only by personnel specifically trained in spill clean-up operations or by the University Spill Team. Only those individuals who are properly equipped and fully aware of the hazards in handling the specific substance(s) spilled, the associated health and environmental effects and compatibility(ies) of the substance(s) should endeavor to correct spill situations.

RESPONSE PROCEDURE: "SMALL SPILLS" (DEFINED AS ONE LITER OR LESS)

1. Ventilate with outside air (if possible) and close hallway doors.

2. Secure area (lock doors).

3. Call University Police at **44911** and provide the following

   information: A. Your name

   B. Building name and room number of spill

   C. Name of substance spilled

   D. Approximate amount spilled

   E. Injuries, names of persons affected

   F. State if you will be cleaning up the (small) spill or whether the University Spill Team should be notified.

4. Meet with University Police official at an agreed upon location. Identify yourself.

RESPONSE PROCEDURES: "LARGE SPILLS" (DEFINED AS GREATER THAN ONE LITER) or when a spill involves a substance that is considered immediately dangerous to life, health or safety.

1. Evacuate immediately and, if conditions allow, secure room (i.e. close doors which separate the room from the rest of the building.)

2. Call the University Police Department at **44911** from a "safe" area and provide the following information:

   a. Your name
   b. Building name and room number affected by the spill
   c. Section of the room affected by the spill
   d. Person(s) injured and type of injury sustained
   e. Name of substance spilled/released
   f. Approximate amount of substance spilled/released
   g. Name of person who may be knowledgeable concerning the room's contents or the substance released

NOTE: The University Police will contact the University Spill Team.

3. Meet with the Emergency Response Personnel and the University Police Department at the front entrance to the building. Identify yourself.

NOTE: Only trained persons familiar with the substance spilled and who have proper training and proper personal protective equipment should consider cleaning up a spill.

Personal protective equipment (such as, but not limited to, goggles, Tyvek suits, respirators, gloves) **should be worn.** Material safety data sheets are either available in each laboratory, or from EHS at 42618, or from the University Police at **44911**. These material safety data sheets shall be used as the main source of information for evaluating the spilled substance.

For additional information or training concerning this procedure, please contact EHS at 42618.

EMERGENCY FIRE RESPONSE PROCEDURES

The primary concern in a fire is the prevention of personal injury. Proper response by individuals will assure the safety of others and minimize damage caused by fire and smoke. The following actions should be utilized when a fire is discovered or the fire alarm horn sounds.

VISIBLE SMOKE OR FIRE

1. Activate the fire alarm pull station and evacuate the building.

2. Do not use the elevators. Exit through a stairway that leads directly outside. Be familiar with at least two means of egress from your area.

3. Call the University Police at **44911** from a SAFE phone near an exit. Provide information.

A PORTABLE FIRE EXTINGUISHER SHOULD ONLY BE USED WHEN:

1. You have been trained to use a fire extinguisher.
2. The fire alarm has already been activated.
3. The fire is in the incipient stage and will not affect your personal safety.
4. The proper type of extinguisher is available.

SMELL OF SMOKE OR ODORS, BUT NO VISIBLE FIRE

1. Call the University Police Department at **44911**
    a. Describe the situation.
    b. Give location.
    c. Meet and identify yourself when personnel respond.

2. Notify your supervisor of the situation and actions that have been taken.

3. Be alert and suspicious of the area until response personnel arrive.

WHEN THE FIRE ALARM SOUNDS

1. Evacuate the building.

2. Do not use elevators. Exit through a stairway that leads directly outside.

FIRE EVACUATIONS OF PHYSICALLY DISABLED PERSONS:

Be aware of physically challenged individuals in your area. Upon an alarm of fire, a physically challenged person should exit into a stairway that leads directly to the outdoors (never an elevator). Immediately notify the

on-site fire department officials and/or UML Police of the location of the physically challenged person so proper evacuation by professionally trained safety personnel can be provided.

Note for dorm rooms with ADA fire department notification devices: When the fire alarm sounds, the physically challenged person can remain in the room, but must close the room door and activate the switch to notify the fire department of their location. The fire department will respond to the room and evacuate person if required.

RE-OCCUPANCY OF THE BUILDING:

The local Fire Department, University Environmental Health and Safety Department or University Police Department will advise when you may re-enter the building. Please stay in an area (outside the building) that will not interfere with fire response personnel.

FOR FURTHER INFORMATION OR CLARIFICATION OF THESE PROCEDURES, PLEASE CONTACT THE OFFICE OF ENVIRONMENT AND EMERGENCY MANAGEMENT AT 42618.

Bomb Alert Procedures

If any member of the University community receives a bomb threat, the person who receives the threat should notify the University Police immediately by calling extension **44911**. **Please do not call the Lowell Police or the Lowell Fire Department.** Call the University Police immediately, and they will take appropriate action, including notifying the appropriate authorities.

All bomb threats are evaluated by the University Police, Environmental Health and Safety, and public safety personnel via guidelines set forth by the United States Department of Treasury, Division of Alcohol, Tax and Fire Arms, Arson Bomb Squad Division.

Similarly, if a member of the University community discovers a suspicious object that appears threatening, do not handle or disturb that object. Call the University Police at extension **44911**; they will notify emergency response personnel and take appropriate action.

A bomb threat can be building-specific or generalized (no specific location given). In either type of bomb threat, the University Police and Environmental Health and Safety staff members, in consultation with other public safety agencies and with other officers of the University, will jointly decide the steps that should be taken to ensure public safety. From that time forward, all members of the University community are expected to respond promptly to the directions provided by the University Police.

Emergency Communications

Communicating important messages to our students and employees always presents a challenge. Whether it's due to the geographical layout of our campus, the busy schedules or the significant volume of email, key messages are sometimes lost.

UMASS Lowell has taken steps to address this matter by communicating with the University community (students, faculty, staff) when emergencies occur or there is a disruption to the classes or vital facility services, through an "Emergency Notification System (ENS)".

With our "Emergency Notification System", members of our University community can opt to receive emergency notifications (e.g. school closings and delays, power outages) from UML via email, text message and voicemail to home, office or mobile accounts.

Sign up today by going to https://uml.ecoporte.com/emergency/jsp/home/home.jsp.

Chapter 4

CHEMICAL HAZARD MANAGEMENT

The four most important principals important to follow in a lab when handling chemicals are the following:

1) Plan ahead.
2) Minimize exposure.
3) Do not underestimate risks.
4) Be prepared for accidents.

Here is an example on how to apply all four principals to your work in the lab.

You are in a new lab and you are asked to start a new experiment with two hazardous chemicals.

Step 1 – Plan ahead.

Before starting an experiment, determine the potential hazards. First, read the material safety data sheets (MSDSs) for the two chemicals. MSDSs provide information about precautions for protecting against hazards of the chemicals. MSDSs include useful information on physical, chemical, and toxicological properties along with information on transporting and disposing of the chemicals. Since MSDSs are the best general source of information, MSDSs should always be reviewed when conducting a hazard assessment for new experiments.

After consulting the MSDSs, write a standard operating procedure (SOP) regarding the new experiment. In the SOP, write detailed steps on how to conduct the procedure and include information on the hazards involved in the experiment. To verify that all hazards have been addressed, review the material safety data sheets for the two hazardous chemicals used in the experiment. Receive laboratory-specific training and review the written SOP with the Principal Investigator. (The SOP can be used as a training tool for all new employees to read before conducting the experiment.) If a lab worker has further concerns regarding his or her safety and health, these concerns can be addressed with the Principal Investigator, the CHO, and/or the EEM-EHS department before starting the experiment. Remember - take your time and plan ahead before conducting the actual experiment.

Step 2 – Minimize exposure.

What are the hazards of the two chemicals in this new experiment and how can you minimize exposure? If both chemicals are an inhalation hazard, all work must be done in a fume hood. The fume hood is an engineering control that, when used correctly, will prevent hazardous vapors from entering into your breathing zone. The best type of engineering control, however, is eliminating the hazard through substitution. Is there a non-hazardous chemical that can be used instead of the hazardous chemical for your experiment? If not, is there a less hazardous chemical that can be used to minimize the hazards? Other types of controls that must be in place, besides engineering controls, are administrative controls and personal protective equipment. In step 1, administrative controls were discussed. Examples of administrative controls are reading the material safety data sheets, reading

the SOP, and receiving laboratory-specific training. Although administrative and engineering controls are important to keep you safe in the lab, you still need to protect your skin and eyes by wearing proper personal protective equipment (PPE). Examples of proper PPE would be safety glasses or safety goggles, lab coat, and proper gloves. If a splash hazard exists, please wear safety goggles and protect your face by wearing a face shield over the safety goggles. If you are pipetting small quantities of a chemical and there is no splash hazard, safety glasses can be worn instead of safety goggles. For all chemicals, please make sure to wear proper gloves. You may go to an on-line glove compatibility chart to look up what type of glove would be bestyou're your work in this new experiment. Here are some links to on-line glove compatibility charts:

http://www.microflex.com/Products/~/media/Files/Literature/Microflex%20Chemical%20Resistance%20Guide.ashx

https://www.vwrsp.com/safety/pdf/2003-july_glove_selection.pdf

http://www.showabestglove.com/site/languageselection/?redirectpage=http:$$www.showabestglove.com$site$chemrest$default.aspx

http://www.ansellpro.com/specware/guide.asp

http://www.mapaglove.com/ChemicalSearch.cfm?id=1

http://www.polyco.co.uk/downloads/chemical_resistance_guide.pdf

http://training.mcrsafety.com/permeation/index.shtml

Remember – your safety comes first!

Step 3 – Do not underestimate risks.

Are the two chemicals you will be mixing together compatible? The Chemical Reactivity Worksheet is a quick and simple tool that was developed by the National Oceanic and Atmospheric Association (NOAA) that can be used to find out the dangers that could arise when mixing a chemical with other chemicals and/or materials. To prevent "unexpected" reactions such as heat generation which can cause pressurization in a container, first check the chemicals you are mixing on this worksheet before actually mixing them together. To learn more information about this free downloadable worksheet, please go to http://response.restoration.noaa.gov/book_shelf/1016_react.pdf.

As a rule, always treat a mixture of chemicals more toxic than its most toxic component.

Step 4 – Be prepared for accidents.

Where is the nearest emergency eyewash station and/or drench hose? Do you know where to go if you are exposed to one of these chemicals in order to be evaluated by a doctor? Make sure to always work with a buddy. Do not work alone in the laboratory. If a corrosive liquid gets in your eye, who is going to call 911 and make sure you receive help until the ambulance arrives? If you are temporarily blinded by the exposure of chemicals in your eyes, you do not want to be struggling to find the emergency eyewash station and campus phone. With a buddy on-site, you can receive the help you will need. If you received chemical contamination on your clothes from a corrosive or toxic

chemical, you will need to take the clothes off before rinsing down with a drench hose. Do you have an extra change of clothes located nearby the lab in case this happens? These are just a few examples of some scenarios that you may encounter. The lab is a hazardous work environment and you must be prepared for accidents before they occur.

One Hundred Most Commonly Found Explosive and Shock-Sensitive Materials

1.Acetylides of heavy metals

2.Aluminum ophorite explosive

3. Amatol

4. Ammonal

5. Ammonium nitrate

6. Ammonium perchlorate

7. Ammonium picrate

8. Ammonium salt lattice

9. Butyl tetryl

10. Calcium nitrate

11. Copper acetylide

12. Cyanuric triazide

13. Cyclotrimethylenetrinitramine

14. Cyclotetramethylenetetranitramine

15. Dinitroethyleneurea

16. Dinitroglycerine

17. Dinitrophenol

18. Dinitrophenolates

19. Dinitrophenyl hydrazine

20. Dinitoresorcinol

21. Dinitrotoluene

22. Dipicryl sulfone

23. Dipicrylamine

24. Erythritol tetranitrate

25. Fulminate or mercury

26. Fulminate of silver

27. Fulminating gold

28. Fulminating mercury

51. Mercury tartrate

52. Mononitrotoluene

53. Nitrated carbohydrate

54. Nitrated glucoside

55. Nitrated polyhydric alcohol

56. Nitrogen trichloride

57. Nitrogen tri-iodide

58. Nitroglycerine

59. Nitroglycerine

60. Nitroguanidine

61. Nitroguanidine

62. Nitroparaffins

63. Nitronium perchlorate

64. Nitrourea

65. Organic amine nitrates

66. Organic nitramines

67. Organic peroxides

68. Picramic acid

69. Picramide

70. Picratol

71. Picric acid

72. Picryl chloride

73. Picryl fluoride

74. Polynitro aliphatic compounds

75. Potassium nitroaminotetrazole

76. Silver acetylide

77. Silver azide

78. Silver styphnate

29. Fulminating platinum

30. Fulminating silver

31. Gelatinized nitrocellulose

32. Guanyl nitrosamino guanyl tetrazene

33. Guanyl nitrosamino guanylidene hydrazine

34. Heavy metal azides

35. Hexanite

36. Hexanitrodiphenylamine

37. Hexanitrostilbene

38. Hexagen

39. Hydrazinium nitrate

40. Hydrozoic acid

41. Lead azide

42. Lead mannite

43. Lead mononitroresorcinate

44. Lead picrate

45. Lead salts

46. Lead styohnate

47. Trimethylolethane

48. Magnesium ophorite

49. Mannitol hexanitrate

50. Mercury oxalate

79. Silver tetrazene

80. Sodatol

81. Sodium amatol

82. Sodium dinitro-ortho-cresolate

83. Sodium nitrate-potassium nitrate explosive mixture

84. Sodium picramate

85. Syphnic acid

86. Tetrazene

87. Tetranitrocarbazole

88. Tetrytol

89. Trimonite

90. Trinitroanisole

91. Trinitrobenzene

92. Trinitrobenzoic acid

93. Trinitrocresol

94. Trinitro-meta-cresole

95. Trinitronaphthalene

96. Trinitrophenetol

97. Trinitrophloroglucinol

98. Trinitroresorcinol

99. Tritonal

100. Urea nitrate

Peroxidizable Compounds

A peroxide is a chemical that contains a peroxo (O-O) unit and has the chemical formula of O_2^{2-}. Peroxide-forming chemicals have the ability to form shock-sensitive explosive peroxide crystals. Diethyl ether and tetrahydrofuran are two of the more common peroxide-forming chemicals used in laboratories. If peroxidizable compounds are located in your laboratory, it is important that a standard operating procedure is written regarding the identification, handling, storage, and disposal of these chemicals. Laboratory-specific training must be conducted and documented before laboratory workers are allowed to handle these compounds.

Under normal storage conditions, the materials listed on the next page have the potential to generate and accumulate peroxide crystal formations. These crystal formations may violently detonate when subjected to heat, light, exposure to air, moisture, and mechanical shock.

NOTE: Peroxide crystals may form on the container cap or on the threads of the lid and could detonate when the lid is opened. Do not open a liquid organic peroxide or peroxide-forming chemical if crystals or a precipitate are present. Instead, call EEM-EHS immediately at 42543.

Remember to write the date of receipt and date of opening on each container of peroxidizable compounds and be cognizant of the shelf life of the container. Also, for routine control of ethers such as diethyl ether, tetrahydrofuran and dioxane, please use a peroxide test. The peroxide test detects inorganic and organic compunds which contain a peroxide or hydroperoxide group. These peroxide tests can be ordered from Lab Safety by calling 1-800-240-6373. The product number for the EMQUANT peroxide test is 27173.

Examples of Peroxidizable Compounds

The following materials should be discarded after three months due to peroxide hazards on storage;

Divinyl acetylene
Divinyl ether
Isopropyl ether
Potassium amide
Potassium metal
Sodium amide
Vinylidene chloride

The following materials should be discarded after one year due to peroxide hazard on concentration:

Acetal
Cumene
Cyclohexene
Cyclooxyene
Cyclopentene
Diacetylene
Dicyclopentadiene
Diethyl ether
Diethylene glycol dimethyl ether (diglyme)
Dioxane
Ethylene glycol dimethyl ether (glyme)
Furan
Methyl acetylene
Methylcyclopentane
Methyl isobutyl ketone
Tetrahydronaphtalene (Tetralin)
Tetrahydrofuran
Vinyl ethers

The following materials should be discarded after one year due to peroxide initiation of polymerization:

Acrolein
Acrylic acid
Acrylonitrile
Butadiene
Chloroprene
Chlorotrifluoroethylene
Methyl methacrylate
Styrene
Tetrafluoroethylene
Vinyl acetylene
Vinyl acetate
Vinyl chloride
Vinyl pyridine

Although most of the above listed materials are sold with inhibitors, some materials such as ethyl ether and tetrahydrofuran are sold without inhibitors. These materials should be tested and you may want to discard the peroxides that are not sold with inhibitors after six months, depending on how the

materials are stored. (Best management practices for all peroxide formers is to store them in a cool, dark place such as a flammable storage refrigerator.)

Peroxide test strips, which change color to indicate the presence of peroxides, may be purchased through most laboratory reagent distributors. Laboratory workers can monitor for the presence of peroxides once the container is opened, upon each use, or monthly. If there is any suspicion that peroxides are present, do not open the container or otherwise disturb the contents. Call EEM-EHS at 42543 for disposal.

Chapter 5

HAZARDOUS WASTE MANAGEMENT

Federal and state law regulates storage, labeling, packaging and disposal of hazardous waste. Each generator of hazardous waste at UMASS Lowell is responsible for the proper management of their wastes.

The Resource Conservation & Recovery Act (RCRA) was enacted by Congress in 1976 to protect human health and the environment. RCRA allows the Environmental Protection Agency (EPA) to promulgate rules governing the control of hazardous waste from the point of generation through disposal. The specific requirements are identified in Title 40 Code of Federal Regulations, Parts 100-399 (http://www.gpoaccess.gov/cfr/index.html) and the Secretary of State's Code of Massachusetts Regulations - 310 CMR 30 (http://www.mass.gov/dep/service/regulations/310cmr30.pdf).

The Office of Environmental and Emergency Management (EEM) assists the University community in maintaining compliance with regulations pertaining to waste management and disposal. Specific services include:

- Technical advice on identification and labeling of hazardous waste
- Weekly inspection checks of all satellite accumulation areas
- Collection of hazardous waste
- Emergency response to accidental spills of chemicals
- Laboratory cleanouts of chemical waste
- Technical advice and training on emergency response to chemical spills
- Waste disposal supplies
- Battery recycling
- Pollution prevention/waste minimization

All hazardous waste at UMASS Lowell is stored in a designated area in the lab labeled as the satellite accumulation area. These satellite accumulation areas are inspected weekly (typically every Wednesday) by EEM-EHS. Full and/or dated containers of hazardous waste are picked up by EEM-EHS during the weekly inspection checks and upon request by calling 42543. Remember, the container must be picked up within 3 days after the container is full or dated; therefore, it is important to call 42543 for a pick-up if your full container of waste is generated on Thursday, Friday, or Saturday. If you generate a full container of hazardous waste on Monday or Tuesday, there is no need to call it in since it will automatically be picked up on Wednesdays. Once picked up by EEM, the hazardous waste is moved to one of the main hazardous waste storage areas. Currently, UMASS Lowell's chemical waste disposal charges are paid through EEM.

SATTELITE ACCUMULATION AREA IN YOUR LAB

TRAINING REVIEW FORM

Please review the following requirements to ensure that you comply with environmental regulations and safe handling procedures.

Training:

Training for handling, labeling and storing hazardous waste is given during the annual laboratory safety training. **Training must take place before working in the laboratory and annually thereafter.** (Note: Documentation of EHS' laboratory safety training must be kept in section 8 of the Chemical Hygiene Plan Notebook.)

Container Labeling:

All hazardous waste containers must be labeled at the time that the waste is first placed into the container. Labels must include the following information:

1) The words "Hazardous Waste"

2) The chemical name of the contents (e.g. Toluene)

3) The associated hazards of the waste (e.g. Flammable)

4) The date that the container becomes full.

Container Closure:

Hazardous waste containers must be closed at all times during storage, except when waste is being added or removed OR a reaction is occurring inside the container. Please place the cap loosely on the container until the reaction is complete.

Storage:

For safety and environmental reasons, hazardous waste must be stored in a designated "Satellite Waste Accumulation Area" (e.g. lab hood). These areas must be inspected weekly for container leakage. **Containers must be removed from the satellite storage area within *three days* after waste container becomes filled**. Make sure the hazardous waste is properly labeled and closed with lid.

Containers that are partially filled may remain in a "Satellite Waste Accumulated Area" indefinitely.

To arrange for a Pick-Up. Call:

The EHS Chemical Receiving Stockroom at 42543.

Satellite Accumulation Area Regulations For MA Small Quantity Generators

1. Area must be under the control of the **individual directly responsible for the** process that generates the waste. (310 CMR 30.351 (4)(b))

2. **Satellite** area must be at or near each **specific point** of generation where wastes initially accumulate. (310 CMR 30.351(4)).

3. The wastes must be generated as a result of a process occurring at the specific point of generation where the wastes are initially accumulated. (310 CMR 30.351 (4) (a)).

4. Only one container per waste stream may be in use at any one time. (310 CMR 30.351 (4)(c)).

5. Maximum capacity of containers is as follows: 55 gallons of hazardous waste and/or 1 quart of acutely hazardous waste. (310 CMR 30.351 (4)(c)(1,2))

6. When a container is full, it shall be dated immediately and within 3 days, moved to the main storage area and come into compliance with all regulations pertaining to that area. (310 CMR 30.351 (4)(d))

7. The surface underlying the containers shall be free of cracks, gaps and sufficiently impervious to contain leaks. (310 CMR 30.340 (1)(f))

8. Each container shall be marked with the following:
    1. The words “Hazardous Waste”
    2. The chemical names (e.g. acetone, toluene)
    3. The hazard associated with those chemicals (e.g., ignitable, toxic) (310 CMR 30.682)

9. Containers must be in good condition. (Free of rust and/or structural damage).

10. Container must be compatible with waste inside. (310 CMR 30.684)

11. Container must be closed during storage. (310 CMR 30.685(1))

12. Containers must not be handled in a manner, which may cause it to rupture or cause it to leak. (310 CMR 30.685(2))

13. Containers must be spaced so they can be inspected. (310 CMR 30.685(4))

14. The satellite area must be inspected weekly. (310 CMR 30.686)

NOTE: To assume compliance with the wastewater discharge license from the City of Lowell, no hazardous waste may be poured down the drain. To determine whether or not your waste is hazardous, please fill out a non-hazardous waste determination form. (A copy of this form is located below.) If the waste is determined to be non-hazardous, the form will be signed by EEM-EHS and submitted to the Principal Investigator.

The Office of Environmental and Emergency Management (EEM)

Environmental Health and Safety (EHS)

Non-Hazardous Waste Determination Form

Date:_____

Building: _____ Room Number: _____

P.I/Faculty/Staff _____ Faculty Signature: _____

The University is NOT PERMITTED to release ANY hazardous material to the municipal waste water treatment facility. Prior to the release of any waste to the municipal waste water system, the EHS office MUST determine that a waste by-product is non-hazardous.

Fill out the following information for each by-product/waste-stream being considered for a Non-Hazardous Waste Determination.

Step A

Are there any types of solvents used in the process? ___Yes ___ No

Is the pH below 6.0 or above 9.5? ___Yes ___ No

Does the waste product contain any of these metals: As, Al, Cd, Cr, Cu, Pb, Hg, Ni, Ag, Zn)?___Yes ___ No

Is the metal concentration present in the above-mentioned waste product **above** the limits shown

below in Figure 1? ___Yes ___ No

Figure 1 Lowell Utility Local Discharge Limitations (mg/l)

As	0.556	Cu	3.124
Al	24.693	Pb	0.857
Ag	0.053	Hg	0.004
Cd	0.056	Ni	1.541
Cr	8.108	Zn	4.959

Does the waste product contain phenols or other odor-producing substances? ___Yes ___ No

Does the waste product contain any radioactive materials? ___Yes ___ No

Is the waste product a sludge, slurry or solid? ___Yes ___ No

If you answered yes to any of the above questions, label and dispose of the waste as a hazardous waste product.

If you answered no, continue with Step B.

Step B

What is the anticipated volume of liquid generated per week or month? _____

List **ALL** chemicals contained in the waste by-product. **Do not use trade names or chemical formulas. Attach additional sheets if necessary.**

Name of Waste Product	Chemical Components of the waste product (see MSDS for more information regarding chemical components)	% of chemical component in the waste product

Please submit this form to the Office of Environmental Health and Safety (EHS). If there are any questions, please contact EHS at 42618.

EHS Determination:

Environmental and Emergency Management (EEM)

Environmental Health and Safety (EHS)

HAZARDOUS WASTE SATELLITE ACCUMULATION AREA CHECKLIST

Building and room number: _____

Date (weekly)	Containers Labeled	Secured & Closed	Containers in Good Condition	Containers are not full	Incompatibles Separated	Initial	Print Last Name

Notes:

- Hazardous waste should be stored in compatible DOT containers.
- Hazardous waste should be stored on an impervious surface and in secondary containment.
- No more than 55 gallons of each type of hazardous waste should be presented at each Satellite Accumulation Area.

When a container is full, it should be moved by EEM to a hazardous waste storage area within 72 hours (3 days).

UMASS Lowell
EEM-EHS

Proper Waste Management of Solvent Contaminated Wipes and Gloves

Solvent contaminated wipes, gloves, and other solvent contaminated materials are often generated during equipment cleaning and maintenance activities conducted in research laboratories, facilities and clinical settings. Wipes and gloves that have been in contact with certain listed chemicals and solvents are considered hazardous waste and must be managed appropriately.
The purpose of this document is to establish basic criteria to help determine whether your solvent wipes and gloves are regulated as hazardous waste. If you need help in making this determination, please contact the EEM-EHS office at 42543.

What cannot be disposed in normal trash and must be collected by EEM-EHS for proper disposal:

- Wipes and gloves that have been in contact with any of the following F-listed solvents or chemicals :

Halogenated Solvents

Tetrachloroethylene	Chlorobenzene
Trichloroethylene	1,1,2-trichloro-1,2,2-trifluoroethane
Methylene Chloride	Ortho-dichlorobenzene
1,1,1-trichloroethane	Trichlorofluoromethane
Carbon Tetrachloride	1,1,2-trichloroethane
Chlorinated Fluorocarbons	

Non-Halogenated Solvents

Xylene	Nitrobenzene
Acetone	Toluene
Ethyl Acetate	Methyl Ethyl Ketone
Ethyl Benzene	Carbon Disulfide
Ethyl Ether	Isobutanol
Methyl Isobutyl Ketone	Pyridine
n-Butyl Alcohol	Benzene
Cyclohexanone	2-ethoxyethanol
Methanol	2-nitropropane
Cresols & Cresylic Acid	

- Wipes and gloves that have been in contact with an ignitable or toxic solvent (other than F-listed) where the solvent has not been consumed in the process

- Wipes and gloves containing free liquid that cannot be drain disposed

- Wipes and gloves contaminated with heavy metals

- Wipes and gloves used to clean up a spilled "P" or "U" listed commercial chemical product (see following pages for list of P and U listed commercial chemicals.)

- Wipes and gloves contaminated with PCBs

- Wipes and gloves used to clean up a spill of hazardous waste

What can be disposed in normal trash:
Wipes and gloves that have been in contact with a solvent (other than listed above) where the solvent has been consumed during use may be discarded in a receptacle as normal trash. Examples include ethanol or isopropyl alcohol wipes where the ethanol or isopropyl alcohol has been consumed during use and the wipe is dry at the time of disposal.

Code	Chemical
P026	1-(o-Chlorophenyl)thiourea
P081	1,2,3-Propanetriol, trinitrate (R)
P042	1,2-Benzenediol, 4-[1-hydroxy-2-(methylamino)ethyl]-, (R)-
P067	1,2-Propylenimine
P185	1,3-Dithiolane-2-carboxaldehyde, 2,4-dimethyl-, O- [(methylamino)- carbonyl]oxime
P004	1,4,5,8-Dimethanonaphthalene, 1,2,3,4,10,10-hexa- chloro-1,4,4a,5,8,8a,-hexahydro-, (1alpha,4alpha, 4abeta,5alpha,8alpha,8abeta)-
P060	1,4,5,8-Dimethanonaphthalene, 1,2,3,4,10,10-hexa- chloro-1,4,4a,5,8,8a-hexahydro-, (1alpha,4alpha, 4abeta,5beta,8beta,8abeta)-
P002	1-Acetyl-2-thiourea
P048	2,4-Dinitrophenol
P051	2,7:3,6-Dimethanonaphth [2,3-b]oxirene, 3,4,5,6,9,9 -hexachloro- 1a,2,2a,3,6,6a,7,7aoctahydro-, (1aalpha,2beta,2abeta,3alpha,6alpha,6abeta,7 beta, 7aalpha)-, & metabolites
P037	2,7:3,6-Dimethanonaphth[2,3-b]oxirene, 3,4,5,6,9,9- hexachloro- 1a,2,2a,3,6,6a,7,7aoctahydro-, (1aalpha,2beta,2aalpha,3beta,6beta,6aalpha,7 beta, 7aalpha)-
P045	2-Butanone, 3,3-dimethyl-1-(methylthio)-, O-[methylamino)carbonyl] oxime
P034	2-Cyclohexyl-4,6-dinitrophenol
P001	2H-1-Benzopyran-2-one, 4-hydroxy-3-(3-oxo-1- phenylbutyl)-, & salts, when present at concentrations greater than 0.3%
P069	2-Methyllactonitrile
P017	2-Propanone, 1-bromo-
P005	2-Propen-1-ol
P003	2-Propenal
P102	2-Propyn-1-ol
P007	3(2H)-Isoxazolone, 5-(aminomethyl)-
P027	3-Chloropropionitrile
P047	4,6-Dinitro-o-cresol, & salts
P059	4,7-Methano-1H-indene, 1,4,5,6,7,8,8-heptachloro- 3a,4,7,7a-tetrahydro-
P008	4-Aminopyridine
P008	4-Pyridinamine
P007	5-(Aminomethyl)-3-isoxazolol
P050	6,9-Methano-2,4,3-benzodioxathiepin, 6,7,8,9,10,10- hexachloro-1,5,5a,6,9,9a-hexahydro-, 3-oxide
P127	7-Benzofuranol, 2,3-dihydro-2,2-dimethyl-, methylcarbamate
P088	7-Oxabicyclo[2.2.1]heptane-2,3-dicarboxylic acid
P023	Acetaldehyde, chloro-
P057	Acetamide, 2-fluoro-
P002	Acetamide, N-(aminothioxomethyl)-
P058	Acetic acid, fluoro-, sodium salt
P003	Acrolein
P070	Aldicarb
P203	Aldicarb sulfone
P004	Aldrin
P005	Allyl alcohol
P046	alpha,alpha-Dimethylphenethylamine
P072	alpha-Naphthylthiourea
P006	Aluminum phosphide (R,T)
P009	Ammonium picrate (R)
P119	Ammonium vanadate
P099	Argentate(1-), bis(cyano-C)-, potassium
P010	Arsenic acid H3AsO4
P012	Arsenic oxide As2O3

P011	Arsenic oxide As2O5
P011	Arsenic pentoxide
P012	Arsenic trioxide
P038	Arsine, diethyl-
P036	Arsonous dichloride, phenyl-
P054	Aziridine
P067	Aziridine, 2-methyl-
P013	Barium cyanide
P024	Benzenamine, 4-chloro-
P077	Benzenamine, 4-nitro-
P028	Benzene, (chloromethyl)-
P046	Benzeneethanamine, alpha,alpha-dimethyl-
P014	Benzenethiol
P188	Benzoic acid, 2-hydroxy-, compd with (3aS-cis)- 1,2,3,3a,8,8a-hexahydro-1,3a,8-trimethylpyrrolo [2,3-b]indol-5-yl methylcarbamate ester (1:1)
P028	Benzyl chloride
P015	Beryllium powder
P017	Bromoacetone
P018	Brucine
P021	Calcium cyanide Ca(CN)2
P189	Carbamic acid, [(dibutylamino)- thio]methyl-, 2,3-dihydro-2,2-dimethyl- 7-benzofuranyl ester
P191	Carbamic acid, dimethyl-, 1-[(dimethyl-amino) carbonyl]- 5-methyl-1H- pyrazol-3-yl ester
P192	Carbamic acid, dimethyl-, 3-methyl-1- (1-methylethyl)- 1H-pyrazol-5-yl ester
P190	Carbamic acid, methyl-, 3-methylphenyl ester
P127	Carbofuran
P022	Carbon disulfide
P095	Carbonic dichloride
P189	Carbosulfan
P023	Chloroacetaldehyde
P029	Copper cyanide
P029	Copper cyanide Cu(CN)
P030	Cyanides (soluble cyanide salts), not otherwise specified
P031	Cyanogen
P033	Cyanogen chloride
P033	Cyanogen chloride (CN)Cl
P016	Dichloromethyl ether
P036	Dichlorophenylarsine
P037	Dieldrin
P038	Diethylarsine
P041	Diethyl-p-nitrophenyl phosphate
P043	Diisopropylfluorophosphate (DFP)
P044	Dimethoate
P191	Dimetilan
P020	Dinoseb
P085	Diphosphoramide, octamethyl-
P111	Diphosphoric acid, tetraethyl ester
P039	Disulfoton
P049	Dithiobiuret
P050	Endosulfan
P088	Endothall
P051	Endrin
P051	Endrin, & metabolites
P042	Epinephrine
P031	Ethanedinitrile

P194	Ethanimidothioc acid, 2-(dimethylamino)-N- [[(methylamino)carbonyl]oxy]-2-oxo-, methyl ester
P066	Ethanimidothioic acid, N-[[(methylamino)carbonyl]oxy]-, methyl ester
P101	Ethyl cyanide
P054	Ethyleneimine
P097	Famphur
P056	Fluorine
P057	Fluoroacetamide
P058	Fluoroacetic acid, sodium salt
P198	Formetanate hydrochloride
P197	Formparanate
P065	Fulminic acid, mercury(2+) salt (R,T)
P059	Heptachlor
P062	Hexaethyl tetraphosphate
P068	Hydrazine, methyl-
P116	Hydrazinecarbothioamide
P063	Hydrocyanic acid
P063	Hydrogen cyanide
P096	Hydrogen phosphide
P060	Isodrin
P192	Isolan
P196	Manganese dimethyldithiocarbamate
P196	Manganese, bis(dimethylcarbamodithioato-S,S')-,
P202	m-Cumenyl methylcarbamate
P065	Mercury fulminate (R,T)
P092	Mercury, (acetato-O)phenyl-
P082	Methanamine, N-methyl-N-nitroso-
P064	Methane, isocyanato-
P016	Methane, oxybis[chloro-
P112	Methane, tetranitro- (R)
P118	Methanethiol, trichloro-
P198	Methanimidamide, N,N-dimethyl-N'-[2-methyl-4- [[(methylamino) carbonyl]oxy]phenyl]-
P199	Methiocarb
P066	Methomyl
P068	Methyl hydrazine
P064	Methyl isocyanate
P071	Methyl parathion
P190	Metolcarb
P128	Mexacarbate
P073	Nickel carbonyl
P073	Nickel carbonyl Ni(CO)4, (T-4)-
P074	Nickel cyanide
P074	Nickel cynaide Ni(CN)2
P075	Nicotine, & salts
P076	Nitric oxide
P078	Nitrogen dioxide
P076	Nitrogen oxide NO
P078	Nitrogen oxide NO2
P081	Nitroglycerine (R)
P082	N-Nitrosodimethylamine
P084	N-Nitrosomethylvinylamine
P040	O,O-Diethyl O-pyrazinyl phosphorothioate
P085	Octamethylpyrophosphoramide
P087	Osmium oxide OsO4, (T-4)-
P087	Osmium tetroxide

P194	Oxamyl
P089	Parathion
P024	p-Chloroaniline
P199	Phenol, (3,5-dimethyl-4-(methylthio)-, methylcarbamate
P020	Phenol, 2-(1-methylpropyl)-4,6-dinitro-
P009	Phenol, 2,4,6-trinitro-, ammonium salt (R)
P048	Phenol, 2,4-dinitro-
P034	Phenol, 2-cyclohexyl-4,6-dinitro-
P047	Phenol, 2-methyl-4,6-dinitro-, & salts
P202	Phenol, 3-(1-methylethyl)-, methyl carbamate
P201	Phenol, 3-methyl-5-(1-methylethyl)-, methyl carbamate
P128	Phenol, 4-(dimethylamino)-3,5-dimethyl-, methylcarbamate (ester)
P092	Phenylmercury acetate
P093	Phenylthiourea
P094	Phorate
P095	Phosgene
P096	Phosphine
P041	Phosphoric acid, diethyl 4-nitrophenyl ester
P094	Phosphorodithioic acid, O,O-diethyl S-[(ethylthio)methyl] ester
P039	Phosphorodithioic acid, O,O-diethyl S-[2-(ethylthio)ethyl] ester
P044	Phosphorodithioic acid, O,O-dimethyl S-[2- (methylamino)-2-oxoethyl] ester
P043	Phosphorofluoridic acid, bis(1-methylethyl) ester
P071	Phosphorothioic acid, O,O,-dimethyl O-(4- nitrophenyl) ester
P089	Phosphorothioic acid, O,O-diethyl O-(4-nitrophenyl) ester
P040	Phosphorothioic acid, O,O-diethyl O-pyrazinyl ester 3
P097	Phosphorothioic acid, O-[4-[(dimethylamino)sulfonyl]phenyl] O,O-dimethyl ester
P204	Physostigmine
P188	Physostigmine salicylate
P110	Plumbane, tetraethyl-
P077	p-Nitroaniline
P098	Potassium cyanide
P098	Potassium cyanide K(CN)
P099	Potassium silver cyanide
P201	Promecarb
P203	Propanal, 2-methyl-2-(methyl-sulfonyl)-, O-[(methylamino)carbonyl] oxime
P070	Propanal, 2-methyl-2-(methylthio)-, O-[(methylamino)carbonyl]oxime
P101	Propanenitrile
P069	Propanenitrile, 2-hydroxy-2-methyl-
P027	Propanenitrile, 3-chloro-
P102	Propargyl alcohol
P075	Pyridine, 3-(1-methyl-2-pyrrolidinyl)-, (S)-, & salts
P204	Pyrrolo[2,3-b]indol-5-ol, 1,2,3,3a,8,8a-hexahydro- 1,3a,8-trimethyl-, methylcarbamate (ester), (3aS-cis)-
P114	Selenious acid, dithallium(1+) salt
P103	Selenourea
P104	Silver cyanide
P104	Silver cyanide Ag(CN)
P105	Sodium azide
P106	Sodium cyanide
P106	Sodium cyanide Na(CN)
P108	Strychnidin-10-one, & salts
P018	Strychnidin-10-one, 2,3-dimethoxy-
P108	Strychnine, & salts
P115	Sulfuric acid, dithallium(1+) salt
P110	Tetraethyl lead

P111	Tetraethyl pyrophosphate
P109	Tetraethyldithiopyrophosphate
P112	Tetranitromethane (R)
P062	Tetraphosphoric acid, hexaethyl ester
P113	Thallic oxide
P113	Thallium oxide Tl2O3
P114	Thallium(I) selenite
P115	Thallium(I) sulfate
P109	Thiodiphosphoric acid, tetraethyl ester
P045	Thiofanox
P049	Thioimidodicarbonic diamide [(H2N)C(S)]2NH
P014	Thiophenol
P116	Thiosemicarbazide
P026	Thiourea, (2-chlorophenyl)-
P072	Thiourea, 1-naphthalenyl-
P093	Thiourea, phenyl-
P185	Tirpate
P123	Toxaphene
P118	Trichloromethanethiol
P119	Vanadic acid, ammonium salt
P120	Vanadium oxide V2O5
P120	Vanadium pentoxide
P084	Vinylamine, N-methyl-N-nitroso-
P001	Warfarin, & salts, when present at concentrations greater than 0.3%
P121	Zinc cyanide
P121	Zinc cyanide Zn(CN)2
P122	Zinc phosphide Zn3P2, when present at concentrations greater than 10% (R,T)
P205	Zinc, bis(dimethylcarbamodithioato-S,S')-,
P205	Ziram

Code	Chemical
U021	1,1'-Biphenyl]-4,4'-diamine
U073	[1,1'-Biphenyl]-4,4'-diamine, 3,3'-dichloro-
U091	[1,1'-Biphenyl]-4,4'-diamine, 3,3'-dimethoxy-
U095	[1,1'-Biphenyl]-4,4'-diamine, 3,3'-dimethyl-
U208	1,1,1,2-Tetrachloroethane
U209	1,1,2,2-Tetrachloroethane
U227	1,1,2-Trichloroethane
U078	1,1-Dichloroethylene
U098	1,1-Dimethylhydrazine
U207	1,2,4,5-Tetrachlorobenzene
U085	1,2:3,4-Diepoxybutane (I,T)
U028	1,2-Benzenedicarboxylic acid, bis(2-ethylhexyl) ester
U069	1,2-Benzenedicarboxylic acid, dibutyl ester
U088	1,2-Benzenedicarboxylic acid, diethyl ester
U102	1,2-Benzenedicarboxylic acid, dimethyl ester
U107	1,2-Benzenedicarboxylic acid, dioctyl ester
U202	1,2-Benzisothiazol-3(2H)-one, 1,1-dioxide, & salts
U066	1,2-Dibromo-3-chloropropane
U079	1,2-Dichloroethylene
U099	1,2-Dimethylhydrazine
U109	1,2-Diphenylhydrazine
U155	1,2-Ethanediamine, N,N-dimethyl-N'-2-pyridinyl-N'- (2-thienylmethyl)-
U193	1,2-Oxathiolane, 2,2-dioxide
U142	1,3,4-Metheno-2H-cyclobuta[cd]pentalen-2- one, 1,1a, 3,3a,4,5,5,5a,5b,6-decachlorooctahydro-
U234	1,3,5-Trinitrobenzene (R,T)
U182	1,3,5-Trioxane, 2,4,6-trimethyl-
U201	1,3-Benzenediol
U364	1,3-Benzodioxol-4-ol, 2,2-dimethyl-,
U278	1,3-Benzodioxol-4-ol, 2,2-dimethyl-, methyl carbamate.
U141	1,3-Benzodioxole, 5-(1-propenyl)-
U203	1,3-Benzodioxole, 5-(2-propenyl)-
U090	1,3-Benzodioxole, 5-propyl-
U128	1,3-Butadiene, 1,1,2,3,4,4-hexachloro-
U130	1,3-Cyclopentadiene, 1,2,3,4,5,5-hexachloro-
U084	1,3-Dichloropropene
U190	1,3-Isobenzofurandione
U186	1,3-Pentadiene (I)
U193	1,3-Propane sultone
U074	1,4-Dichloro-2-butene (I,T)
U108	1,4-Diethyleneoxide
U108	1,4-Dioxane
U166	1,4-Naphthalenedione
U166	1,4-Naphthoquinone
U172	1-Butanamine, N-butyl-N-nitroso-
U031	1-Butanol (I)
U011	1H-1,2,4-Triazol-3-amine
U186	1-Methylbutadiene (I)
U167	1-Naphthalenamine
U279	1-Naphthalenol, methylcarbamate.
U194	1-Propanamine (I,T)
U111	1-Propanamine, N-nitroso-N-propyl-
U110	1-Propanamine, N-propyl- (I)

U235	1-Propanol, 2,3-dibromo-, phosphate (3:1)
U140	1-Propanol, 2-methyl- (I,T)
U243	1-Propene, 1,1,2,3,3,3-hexachloro-
U084	1-Propene, 1,3-dichloro-
U085	2,2'-Bioxirane
U237	2,4-(1H,3H)-Pyrimidinedione, 5-[bis(2- chloroethyl)amino]-
U240	2,4-D, salts & esters
U081	2,4-Dichlorophenol
U101	2,4-Dimethylphenol
U105	2,4-Dinitrotoluene
U197	2,5-Cyclohexadiene-1,4-dione
U147	2,5-Furandione
U082	2,6-Dichlorophenol
U106	2,6-Dinitrotoluene
U236	2,7-Naphthalenedisulfonic acid, 3,3'-[(3,3'- dimethyl[1,1'-biphenyl]-4,4'-diyl)bis(azo)bis[5-amino-4-hydroxy]-, tetrasodium salt
U005	2-Acetylaminofluorene
U159	2-Butanone (I,T)
U160	2-Butanone, peroxide (R,T)
U053	2-Butenal
U074	2-Butene, 1,4-dichloro- (I,T)
U143	2-Butenoic acid, 2-methyl-, 7-[[2,3-dihydroxy- 2-(1-methoxyethyl)-3-methyl-1-oxobutoxy]methyl]- 2,3,5,7a-tetrahydro-1H-pyrrolizin-1-yl ester, [1S-[1alpha(Z),7(2S*,3R*),7aalpha]]-
U042	2-Chloroethyl vinyl ether
U125	2-Furancarboxaldehyde (I)
U058	2H-1,3,2-Oxazaphosphorin-2-amine, N,N-bis(2-chloroethyl)tetrahydro-, 2-oxide
U366	2H-1,3,5-Thiadiazine- 2-thione, tetrahydro-3,5- dimethyl-
U248	2H-1-Benzopyran-2-one, 4-hydroxy-3-(3-oxo-1-phenyl- butyl)-, & salts, when present at concentrations of 0.3% or less
U116	2-Imidazolidinethione
U168	2-Naphthalenamine
U171	2-Nitropropane (I,T)
U191	2-Picoline
U002	2-Propanone (I)
U007	2-Propenamide
U009	2-Propenenitrile
U152	2-Propenenitrile, 2-methyl- (I,T)
U008	2-Propenoic acid (I)
U118	2-Propenoic acid, 2-methyl-, ethyl ester
U162	2-Propenoic acid, 2-methyl-, methyl ester (I,T)
U113	2-Propenoic acid, ethyl ester (I)
U073	3,3'-Dichlorobenzidine
U091	3,3'-Dimethoxybenzidine
U095	3,3'-Dimethylbenzidine
U148	3,6-Pyridazinedione, 1,2-dihydro-
U375	3-Iodo-2-propynyl n-butylcarbamate.
U157	3-Methylcholanthrene
U164	4(1H)-Pyrimidinone, 2,3-dihydro-6-methyl-2-thioxo-
U158	4,4'-Methylenebis(2-chloroaniline)
U036	4,7-Methano-1H-indene, 1,2,4,5,6,7,8,8-octachloro-2, 3,3a,4,7,7a-hexahydro-
U030	4-Bromophenyl phenyl ether
U049	4-Chloro-o-toluidine, hydrochloride
U161	4-Methyl-2-pentanone (I)

U059	5,12-Naphthacenedione, 8-acetyl-10-[(3-amino-2,3,6- trideoxy)-alpha-L-lyxohexopyranosyl)oxy]-7, 8,9,10 -tetrahydro-6,8,11-trihydroxy-1-methoxy-, (8S-cis) -
U181	5-Nitro-o-toluidine
U094	7,12-Dimethylbenz[a]anthracene
U367	7-Benzofuranol, 2,3-dihydro-2,2-dimethyl-
U394	A2213.
U001	Acetaldehyde (I)
U034	Acetaldehyde, trichloro-
U187	Acetamide, N-(4-ethoxyphenyl)-
U005	Acetamide, N-9H-fluoren-2-yl-
U112	Acetic acid ethyl ester (I)
U240	Acetic acid, (2,4-dichlorophenoxy)-, salts & esters 3
U144	Acetic acid, lead(2+) salt
U214	Acetic acid, thallium(1+) salt
U002	Acetone (I)
U003	Acetonitrile (I,T)
U004	Acetophenone
U006	Acetyl chloride (C,R,T)
U007	Acrylamide
U008	Acrylic acid (I)
U009	Acrylonitrile
U096	alpha,alpha-Dimethylbenzylhydroperoxide (R)
U167	alpha-Naphthylamine
U011	Amitrole
U012	Aniline (I,T)
U136	Arsinic acid, dimethyl-
U014	Auramine
U015	Azaserine
U010	Azirino[2',3':3,4]pyrrolo[1,2-a]indole-4,7-dio ne, 6 -amino-8-[[(aminocarbonyl)oxy]methyl]-1,1a, 2,8,8a, 8b-hexahydro-8a-methoxy-5-methyl-, [1aS-(1aalpha, 8beta,8aalpha,8balpha)]-
U280	Barban.
U364	Bendiocarb phenol
U278	Bendiocarb.
U271	Benomyl.
U018	Benz[a]anthracene
U094	Benz[a]anthracene, 7,12-dimethyl-
U016	Benz[c]acridine
U157	Benz[j]aceanthrylene, 1,2-dihydro-3-methyl-
U017	Benzal chloride
U192	Benzamide, 3,5-dichloro-N-(1,1-dimethyl-2-propynyl) -
U012	Benzenamine (I,T)
U328	Benzenamine, 2-methyl-
U222	Benzenamine, 2-methyl-, hydrochloride
U181	Benzenamine, 2-methyl-5-nitro-
U014	Benzenamine, 4,4'-carbonimidoylbis[N,N-dimethyl-
U158	Benzenamine, 4,4'-methylenebis[2-chloro-
U049	Benzenamine, 4-chloro-2-methyl-, hydrochloride
U353	Benzenamine, 4-methyl-
U093	Benzenamine, N,N-dimethyl-4-(phenylazo)-
U019	Benzene (I,T)
U055	Benzene, (1-methylethyl)- (I)
U017	Benzene, (dichloromethyl)-
U023	Benzene, (trichloromethyl)-
U061	Benzene, 1,1'-(2,2,2-trichloroethylidene)bis[4- chloro-

U247	Benzene, 1,1'-(2,2,2-trichloroethylidene)bis[4- methoxy-
U060	Benzene, 1,1'-(2,2-dichloroethylidene)bis[4-chloro-
U207	Benzene, 1,2,4,5-tetrachloro-
U070	Benzene, 1,2-dichloro-
U234	Benzene, 1,3,5-trinitro-
U071	Benzene, 1,3-dichloro-
U223	Benzene, 1,3-diisocyanatomethyl- (R,T)
U072	Benzene, 1,4-dichloro-
U030	Benzene, 1-bromo-4-phenoxy-
U105	Benzene, 1-methyl-2,4-dinitro-
U106	Benzene, 2-methyl-1,3-dinitro-
U037	Benzene, chloro-
U239	Benzene, dimethyl- (I,T)
U127	Benzene, hexachloro-
U056	Benzene, hexahydro- (I)
U220	Benzene, methyl-
U169	Benzene, nitro-
U183	Benzene, pentachloro-
U185	Benzene, pentachloronitro-
U038	Benzeneacetic acid, 4-chloro-alpha-(4-chlorophenyl) -alpha-hydroxy-, ethyl ester
U035	Benzenebutanoic acid, 4-[bis(2-chloroethyl)amino]-
U221	Benzenediamine, ar-methyl-
U020	Benzenesulfonic acid chloride (C,R)
U020	Benzenesulfonyl chloride (C,R)
U021	Benzidine
U022	Benzo[a]pyrene
U064	Benzo[rst]pentaphene
U023	Benzotrichloride (C,R,T)
U047	beta-Chloronaphthalene
U168	beta-Naphthylamine
U401	Bis(dimethylthiocarbamoyl) sulfide.
U400	Bis(pentamethylene)thiuram tetrasulfide.
U225	Bromoform
U392	Butylate.
U136	Cacodylic acid
U032	Calcium chromate
U280	Carbamic acid, (3-chlorophenyl)-, 4-chloro-2- butynyl ester.
U409	Carbamic acid, [1,2-phenylenebis (iminocarbonothioyl)] bis-, dimethyl ester.
U271	Carbamic acid, [1-[(butylamino)carbonyl]-1H- benzimidazol-2-yl]-, methyl ester.
U372	Carbamic acid, 1H-benzimidazol-2-yl, methyl ester.
U375	Carbamic acid, butyl-, 3-iodo-2-propynyl ester.
U238	Carbamic acid, ethyl ester
U178	Carbamic acid, methylnitroso-, ethyl ester
U373	Carbamic acid, phenyl-, 1-methylethyl ester.
U097	Carbamic chloride, dimethyl-
U378	Carbamodithioic acid, (hydroxymethyl)methyl-, monopotassium salt.
U114	Carbamodithioic acid, 1,2-ethanediylbis-, salts & esters
U379	Carbamodithioic acid, dibutyl, sodium salt.
U277	Carbamodithioic acid, diethyl-, 2-chloro-2-propenyl ester.
U381	Carbamodithioic acid, diethyl-, sodium salt.
U383	Carbamodithioic acid, dimethyl, potassium salt.
U382	Carbamodithioic acid, dimethyl-, sodium salt.
U376	Carbamodithioic acid, dimethyl-, tetraanhydrosulfide with orthothioselenious acid.
U377	Carbamodithioic acid, methyl,- monopotassium salt.
U384	Carbamodithioic acid, methyl-, monosodium salt.

U062	Carbamothioic acid, bis(1-methylethyl)-, S-(2,3- dichloro-2-propenyl) ester
U389	Carbamothioic acid, bis(1-methylethyl)-, S-(2,3,3- trichloro-2-propenyl) ester.
U392	Carbamothioic acid, bis(2-methylpropyl)-, S-ethyl ester.
U391	Carbamothioic acid, butylethyl-, S-propyl ester.
U386	Carbamothioic acid, cyclohexylethyl-, S-ethyl ester.
U387	Carbamothioic acid, dipropyl-, S-(phenylmethyl) ester.
U390	Carbamothioic acid, dipropyl-, S-ethyl ester.
U385	Carbamothioic acid, dipropyl-, S-propyl ester.
U279	Carbaryl.
U372	Carbendazim.
U367	Carbofuran phenol.
U033	Carbon oxyfluoride (R,T)
U211	Carbon tetrachloride
U215	Carbonic acid, dithallium(1+) salt
U033	Carbonic difluoride
U156	Carbonochloridic acid, methyl ester (I,T)
U034	Chloral
U035	Chlorambucil
U036	Chlordane, alpha & gamma isomers
U026	Chlornaphazin
U037	Chlorobenzene
U038	Chlorobenzilate
U044	Chloroform
U046	Chloromethyl methyl ether
U032	Chromic acid H2CrO4, calcium salt
U050	Chrysene
U393	Copper dimethyldithiocarbamate.
U393	Copper, bis(dimethylcarbamodithioato-S,S')-,
U051	Creosote
U052	Cresol (Cresylic acid)
U053	Crotonaldehyde
U055	Cumene (I)
U246	Cyanogen bromide (CN)Br
U386	Cycloate.
U056	Cyclohexane (I)
U129	Cyclohexane, 1,2,3,4,5,6-hexachloro-, (1alpha,2alpha,3beta,4alpha,5alpha,6beta)-
U057	Cyclohexanone (I)
U058	Cyclophosphamide
U059	Daunomycin
U366	Dazomet.
U060	DDD
U061	DDT
U206	D-Glucose, 2-deoxy-2-[[(methylnitrosoamino)- carbonyl]amino]-
U062	Diallate
U063	Dibenz[a,h]anthracene
U064	Dibenzo[a,i]pyrene
U069	Dibutyl phthalate
U075	Dichlorodifluoromethane
U025	Dichloroethyl ether U027 Dichloroisopropyl ether
U024	Dichloromethoxy ethane
U088	Diethyl phthalate
U395	Diethylene glycol, dicarbamate.
U028	Diethylhexyl phthalate
U089	Diethylstilbesterol

U090	Dihydrosafrole
U102	Dimethyl phthalate
U103	Dimethyl sulfate
U092	Dimethylamine (I)
U097	Dimethylcarbamoyl chloride
U107	Di-n-octyl phthalate
U111	Di-n-propylnitrosamine
U110	Dipropylamine (I)
U403	Disulfiram.
U041	Epichlorohydrin
U390	EPTC.
U001	Ethanal (I)
U404	Ethanamine, N,N-diethyl-
U174	Ethanamine, N-ethyl-N-nitroso-
U208	Ethane, 1,1,1,2-tetrachloro-
U226	Ethane, 1,1,1-trichloro-
U209	Ethane, 1,1,2,2-tetrachloro-
U227	Ethane, 1,1,2-trichloro-
U024	Ethane, 1,1'-[methylenebis(oxy)]bis[2-chloro-
U076	Ethane, 1,1-dichloro-
U117	Ethane, 1,1'-oxybis-(I)
U025	Ethane, 1,1'-oxybis[2-chloro-
U067	Ethane, 1,2-dibromo-
U077	Ethane, 1,2-dichloro-
U131	Ethane, hexachloro-
U184	Ethane, pentachloro-
U218	Ethanethioamide
U394	Ethanimidothioic acid, 2-(dimethylamino)-N-hydroxy-2- oxo-, methyl ester.
U410	Ethanimidothioic acid, N,N'- [thiobis[(methylimino) carbonyloxy]]bis-, dimethyl ester
U173	Ethanol, 2,2'-(nitrosoimino)bis-
U395	Ethanol, 2,2'-oxybis-, dicarbamate.
U359	Ethanol, 2-ethoxy-
U004	Ethanone, 1-phenyl-
U042	Ethene, (2-chloroethoxy)-
U078	Ethene, 1,1-dichloro-
U079	Ethene, 1,2-dichloro-, (E)-
U043	Ethene, chloro-
U210	Ethene, tetrachloro-
U228	Ethene, trichloro-
U112	Ethyl acetate (I)
U113	Ethyl acrylate (I)
U238	Ethyl carbamate (urethane)
U117	Ethyl ether (I)
U118	Ethyl methacrylate
U119	Ethyl methanesulfonate
U407	Ethyl Ziram.
U067	Ethylene dibromide
U077	Ethylene dichloride
U359	Ethylene glycol monoethyl ether
U115	Ethylene oxide (I,T)
U114	Ethylenebisdithiocarbamic acid, salts & esters
U116	Ethylenethiourea
U076	Ethylidene dichloride
U396	Ferbam
U120	Fluoranthene

U122	Formaldehyde
U123	Formic acid (C,T)
U124	Furan (I)
U213	Furan, tetrahydro-(I)
U125	Furfural (I)
U124	Furfuran (I)
U206	Glucopyranose, 2-deoxy-2-(3-methyl-3-nitrosoureido) -, DU126
	Glycidylaldehyde
U163	Guanidine, N-methyl-N'-nitro-N-nitroso-
U365	H-Azepine-1-carbothioic acid, hexahydro-, S-ethyl ester.
U127	Hexachlorobenzene
U128	Hexachlorobutadiene
U130	Hexachlorocyclopentadiene
U131	Hexachloroethane
U132	Hexachlorophene
U243	Hexachloropropene
U133	Hydrazine (R,T)
U098	Hydrazine, 1,1-dimethyl-
U086	Hydrazine, 1,2-diethyl-
U099	Hydrazine, 1,2-dimethyl-
U109	Hydrazine, 1,2-diphenyl-
U134	Hydrofluoric acid (C,T)
U134	Hydrogen fluoride (C,T)
U135	Hydrogen sulfide
U135	Hydrogen sulfide H2S
U096	Hydroperoxide, 1-methyl-1-phenylethyl- (R)
U137	Indeno[1,2,3-cd]pyrene
U396	Iron, tris(dimethylcarbamodithioato-S,S')-,
U140	Isobutyl alcohol (I,T)
U141	Isosafrole
U142	Kepone
U143	Lasiocarpine
U144	Lead acetate
U145	Lead phosphate
U146	Lead subacetate
U146	Lead, bis(acetato-O)tetrahydroxytri-
U129	Lindane
U150	L-Phenylalanine, 4-[bis(2-chloroethyl)amino]-
U015	L-Serine, diazoacetate (ester)
U147	Maleic anhydride
U148	Maleic hydrazide
U149	Malononitrile
U071	m-Dichlorobenzene
U150	Melphalan
U151	Mercury
U384	Metam Sodium.
U152	Methacrylonitrile (I, T)
U092	Methanamine, N-methyl- (I)
U029	Methane, bromo-
U045	Methane, chloro- (I, T)
U046	Methane, chloromethoxy-
U068	Methane, dibromo-
U080	Methane, dichloro-
U075	Methane, dichlorodifluoro-
U138	Methane, iodo-

U211	Methane, tetrachloro-
U225	Methane, tribromo-
U044	Methane, trichloro-
U121	Methane, trichlorofluoro-
U119	Methanesulfonic acid, ethyl ester
U153	Methanethiol (I, T)
U154	Methanol (I)
U155	Methapyrilene
U247	Methoxychlor
U154	Methyl alcohol (I)
U029	Methyl bromide
U045	Methyl chloride (I,T)
U156	Methyl chlorocarbonate (I,T)
U226	Methyl chloroform
U159	Methyl ethyl ketone (MEK) (I,T)
U160	Methyl ethyl ketone peroxide (R,T)
U138	Methyl iodide
U161	Methyl isobutyl ketone (I)
U162	Methyl methacrylate (I,T)
U068	Methylene bromide
U080	Methylene chloride
U164	Methylthiouracil
U010	Mitomycin C
U163	MNNG
U365	Molinate.
U086	N,N'-Diethylhydrazine
U026	Naphthalenamine, N,N'-bis(2-chloroethyl)-
U165	Naphthalene
U047	Naphthalene, 2-chloro-
U031	n-Butyl alcohol (I)
U217	Nitric acid, thallium(1+) salt
U169	Nitrobenzene (I,T)
U173	N-Nitrosodiethanolamine
U174	N-Nitrosodiethylamine
U172	N-Nitrosodi-n-butylamine
U176	N-Nitroso-N-ethylurea
U177	N-Nitroso-N-methylurea
U178	N-Nitroso-N-methylurethane
U179	N-Nitrosopiperidine
U180	N-Nitrosopyrrolidine
U194	n-Propylamine (I,T)
U087	O,O-Diethyl S-methyl dithiophosphate
U048	o-Chlorophenol
U070	o-Dichlorobenzene
U328	o-Toluidine
U222	o-Toluidine hydrochloride
U115	Oxirane (I,T)
U041	Oxirane, (chloromethyl)-
U126	Oxiranecarboxyaldehyde
U182	Paraldehyde
U197	p-Benzoquinone
U039	p-Chloro-m-cresol
U072	p-Dichlorobenzene
U093	p-Dimethylaminoazobenzene
U391	Pebulate.

U183	Pentachlorobenzene
U184	Pentachloroethane
U185	Pentachloronitrobenzene (PCNB)
U161	Pentanol, 4-methyl-
U187	Phenacetin
U188	Phenol
U411	Phenol, 2-(1-methylethoxy)-, methylcarbamate.
U132	Phenol, 2,2'-methylenebis[3,4,6-trichloro-
U081	Phenol, 2,4-dichloro-
U101	Phenol, 2,4-dimethyl-
U082	Phenol, 2,6-dichloro-
U048	Phenol, 2-chloro-
U089	Phenol, 4,4'-(1,2-diethyl-1,2-ethenediyl)bis-, (E)-
U039	Phenol, 4-chloro-3-methyl-
U170	Phenol, 4-nitro-
U052	Phenol, methyl-
U145	Phosphoric acid, lead(2+) salt (2:3)
U087	Phosphorodithioic acid, O,O-diethyl S-methyl ester
U189	Phosphorus sulfide (R)
U190	Phthalic anhydride
U400	Piperidine, 1,1'-(tetrathiodicarbonothioyl)-bis-
U179	Piperidine, 1-nitroso-
U170	p-Nitrophenol
U383	Potassium dimethyldithiocarbamate.
U378	Potassium n-hydroxymethyl- n-methyldi-thiocarbamate.
U377	Potassium n-methyldithiocarbamate.
U192	Pronamide
U066	Propane, 1,2-dibromo-3-chloro-
U083	Propane, 1,2-dichloro-
U027	Propane, 2,2'-oxybis[2-chloro-
U171	Propane, 2-nitro- (I,T)
U149	Propanedinitrile
U373	Propham.
U411	Propoxur.
U083	Propylene dichloride
U387	Prosulfocarb.
U353	p-Toluidine
U196	Pyridine
U191	Pyridine, 2-methyl-
U180	Pyrrolidine, 1-nitroso-
U200	Reserpine
U201	Resorcinol
U202	Saccharin, & salts
U203	Safrole
U204	Selenious acid
U204	Selenium dioxide
U205	Selenium sulfide
U205	Selenium sulfide SeS2 (R,T)
U376	Selenium, tetrakis(dimethyldithiocarbamate).
U379	Sodium dibutyldithiocarbamate.
U381	Sodium diethyldithiocarbamate.
U382	Sodium dimethyldithiocarbamate.
U206	Streptozotocin
U277	Sulfallate.
U189	Sulfur phosphide (R)

U103	Sulfuric acid, dimethyl ester
U402	Tetrabutylthiuram disulfide.
U210	Tetrachloroethylene
U213	Tetrahydrofuran (I)
U401	Tetramethylthiuram monosulfide.
U216	Thallium chloride Tlcl
U214	Thallium(I) acetate
U215	Thallium(I) carbonate
U216	Thallium(I) chloride
U217	Thallium(I) nitrate
U218	Thioacetamide
U410	Thiodicarb.
U153	Thiomethanol (I,T)
U244	Thioperoxydicarbonic diamide [(H2N)C(S)]2S2, tetramethyl-
U402	Thioperoxydicarbonic diamide, tetrabutyl.
U403	Thioperoxydicarbonic diamide, tetraethyl.
U409	Thiophanate-methyl.
U219	Thiourea
U244	Thiram
U220	Toluene
U223	Toluene diisocyanate (R,T)
U221	Toluenediamine
U389	Triallate.
U228	Trichloroethylene
U121	Trichloromonofluoromethane
U404	Triethylamine.
U235	Tris(2,3-dibromopropyl) phosphate
U236	Trypan blue
U237	Uracil mustard
U176	Urea, N-ethyl-N-nitroso-
U177	Urea, N-methyl-N-nitroso-
U385	Vernolate.
U043	Vinyl chloride
U248	Warfarin, & salts, when present at concentrations of 0.3% or less
U239	Xylene (I)
U200	Yohimban-16-carboxylic acid, 11,17-dimethoxy-18-[(3, 4,5-trimethoxybenzoyl)oxy]-, methyl ester, (3beta, 16beta,17alpha,18beta,20alpha)-
U249	Zinc phosphide Zn3P2, when present at concentrations of 10% or less
U407	Zinc, bis(diethylcarbamodithioato-S,S')-

Chapter 6

ENVIRONMENTAL MANAGEMENT and STEWARDSHIP

Environmental Policy

As a public institution of higher education, University of Massachusetts Lowell is committed to being a model of environmental health and safety in our teaching, in our research, in our partnerships with the community, and in the management of our own organization. The University challenges and empowers each employee and student to promote environmental leadership through our environmental principle, "Ride the CREST":

C: Continuous Improvement
R: Reduce, Reuse, Recycle
E: Environmental Compliance
S: Stewardship
T: Training and Education

Continuous Improvement
… To enhance the environmental management system through checking, corrective action and annual top management review to achieve improvements in overall environmental performance.

Reduce, Reuse, Recycle
… To use processes, practices, materials or products that avoid or reduce pollution, which, may include process changes, efficient use of resources, material substitution and recycling.

Environmental Compliance
…To meet and where practical exceed all relevant current environmental laws and regulations.

Stewardship
… To empower employees and students to identify significant environmental aspects of our activities, products, and services, and to implement programs with targets and objectives that protect the health and safety of the people and the ecosystem.

Training and Education
… To provide appropriate training to all employees and students to ensure competence and awareness of our environmental policies and procedures, the significant environmental impacts of their work or activities, their roles and responsibilities in support of our environmental management system, and the potential consequences of departure from specified procedures.

Chapter 7

Safety Training

Laboratory safety training is offered once a month by EEM - EHS. This training is required annually for all paid employees that work in UMASS Lowell laboratories. The training is held at the Lydon Library Media Center at North Campus. Here is a link to the most current training schedule –xxxxx.

Along with this baseline training, all paid employees must receive laboratory-specific training before working in the lab. The Principal Investigator or laboratory manager must train the employees of their lab(s) on the specific hazards in the lab(s), controls in place to reduce exposure to hazardous materials as well as good laboratory practices. The employee must also review the CHP and know its location. Please keep documentation of this training in section 8 of the CHP Notebook.

NOTE: It is the responsibility of the Principal Investigator to make sure that all of his or her employees have received the baseline laboratory safety training as well as the laboratory-specific training.

Train-the-trainer resources are available. Please contact EEM-EHS at 42618 if interested.

Remember, laboratory safety training is a continuing process and should be an integral part of the laboratory workers' daily activities.

Chapter 8

Safe Laboratory Practices

Basic Safety Rules

1. Know the hazards of the chemicals and equipment in your laboratory.
2. Read and understand the material safety data sheets for chemicals that you will be using.
3. Receive base-line training on laboratory safety from EEM-EHS.
4. Receive laboratory-specific training for all hazardous procedures performed in the laboratory.
5. Read and understand the standard operating procedures (SOPs) for all hazardous procedures performed in the laboratory. (A SOP must be written by PI if one is not available.)
6. Plan, ahead of time, what to do in different emergency situations in your laboratory.
7. Wear proper personal protective equipment.
8. Wear pants and closed toe shoes. (Do not wear flip flops, sandals, or shorts in the laboratory.)
9. Do not eat, drink, or use tobacco products in the laboratory.
10. Wash hands before leaving the laboratory with soap and water.
11. Avoid working alone in a laboratory.
12. Confine loose hair and loose clothing.
13. Clean work surfaces regularly.
14. Keep lab doors closed.
15. Aisle ways and exits must be kept clear.
16. Be sure that the fume hood works properly.
17. Become familiar with the location of emergency shower and eye wash stations, fire extinguishers, spill kits, first aid kits, and fire blankets in your area.
18. Do not use floors, stairways, or hallways as storage areas.
19. Utilize break-resistant secondary containers when transporting chemicals through hallways.
20. Do not wear gloves outside of the laboratory. (Place chemicals in a secondary container before transferring to another laboratory to avoid the need for gloves.)
21. Write the date received and the date opened on all containers of peroxide-forming chemicals such as diethyl ether and tetrahydrofuran (THF).
22. Do not store chemical containers on the floor.
23. Label secondary containers of chemicals with the full chemical name and primary hazard.
24. Remove barcode labels from primary containers and report the information to EEM-EHS.
25. Principal Investigators cannot purchase chemicals with a Procard.

Basic Safety Rules for Handling Compressed Gases

1. Secure full and empty compressed gas cylinders in an upright position with a chain, bracket or other restraining device.
2. Do not store compressed gas cylinders near excessive heat, highly combustible materials, and other areas where they could be damaged or knocked over.

3. Store compressed gas cylinders of oxidizers at least 20 feet from compressed gas cylinders of flammables. (The 20 feet rule does not apply if there is a noncombustible wall separating the flammables and oxidizers. The wall cannot be less than 5 feet high and must have a fire-resistance rating of ½ hour.)
4. Place valve protection caps on all compressed gas cylinders unless they are in use.
5. Label the cylinder status as “full” or “empty”.
6. The name of the compressed gas (i.e. oxygen, nitrogen, etc.) and the primary hazard must be on the cylinder.
7. Utilize flash arrestors to prevent flash-back in a line containing a flammable gas.
8. Check all tubing periodically for integrity. (Remove tubing from service if it is damaged, cracked or missing.)
9. Store cylinders in a dry, well-ventilated area.
10. Do not store cylinders in hallways, corridors, stairwells or near elevators.
11. Cylinders must be accessible at all times.
12. When transporting a cylinder, the cylinder must be strapped to a transport cart. The valve protection cap must be on the cylinder.
13. Do not transport cylinders between floors on an elevator when there are passengers on the elevator.

Basic Safety Rules for Handling Cryogenic Liquids

1. Read the MSDS and laboratory-specific SOP for handling cryogenic liquids.
2. To minimize exposure during use, wear proper personal protective equipment. (Typical personal protective equipment worn when handling cryogenic liquids are safety goggles, insulated gloves, lab coat and a face shield. Gloves should be loose when worn so that they are easy to take off if there is a spill.)
3. Use fume hoods when working with cryogenic liquids, if possible.
4. Use tongs when handling objects in cryogenic liquids.
5. Use only approved materials with cryogenic liquids. (Unapproved materials such as rubber, plastic, and carbon steel will become brittle and shatter. Hollow tubes become over-pressurized.)
6. Inspect equipment periodically.
7. Remove ice and frost from openings to prevent over-pressurization.
8. Report any leaks or improperly set relief valves to the manufacturer.
9. Do not use a corrosive cleaning material to clean equipment since it can damage the metal jacket.
10. Use at least two people when transporting cryogenic liquids.
11. Use handcarts equipped with brakes for large dewars and cylinders.
12. Do not transport cylinders between floors on an elevator when there are passengers on the elevator. (Try to avoid traveling in an elevator with a dewar since the elevator is a small space. If the cylinder failed or leaked, there would be a displacement of oxygen inside the elevator which could cause asphyxiation.)
13. When pouring a cryogenic liquid into a secondary container, pour slowly to avoid splashes.
14. Do not overfill when pouring into a secondary container.

15. Use a phase separator, if available, to control vapor path during pouring.
16. Store dewars in well-ventilated rooms.
17. Do not store cryogenic liquids with flammable or corrosive chemicals.

Proper Use of a Fume Hood

A fume hood must be used when working with any chemical that has an inhalation hazard. A fume hood that is operating correctly and used properly will protect the laboratory worker from breathing in hazardous vapors. Labels and arrows are placed on the face of the fume hood by EEM-EHS. The labels indicate the specific sash height that should be used to maintain a sufficient face velocity to protect workers from breathing in hazardous vapors. Work should be conducted with the sash positioned at the sash stop or lower. If the hood doesn't have a sash stop, keep the sash below the height indicated by the sticker and arrow. The sash of the fume hood also provides a safety shield for the face and upper body. Do not put your head in the fume hood since this may result in an exposure to hazardous vapors. Also, please remember to close the sash when the hood is not in use to conserve energy. (Note: The use of perchloric acid *may* require a special hood.)

EEM-EHS inspects the fume hoods annually to verify that the fume hood is running at 100 feet per minute. (The average face velocity criteria for a fume hood is 100 feet per minute.) During the inspection, the fume hood is divided into 6 equal areas and the face velocity is measured in the center of each of these areas using a velometer. These six readings are averaged. If the face velocity average is less than 100 feet per minute, the sash height that produces a 100 feet per minute average will be found. The hood will be labeled with a line that shows the maximum safe operating sash height. If the fume hood does not pass the inspection, then it is labeled with a "DO NOT USE" sign.

All chemicals and equipment should be placed at least 6 inches away from all sides of the fume hood. Also, for proper air circulation,

1. the rear baffle openings must be kept clear
2. large objects should be placed 2 to 3 inches above the work surface
3. nearby windows and doors must be shut
4. pedestrian traffic must be kept to a minimum.

Laboratory fume hoods are not to be used as permanent storage for chemicals or equipment. Chemicals should be covered, properly labeled as to the contents, and removed from the hood when not in use. (NOTE: Hazardous waste may be stored in the designated satellite accumulation area which may be located in a fume hood.) Do not place shelves in the fume hood since this would encourage the storage of materials in the hood and impede proper airflow.

Remember – hood motors should be shut off when not in use to conserve energy.

Proper Use of a Laminar Flow Hood

Do not use hazardous materials inside a laminar flow hood. The laminar flow hood is designed to protect the product or sample from contamination and does not protect the laboratory worker. The laminar flow hood is also called a "clean bench." It provides uniform non-mixing air stream through a high efficiency particulate air (HEPA) filter.

Proper Use of Biological Safety Cabinets (BSCs): HEPA filters are effective at trapping particulates and thus infectious agents but do not capture volatile chemicals. According to Biosafety in Microbiological and Biomedical Laboratories (BMBL) 5th edition, only Type A2 exhausted or Types B1and B2 BSCs exhausting to the outside should be used when working with volatile toxic chemicals, but amounts must be limited. See the table below for additional information. (NOTE: The numbers following wording under the applications column in the table refer to footnotes 1 and 2.)

Characteristics of Biosafety Cabinet Classes

BSC Class, Type	Face Velocity (fpm)	Airflow Pattern	Applications	
			Nonvolatile Toxic Chemicals and Radionuclides	Volatile Toxic Chemicals and Radionuclides
I	75	In at front through HEPA to the outside or into the room through HEPA (Figure 1)	Yes	When exhausted outdoors 1,2
II, A1	75	70% recirculated to the cabinet work area through HEPA; 30% balance can be exhausted through HEPA back into the room or to outside through a canopy unit	Yes (minute amounts)	No
II, A2	100	Similar to II, A1, but has 100 linear fpm intake air velocity and plenums are under negative pressure to room (Figure 2); exhaust air can be ducted to outside through a canopy unit (Figure 3)	Yes	When exhausted outdoors (minute amounts) 1,2
II, B1	100	30% recirculated, 70% exhausted. Exhaust cabinet air must pass through a dedicated	Yes	Yes (minute amounts)1,2

		duct to the outside through a HEPA filter (Figure 4)		
II, B2	100	No recirculation; total exhaust to the outside through a HEPA filter	Yes	Yes. (small amounts) 1,2
III	N/A	Supply air is HEPA filtered. Exhaust air passes through two HEPA filters in series and is exhausted to the outside via a hard connection (Figure 5)	Yes	Yes (small amounts) 1,2

Footnotes:

[1] Installation may require a special duct to the outside, an in-line charcoal filter, and a spark-proof (explosion-proof) motor and other electrical components in the cabinet. Discharge of a Class I or Class II Type A2 cabinet into a room should not occur if volatile chemicals are used.

[2] In no instance should the chemical concentration approach the lower explosion limits of the compounds.

Source: adapted from BMBL, fifth edition, Appendix A, Table 2.

EEM-EHS inspects biological safety cabinets annually. This work is contracted out through a certified company.

Chapter 9

Standard Operating Procedures

It is the responsibility of the principal investigator of each laboratory to write and/or review the SOPs and assure that the personal protective equipment and other controls outlined in the SOP are in place. Laboratory-specific SOPs must include specific work practices, procedures, and policies used to protect employees from laboratory hazards. *Special consideration should be given to working with carcinogens, mutagens, highly toxic chemicals, and reproductive toxins.* A template to help you write an SOP is available in section 7 of the CHP Notebook.

Each Principal Investigator should identify and prepare a list of those materials and procedures in their lab for which special provisions will be applied. The OSHA Laboratory Standard suggests that these include reproductive toxins, highly (acutely) toxic materials, and "Select Carcinogens." (See definition listed below for "Select Carcinogens.") A list of these laboratory-specific substances should be placed in the CHP Notebook. The OSHA Laboratory Standard indicates that specific consideration should be given to:

- Establishment of a designated storage and work/use area
- Containment devices such as fume hoods or glove boxes
- Procedures for safe removal of contaminated waste
- Decontamination procedures

The OSHA Laboratory Standard defines a "Select Carcinogen" as any substance, which meets one of the following criteria:

(i) It is regulated by OSHA as a carcinogen

(ii) It is listed under the category, "known to be carcinogens," in the Annual Report on Carcinogens published by the National Toxicology Program (NTP) (latest edition) - http://ntp.niehs.nih.gov/index.cfm?objectid=32BA9724-F1F6-975E-7FCE50709CB4C932

(iii) It is listed under Group 1 ("carcinogenic to humans") by the International Agency for Research on Cancer Monographs (IARC) (latest editions) - http://monographs.iarc.fr/index.php

(iv) It is listed in either Group 2A or 2B by IARC or under the category,"reasonably anticipated to be carcinogens" by NTP.

More information on carcinogens can be found on the OSHA Safety and Health Topics for Carcinogens webpage - http://www.osha.gov/SLTC/carcinogens/index.html. On this website, there is also a list of links to OSHA standards that apply to substances classified as carcinogens or potential carcinogens by the NTP. Another list of the NTP and IARC known and probable carcinogens is available on the American Cancer Society webpage - http://www.cancer.org/Cancer/CancerCauses/OtherCarcinogens/GeneralInformationaboutCarcinogens/known-and-probable-human-carcinogens.

Chapter 10

Personal Protective Equipment (PPE)

Summary of Types of PPE

1. Eye and Face Protection

Safety glasses with side shields are required to be worn when working in the laboratory. The safety glasses must conform to the American National Standard Institute (ANSI) standard Z87.1-1989. However, the safety glasses do not protect eyes from chemical splashes or aerosols since they do not fit tightly over the eyes. If you are working in an experiment with chemicals where a splash hazard exists, it is important to wear safety goggles instead of safety glasses. The safety goggles provide a seal around the eyes. If there is a potential for your face to be exposed to a chemical splash, it is important to wear a face shield over the safety goggles.

2. Foot Protection

Sandals, flip flops, clogs, and cloth/canvas shoes do not provide adequate protection for your feet when there is a chemical spill. It is important to wear closed toe shoes in the laboratory. Shoe covers may be required for work in some labs. For instance, when source loading arsenic chunks into a molecular beam epitaxy chamber, there is the potential for arsenic contamination. It is prudent to wear shoe covers in this type of laboratory to avoid tracking of arsenic outside of the laboratory. (The shoe covers would be placed on when entering the laboratory and they would be removed before leaving the laboratory.)

3. Hand Protection

It is important to wear gloves that will provide appropriate protection to the hazard. Some examples of hazards encountered in a laboratory are handling hazardous chemicals, sharp-edged objects, and very hot or very cold objects or materials. Please inspect the gloves for discoloration, punctures and tears before use. In summary, here are the factors to consider when choosing the best type of glove to wear:

- Type of chemical/physical hazard: You will need to determine the best type of glove to wear for working with a chemical by looking at a glove compatibility chart (available from most manufacturers). This chart will give you the breakthrough time for different types of gloves and chemicals. What is the breakthrough time? It is the time that has elapsed from initial contact of a chemical with the outside surface of the glove till the time at which the chemical is detected on the inside surface of the gloves.

  If there is a physical hazard such as skin burns from hot or cold objects, you will need to wear thermal or cryogenic gloves. Leather gloves can be worn to protect your hands from abrasions or laceration hazards.

- Dexterity: You will receive better chemical protection with a thicker glove since the glove will be more resistant to physical damage; however, the thicker glove may impede your research if more dexterity is needed.
- Length of gloves: Depending on type of research, a wrist length glove will provide adequate protection. There are instances, such as when immersing hands in a large container of a hazardous chemical, that elbow length gloves will provide better protection.
- Double gloving will increase the breakthrough time of the gloves. Remember to remove and change the top layer of gloves whenever there is visible contamination.

For incidental contact with hazardous chemicals, double gloving with nitrile gloves may be sufficient. It is important to check a glove compatibility chart to verify that disposable nitrile gloves will be a good barrier between your hands and the hazardous chemical. Keep in mind that nitrile gloves may not be appropriate when handling highly toxic chemicals or solvents. For example, when using methylene chloride, you will find that nitrile gloves do not provide sufficient protection for incidental contact. The breakthrough time for methylene chloride to permeate through a nitrile glove and be in contact with your skin is approximately 5 minutes. You may, in this case, still opt to use the nitrile gloves for dexterity reasons and plan to double glove, changing the top layer of gloves every 5 minutes and when there is visible contamination.

How do you properly remove disposable gloves? First, grab the cuff of the left glove with the gloved right hand. Be careful not to touch your skin when grabbing the cuff. Hold the left glove that was removed in your gloved right hand. Then, place your finger from your now bare left hand under the cuff of the right glove. Invert the right glove over the glove in the palm of your hand. Dispose of the gloves properly and then wash your hands with soap and water. Do not reuse disposable gloves.

***** A note about disposable latex gloves**
The use of disposable latex gloves for chemical handling is discouraged because latex gloves do not provide good barrier protection from commonly used chemicals. The breakthrough time may be minutes or seconds.

4. Personal Clothing

Shorts and skirts are not allowed in laboratories where hazardous materials are used because it is inappropriate to leave large areas of skin exposed. Instead, pants must be worn in the laboratories as well as laboratory coats that are buttoned with the sleeves rolled down. Laboratory coats should be made of 100% cotton, especially in laboratories where flammable materials are used. (Laboratory coats made of 100% cotton will not burn readily. Laboratory coats made of polyester/cotton blends are more combustible.) However, the best type of laboratory coat to wear when working with flammable or pyrophoric chemicals is Nomex. Nomex has the highest fire resistance because the lab coat thickens, carbonizes, and remains intact under fire conditions. (Nomex is also resistant to acids, bases, and most solvents.)

Since acids react readily with cotton, plastic or rubber aprons may be worn over the laboratory coats. Please note that, although plastic aprons provide protection from corrosive liquids, the aprons accumulate static electricity. For this reason, the plastic aprons should not be used when working with flammable solvents, explosives sensitive to electrostatic discharge, or materials that can be ignited by static discharge.

Remember to leave your laboratory coat inside the lab before you leave and do not bring your laboratory coat home to clean. Please contact EEM-EHS to get information on laundering services available for washing laboratory coats. NOTE: Specify "no bleach" to the laundering service before washing Nomex laboratory coats since bleach will degrade these types of laboratory coats.

Restrain long hair and do not wear loose clothing such as neckties in a laboratory. The hair or loose clothing could catch fire or be dipped in hazardous chemicals.

Respirators

In a typical laboratory setting, respirators will be unnecessary since a fume hood should be available to work with all materials that are an inhalation hazard. However, there are some exceptions when a laboratory worker may desire or require a respirator. For instance, if the laboratory worker's experimental equipment cannot fit in the fume hood and snorkels are unavailable, the laboratory worker may want to wear a respirator while working on the countertop if an inhalation hazard is present. Please contact the Respiratory Protection Program Administrator, Kathi Lyon, at 42746 for more information. EEM-EHS will come out to the work site to evaluate the hazards and determine if a respirator is necessary. Instructions will be given to the laboratory worker on the proper procedure for obtaining a respirator.

Choosing The Correct Type of PPE

In order to determine the correct personal protective equipment (PPE) to wear in the laboratory, it is important to first assess the hazards of all materials and/or equipment in the workspace. At a minimum, the following PPE should be worn in all laboratories where hazardous materials are handled and stored: lab coat, safety glasses, and proper gloves.

The MSDS is one resource that is used to determine the hazards of the chemicals in use. The MSDS will also list specific PPE to wear but it may not list the specific type of gloves to wear. If this is the case, please refer to a glove compatibility chart. Another resource may be the manufacturer's instructions for a piece of equipment. Typically, the manufacturer's instructions will have information on the hazards of the piece of equipment as well as controls in place to protect oneself from the hazards. For example, with use of a rotary evaporator, there is a risk of the glass components imploding. To minimize this hazard, it is important that the glass components are made of Pyrex or similar glass and the whole system should be enclosed by a shield. The type of glass will minimize the amount of flying glass if there is an implosion and the shield will protect the lab workers from becoming injured by the flying glass. With these controls in place, it is still important to wear a lab coat, safety glasses, and proper gloves. Lastly, the correct PPE may already be listed in a laboratory-specific standard operating procedure.

Certifying the PPE Assessment

After resources such as material safety data sheets, standard operating procedures and manufacturer's instructions are reviewed; please fill out a personal protective equipment assessment which is located in section 12 of the CHP Notebook. This will be a good overview of the hazards in the lab and will provide laboratory workers with the specific PPE required for all hazardous tasks performed in the lab. If assistance is needed with filling out the PPE assessment, please contact

EEM-EHS. Once all information in the PPE assessment is completed, the Principal Investigator must sign the document in order to certify the assessment.

Training

Training must be provided for all laboratory workers. The training must include the following topics:

- When and why PPE is necessary
- What PPE is necessary
- How to properly don, doff, adjust and wear PPE
- The limitations of the PPE
- The proper care, maintenance, longevity and disposal of the PPE.

Employees must be able to demonstrate an understanding of the PPE training and use the PPE properly before being allowed to perform work requiring the use of PPE.

Retraining

- When the Principal Investigator has reason to believe that any affected employee who has already been trained does not have the understanding and skills required, the Principal Investigator shall retrain that employee. Circumstances where retraining is required include, but are not limited to, situations where:

  - Changes in the workplace render previous training obsolete
  - Changes in the types of PPE to be used render previous training obsolete
  - Inadequacies in an affected employee's knowledge or use of assigned PPE indicate that the employee has not retained the required understanding or skill

Chapter 11

Additional Topics

Required Signage

All laboratories are required to have the “Emergency Laboratory Safety Information” sign posted on the outside of all laboratory doors. It is important that this information be filled out and posted on the doors to communicate hazards and to also have contact information available in the event of an emergency after hours. For example, the UMASS Lowell police may need to contact the Principal Investigator of the lab after a power outage or flood. For more information about the required signage, please call EEM-EHS at 42543. (The actual sign is shown on the next page.)

NOTE: If you do not want to post your home and/or cell phone on the contact sign, please write “on file” on the sign after giving the phone numbers to EEM-EHS. EEM-EHS maintains an emergency telephone listing which is provided to the UMass Lowell police dispatch.

EMERGENCY LABORATORY SAFETY INFORMATION

PLEASE AFFIX ON LAB ENTRY DOOR **U MASS LOWELL**

Department _____ Room _____ Date _____

1) Faculty/Staff Responsible _____ Office Phone _____ *Home Phone _____

2) Faculty/Staff Responsible _____ Office Phone _____ *Home Phone _____

Laboratory Hazards

(Please check each item that applies)

BIOHAZARD		LOCATION
Level _____	1 Low	
_____	2	
_____	3 High	
☐ Animal Care		_____
☐ Bacteria		_____
☐ Fungi		_____
☐ Parasite/Protozoan		_____
☐ Virus		_____
☐ Other _____		_____

CHEMICAL	LOCATION
☐ Acids/Bases	_____
☐ Air/Shock/Water Sensitive	_____
☐ Carcinogens/Mutagens	_____
☐ Flammable Liquids	_____
☐ Gas Cylinder Flammable	_____
☐ Gas Cylinder Nonflammable	_____
☐ Gas Cylinder Poison	_____
☐ Oxidizers	_____
☐ Poisons	_____
☐ Waste Solvents	_____
☐ Other _____	_____

RADIATION	LOCATION
☐ Laser	_____
☐ Microwave	_____
☐ Radioactive Materials	_____
☐ Radioactive Waste	_____
☐ X-Ray	_____
☐ Transilluminator	_____
☐ Other _____	_____

EMERGENCY EQUIPMENT _____ Drench Shower _____ Eyewash Station _____ Fire Extinguisher

EMERGENCY NUMBERS: **Fire / Police / Medical - 2911**

University Environmental Health & Safety Dept. - 2618

**Optional - If left blank, please leave your telephone number with University Police Dept.*
**For additional clarification/information, contact EHS Department - Ext. 2618*

Waste Minimization

Here are some ideas to minimize the generation of hazardous waste in your labs.

1. Perform chemical reactions on a smaller scale.
2. Use less solvent to rinse equipment. (For example, rinse equipment several times with small volumes of solvents rather than rinsing once or twice with larger volumes.)
3. Substitute nonhazardous or less hazardous chemicals when possible.
4. Recycle and reuse materials when possible. (For example, coordinate laboratory work with colleagues at UMASS Lowell who may be using some of the same chemicals.)
5. Include, in experiments, the reaction work-up steps that deactivate hazardous materials or reduce the toxicity of the hazardous materials.

Green Chemistry

Green chemistry is the use of environmentally friendly, sustainable chemicals. By practicing green chemistry, labs may minimize or eliminate hazardous waste generation which ultimately leads to less pollution in our environment.

Sustainable Chemistry Hierarchy

1. Source reduction and prevention of chemical hazards
    a. Design chemical products to be less hazardous to human health and the environment
    b. Use feedstocks and reagents that are less hazardous to human health and the environment
    c. Design chemical products to be reused or recycled
2. Reuse and recycle chemicals
3. Treat chemicals to render them less hazardous
4. Dispose of chemicals properly

Reproductive Health in the Laboratory

Employees and students may contact EEM-EHS to schedule a reproductive health assessment. Please fill out the form on the page below to assist EEM-EHS with their assessment.

For further information regarding reproductive health, please read the National Institute of Occupational Safety and Health (NIOSH) publications listed below -

1. http://www.cdc.gov/niosh/docs/99-104/ - The Effects of Workplace Hazards on Female Reproductive Health

2. http://www.cdc.gov/niosh/malrepro.html - The Effects of Workplace Hazards on Male Reproductive Health

You may also review the list of reproductive toxins from California's Proposition 65 - http://www.oehha.ca.gov/prop65/prop65_list/files/P65List031811links.pdf.

University of Massachusetts Lowell Reproductive Hazard Evaluation Form

This questionnaire is for men and women who frequently use chemicals or may be exposed to other hazardous conditions at work that may be reproductive hazards.

Name: _____ Department: _____

Address: _____ Phone Number: _____

Job duties with potential exposure(s) of concern:

_____

_____

1. Please indicate which of the following agents you may be exposed to while performing the job duties with potential exposure(s) of concern:

Agent	Yes	No	Frequency of exposure?	Exposure duration or quantity?
Noise				
Temperature Extremes				
Radiation				
Infectious Agents				
Hazardous chemicals				

2. Please list the infectious agents, hazardous chemicals or radiation sources you may be exposed to, if applicable:

_____

_____

3. Indicate the type of **ventilation** used while performing the job duties with potential exposure(s) of concern:

_____ Fume hood or other local exhaust system

_____ General mechanical ventilation (building heating/ventilation/air-conditioning system)

_____ Natural ventilation (outside air through windows or doors)

_____ Other (please describe:_____)

4. Please describe **administrative controls** in place (laboratory-specific training, standard operating procedures, etc):

_____

_____

4. Please describe the types of **personal protective equipment (PPE)** you use while performing the job duties with potential exposure(s) of concern (PPE may include eye/face/hearing protection, gloves, respirator, lab coat, etc.): _____

5. Additional Concerns or Comments:

EHS Safety Specialist Signature:_____ Date:_____

Ergonomics in the Laboratory

Employees may contact EEM-EHS to schedule an ergonomic assessment. A self-assessment form is provided on the next page to assist you with creating proper ergonomic design within your workspace.

The Wikipedia – the free on-line encyclopedia - defines ergonomics as the study of designing equipment and devices that fit the human body, its movements, and its cognitive abilities. Proper ergonomic design is important to prevent musculoskeletal disorders such as carpal tunnel syndrome. Some examples of how injuries may be avoided are the following:

1. Take breaks from repetitive tasks.
2. Choose tools that fit best. (For example, use pipettes that fit comfortably in the user's hands.)
3. Maintain physical fitness.
4. Use adjustable work stations.
5. Fit the work to the worker. (For example, keep samples and equipment within easy reach.)

Specific information regarding ergonomics in the laboratory is available on the Division of Occupational Health and Safety's website - http://dohs.ors.od.nih.gov/labs.htm.

Laboratory Ergonomics

University of Massachusetts Lowell Self-Assessment Checklist

(Responses with an asterisk * require you to work with your supervisor to reduce ergonomic stresses.)

Computer Workstations

Yes	No*	1.	Is a seat provided?
Yes	No*	2.	Is the seat height adjustable?
Yes	No*	3.	Is lumbar back support provided?
Yes	No*	4.	Is a footrest provided?
Yes	No*	5.	Is there ample leg room?
Yes	No*	6.	Are all adjustable features easy to use?
Yes	No*	7.	Is there ample room to accommodate a keyboard and a computer mouse so the employee can rest their arms at their side and forearms parallel to the floor?
Yes	No*	8.	Is there ample room to place the monitor at arm length's distance?
Yes	No*	9.	Is the monitor at the recommended height?
Yes	No*	10.	If documents are frequently used, is there a document holder?

Laboratory Benches

Yes	No*	1.	If the worker stands, is anti-fatigue matting supplied?
Yes	No*	2.	Is the height of the bench appropriate for the work that is performed?
Yes	No*	3.	Is there adequate leg room?
Yes	No*	4.	Do contact stressors exist such as bench tops with sharp edges?

Laboratory Chairs

Yes	No*	1.	Can all laboratory chairs be adjusted to accommodate all of the employees who need to use the chairs?

Microscopes

Yes	No*	1.	Do the shoulders appear rounded and/or is the worker hunched over?
Yes	No*	2.	Is there excessive neck flexion (>25 degrees)?
Yes	No*	3.	Are there contact stresses between sharp edges and the forearms?
Yes	No*	4.	Is the microscope pulled out to the edge of the workbench?
Yes	No*	5.	Are armrests or padding provided?
Yes	No*	6.	Is there sufficient leg room?
Yes	No*	7.	Does the worker rest their feet on the lab stool?
Yes	No*	8.	Is there a foot rest provided?
Yes	No*	9.	Has the individual been trained how to properly sit at a microscope workstation?
Yes	No*	10.	Are microscope work breaks provided?

Pipetting

Yes	No*	1.	Are manual pipettors used?
Yes	No*	2.	Are electronic pipettors provided?
Yes	No*	3.	Are latch-mode pipettors provided?
Yes	No*	4.	Is the pipettor designed to reduce contact with sharp edges?
Yes	No*	5.	Has the individual been trained how to properly operate the pipettor (e.g., pickup tips, eject tips, program electronic pipettor, etc.).
Yes	No*	6.	Does the worker pipette more than 2 hours per day?
Yes	No*	7.	Are frequent breaks provided?
Yes	No*	8.	Is the pipettor computer-controlled to allow for computer-activated multiple dispensing instead of finger-activated dispensing?

Fine Motor Skills

Yes	No*	1.	Are vials with the fewest amount of threads allowable used?
Yes*	No	2.	Does the worker perform dissection or micro-manipulation with forceps more than 5 hours per week?
Yes	No*	3.	Are frequent micro breaks provided?
Yes*	No	4.	Do contact stresses exist between the forearm and workbench?

Microtome and Cryostat

Yes*	No	1.	Does the worker use excessive wrist flexion and extension when operating the microtome or cryostat?
Yes	No*	2.	Is the workstation at a height that reduces arm abduction as much as possible?
Yes	No*	3.	Does the worker have access to an automatic microtome/cryostat?
Yes	No*	4.	Are frequent breaks provided?
Yes	No*	5.	Is a fully adjustable chair provided?

Chapter 12

CHP Notebook

INTRODUCTION

The CHP Notebook is site-specific for each laboratory group at UMASS Lowell. It is customized by the Principal Investigator, Chemical Hygiene Officer and the laboratory group. All laboratory-specific information required under OSHA's Laboratory Standard such as standard operating procedures and emergency procedures will be filed in this notebook. The contents of the CHP Notebook must be reviewed by all new employees and all training documentation must be stored here. The notebook can be used as an ongoing reference manual for all laboratory workers. Please remember to review the CHP Notebook at least annually to see if any updates need to be made.

Complete this page, annually, after each CHP Notebook review or revision.

NOTE: All laboratory chemical use areas must maintain a customized CHP (the CHP Notebook) which conforms to the requirements of the OSHA Laboratory Standard 29 CFR 1910.1450.

Name (print)	Signature	Date

Table of Contents

Section 1 – Safety Program Key Personnel

Please add your department's safety program key personnel to this list.

Name	Position	Phone #
Richard Lemoine	Director, EEM	934-2618
Glenn MacDonald	Safety Specialist, EEM-EHS	934-2632
Kathi Lyon	Safety Specialist, EEM-EHS	934-2746
Ruth Medina	Biosafety Specialist, EEM-EHS	934-2778
Peter Bergeron	Hazardous Waste Manager, EEM-EHS	934-2543
Juan Ocasio	Safety Technician, EEM-EHS	934-2631

Section 2 – Laboratory Details

This CHP Notebook pertains to the following Principal Investigator(s):

List all rooms under the responsibility of the Principal Investigator(s) including temperature controlled rooms, storage closets, and animal facilities.

Section 3 – Laboratory Specific Information and Emergency Phone Numbers

(NOTE: The emergency phone numbers cannot be only UMASS Lowell office numbers. You may not be in your office at the time of the emergency! Please also list cell phone numbers and/or home phone numbers.)

Name of Principal Investigator (PI): _____

Emergency Phone Numbers:
(Day) _____
(Evening) _____
(Cell) _____

Name of Lab CHO *(if different than the PI)*: _____

Emergency Phone Numbers:
(Day) _____
(Evening) _____
(Cell) _____

Names of Other Lab Personnel:	Emergency Phone Numbers:

Section 4 – Emergency Procedures

WHAT YOU CAN DO TO PREPARE:

- Place emergency supplies (i.e. first aid kit, flashlights, bottled water, batteries, and a portable radio) in your office or lab.
- Post emergency phone numbers by phone in your office and lab.
- Become familiar with shortest exit routes from your lab and office.
- Locate the nearest fire alarm pull station.
- Review basic on-line fire extinguisher training at http://www.fireextinguisher.com/.
- Learn about what the UMASS Lowell police department offers regarding crime prevention in the community by visiting the following link: http://www.uml.edu/police/Crime_Prevention/Crime_Prevention.html
- Post an evacuation plan in your lab. (You may insert a copy of the evacuation plan into this section of the CHP Notebook.)

Section 5 – Hazardous Chemical Inventory

The hazardous chemical inventory is maintained by EEM-EHS. It is available to the Principal Investigators for laboratories under their specific oversight, upon request, to Glenn MacDonald or Kathi Lyon at extension 42618.

Section 6 – Material Safety Data Sheets

Material safety data sheets can be found in the north campus EHS office, room OLGI-3 of Olney Hall. Laboratory groups may also prefer to place copies of their own material safety data sheets in this section of the CHP Notebook or a separate binder for easy access.

Here is a list of links to websites where you can run a query to obtain material safety data sheets.

http://siri.org/msds/index.php

https://www.vwrsp.com/search/index.cgi?tmpl=msds/

http://msds.lindeus.com/

http://www.emdchemicals.com/

Section 7 – Standard Operating Procedures

Principal Investigators (PI) have the responsibility for overall oversight of the laboratory which includes operations, compliance, safety, and security. Standard operating procedures must be written for all procedures that pose a risk to the health and safety of the laboratory personnel. When conducting a procedure such as the use of hazardous materials in an experiment, the PI or a designated lab employee must prepare a written standard operating procedure (SOP) that outlines the hazards of the procedure as well as the controls that must be implemented to conduct the research safely.

NOTE: An SOP does not need to be written for each individual experiment. Procedures with the same hazards can be combined into one SOP.

An SOP template is provided below.

The SOP Title Here

Standard Operating Procedure

Your Name Here

Date

Write a brief description of what this process is used for here.

1.0 Material Requirements:

1.1 Equipment needed for process:

List all of the equipment you need to successfully run this process. Be complete. If this is a new process that has not been done in the lab before, consult with lab staff to make sure that equipment you need is available.

1.2 Chemicals needed for process:

Include a complete list of the chemicals needed. If specific concentrations, purities, or grades are necessary cite them here.

1.2.1 Hazards associated with chemicals:

Include a subsection for each component chemical and if necessary a subsection for the chemical produced. Hazards will be found in the MSDS. Look for information on whether the chemical is flammable, corrosive, toxic, carcinogenic, pyrophoric, an irritant, etc.

1.3 Engineering controls:

Where will you run this process? If this process is to be run in a specific location in the lab be explicit. Options include fume hoods, vented ovens, furnaces, glove boxes, wet benches. If this is a new process and the appropriate engineering controls do not seem to be available in the lab, discuss with lab staff whether the process can be done and how to obtain what is needed. If no engineering controls are needed please cite this fact. Some of this information will be in the MSDS.

1.4 Protective equipment needed:

What do you wear to protect yourself while performing the process? Check MSDS, but be aware that the protective equipment standards cited in these documents frequently refer to handling the chemical outside of approved engineering controls. If you do not know what protective equipment to use or what types of gloves are compatible with the chemicals you will be using, consult lab staff.

2.0 Procedure:

Include detailed instructions on mixing the component chemicals and or use of the gas. Information you should cite will include temperature settings, flow rates/pressure, concentrations, volumes and weights, appearance (if applicable),

what the process is supposed to do, how to tell if the process was successful, and what to do with the hardware, chemicals, and equipment after the process is completed.

3.0 Storage:

Where will you store this in the lab (e.g., solvent, acid, or base cabinet, refrigerator, etc.)? Be aware of incompatibility with other chemicals already in use in the lab. For example, one chemical might react violently with another. In this case you would want to avoid storage in a cabinet with this second chemical. Information will be found in the MSDS.

4.0 Waste Products:

How do you dispose of the waste products used in making the material, after using the material or after the material is depleted or gets old. Be specific and describe the specific disposal procedure to be used within the lab (i.e., do not write "Dispose of in accordance with applicable regulations"). Ask members of the laboratory staff for assistance if you do not know how the waste chemical should be handled.

5.0 Accident Procedures: (Found in the MSDS)

5.1 Contact (include a subsection for each component chemical)

5.1.1 Skin:

5.1.2 Eyes:

5.1.3 Inhalation:

5.1.4 Ingestion:

5.2 Spill or leak: How do you deal with a small spill? Are there specific absorbents that should be used? Is the disposal procedure you cited in section 4 valid in case of a spill? If it is a gas leak, what do you do when the detectors go off? Be specific. Do not include the chemical manufacturer's emergency numbers here.

5.3 Fire: Are there specific concerns to be considered in the event of a fire? For example, some chemicals are water reactive, and using water on a fire where these chemicals are involved will make the problem worse.

Report all accidents (injuries, spills, fires) to the ……. For emergencies, call UMASS Lowell Police at 44911 from a campus phone. An "outside" line is also available 24 hours a day for calls to the UMASS Lowell police. It is 978-934-2394.

Section 8 – Training Records for Employees

Records of training must be kept in the CHP Notebook. In this section, there are a number of different forms that may be used to document training. There is also a training checklist that can be used as a guide by the Principal Investigator and/or Chemical Hygiene Officer when conducting laboratory-specific training. Copies of laboratory safety certificates and other certificates provided by the Office of Environment and Emergency Management must also be placed in this section of the CHP Notebook.

CHEMICAL HYGIENE PLAN
AWARENESS CERTIFICATION

The Occupational Safety and Health Administration (OSHA) requires that laboratory employees be made aware of the Chemical Hygiene Plan at their place of employment (29 CFR 1910.1450). After reading the CHP and CHP Notebook, complete the information below and place a copy of this form in section 8 of the CHP Notebook.

By signing below, you acknowledge that you are aware of the Chemical Hygiene Plan and the policies and procedures applicable to the OSHA standard (29 CFR 1910.1450). You are also aware of all the lab-specific information contained in your lab group's CHP Notebook.

Please type or print legibly.

Name _____Department _____

Campus Location _____Campus Phone_____

Supervisor or PI _____

Signature:_____Date:_____

APPROVED

Principal Investigator's Signature:_____Date:_____

LAB-SPECIFIC TRAINING FORM FOR EMPLOYEE

Name _____Department _____

Campus Location _____

Campus Phone # _____

Supervisor or PI _____

The Laboratory Safety Standard requires that the employee's supervisor provide training on all hazardous procedures. This training must be provided at the time of the employee's initial assignment, on a refresher basis at least annually and upon updating procedures.

NOTE: See attached training checklist.

Document laboratory-specific employee training below:

Type of Training	Date	Provided By	Employee Signature

Training Checklist

This checklist may be used to assist Principal Investigators with the laboratory-specific training requirements outlined in the Laboratory Safety Standard.

Review basic safety rules ☐

Review location of Chemical Hygiene Plan (CHP) and CHP Notebook ☐

Review location of material safety data sheets ☐

Read CHP and CHP Notebook ☐

Read laboratory-specific standard operating procedures (SOPs) ☐

Read material safety data sheets for all chemicals used by employee ☐

Review locations of emergency equipment ☐

Review emergency procedures ☐

Review hazardous waste handling procedures ☐

Review procedures for chemical procurement, distribution, and storage ☐

Review procedures for use of compressed gas cylinders ☐

Review personal protective equipment (PPE) used in lab
Discuss selection of proper gloves and how to use a glove compatibility chart. ☐

Housekeeping, maintenance, and safety inspections ☐

Ventilation and other engineering controls
Discuss proper use of fume hoods and other mechanical ventilation systems. ☐

Medical program
Discuss the need for any medical surveillance such as for respirator use, working with certain potentially hazardous materials or adverse environmental (lab) conditions. ☐

Training Program
Discuss mandatory laboratory-specific training sessions as well as the general laboratory safety training that is also mandatory and offered by EEM-EHS on a monthly basis. ☐

*****Additional Safety Session Topics*****
Review accidents and injuries as well as corrective actions taken to prevent reoccurrences.
Review hazards and controls on new equipment, procedures, and/or materials.
Review results of recent formal or internal inspections as well as plans for correcting deficiencies.

Section 9 – Inspections and Exposure Monitoring Records

This section should contain information on formal and internal laboratory inspections and exposure monitoring reports. This section should also contain records of corrective actions. The EEM-EHS laboratory safety inspection checklist (see below) can be used for your own internal laboratory inspections.

	INSPECTION INFORMATION			
	Building: **Lab Number:** **Date:**			
	Responsible Faculty/Staff:			
	Name of person completing survey:			
	Primary Function; Academic / Research / Services			
	GENERAL SAFETY REQUIREMENTS	**Yes**	**No**	**N/A**
1	Is an updated emergency green card posted on the lab entrance door?			
2	Is an updated EHS Lab Manual accessible to all lab personnel?			
3	Have lab personnel attended a 2hr. Lab Safety Training session within the past year?			
4	Is there an evacuation route posted in the lab?			
5	Is there a working phone in the lab?			
6	Do lab personnel know who to call in the event of a spill?			
7	Is the general lab ventilation working?			
8	If a drench shower is available, is it accessible?			
9	Has the drench shower been inspected?			
10	If eyewash station is available, does it function properly?			
11	Has the eyewash station been inspected?			
12	Is the eyewash station accessible and free of clutter?			
13	Is a first aid kit easily accessible and stocked in the lab?			
14	Are doors closed and secured during and after occupancy?			
15	Are movable parts guarded on equipment as appropriate?			
	ELECTRICAL SAFETY			
16	Is the electrical panel accessible?			
17	Are plugs, cords, and outlets in good condition?			
18	No overloaded outlets or daisy chained power strips?			
19	Extension cords do not pose trip hazards (taped down)?			
20	Power strips kept away from liquids?			
21	No power cords found under doors, carpets or through ceilings?			
	LABORATORY SAFETY			
22	Do lab personnel know where to find material safety data sheets?			
23	Are applicable standard operating procedures available to lab users?			
24	Does the lab have a chemical hygiene plan?			
25	Are beakers, test tubes and flasks clearly labeled to identify contents?			
26	Are chemical storage cabinets clearly labeled? (i.e., flammables, corrosives)			
	HOUSEKEEPING			
27	Is the lab neat and orderly?			
28	Is there minimial glassware on bench tops?			
29	Is there minimal glassware in the sink?			
30	Is there minimal glassware in the fume hood?			
31	Are exits, aisles, and corridors not blocked and is the minimum width 24 inches?			
32	Are chemicals stored off of the floor?			
33	Is the glass window on the lab entrance door free from obstruction?			
34	Are lab users complying with the no eating and drinking policy in the lab?			
35	Are refrigerators/freezers being used and labeled for storage of chemicals only?			
	FIRE SAFETY			

36	Are there fire extinguishers in the lab?			
37	Have the fire extinguishers been inspected within the past year?			
38	Are fire extinguishers fully charged?			
39	Are fire extinguishers clearly identified with a sign?			
40	Are fire extinguishers accessible (not blocked)?			
41	Is storage clearance from ceiling 18" with sprinklers or 24" without sprinklers?			
42	Is there a fire blanket and is it easily accessible in the lab?			
43	Are the majority of flammable materials stored in flammable storage cabinets?			
44	Minimal combustible materials in space ie., cardboard, paper, books, curtains?			
	COMPRESSED GAS CYLINDERS			
45	Are contents of gas cylinders clearly labeled?			
46	Are gas cylinders firmly secured to walls or lab benches or are they properly secured with floor stands? (This includes lecture size compressed gas cylinders.)			
47	Are valve protection caps placed on cylinders not in use?			
48	Are empty gas cylinders properly secured and marked as empty?			
49	Are gases properly segregated?			
	PERSONNAL PROTECTIVE EQUIPMENT			
50	Are closed toe shoes and long pants worn by lab personnel?			
51	Are lab coats worn by lab personnel?			
52	Are gloves worn by lab personnel while handling chemicals?			
53	Is eye protection being worn by lab personnel?			
54	**FUME HOODS**			
	Has the annual calibration been performed on each fume hood?			
55	Is the proper sash height indicated?			
56	Is the sash at or below the marked approval level?			
57	Does the fume hood lighting work properly?			
58	Are audible/visual alarms functional?			
59	Functional fume hoods not being used for long term storage?			
60	Are experiments at least 6" inside the hood?			
	CHEMICAL SAFETY			
61	Is less than 10 gallons of flammables stored outside of flammable storage cabinets?			
62	Is an explosion proof refrigerator available for chemical storage?			
63	Are incompatible materials properly segregated?			
64	Are chemicals stored safely away from the edges of counters and shelves?			
65	Are ethers and other peroxide formers dated upon receipt and when opened?			
66	Are water reactive chemicals stored inside cabinets?			
67	Are pyrophoric chemicals stored inside cabinets?			
68	Are chemical containers in good condition?			
69	Are storage cabinets and shelves in good condition?			
	CHEMICAL WASTE DISPOSAL (310 CMR 30)			
70	Is there an SAA sign demarcating the waste storage area in the lab?			
71	Are satellite waste containers labeled with a UML Hazardous waste label?			
72	Are the appropriate hazard boxes checked on the Hazardous waste label?			
73	Is each chemical constituent written out without abbreviation or formulas?			
74	Are waste containers stored in secondary containment?			
75	Are waste containers kept closed unless being worked with?			
76	Are wastes properly segregated by hazard class?			
77	Are lab users complying with the UML "NO" pour down the drain policy?			

78	Are hazardous waste labels easy to read?			
79	Are stock chemicals stored separately from waste chemicals?			
80	Are full satellite waste containers dated and removed within 72 hours?			
81	Are secondary containment bins free of spilled chemical waste?			
82	Are satellite waste containers in good condition?			
83	Are rigid cardboard boxes available for the collection of lab glass?			
84	Are the lab glass waste boxes in good condition?			
85	Are sharps (broken glass, pipettes, needles, razors etc.) being disposed of properly?			
86	Are sharps containers less than 3/4 full?			

Section 10 – Incidents, Injuries, and Corrective Actions

Include in this section a description of laboratory incidents and corrective actions taken to prevent them in the future.

Note: An incident report form (attached below) must be completed for all workplace injuries and illnesses. Please fax a copy of the completed incident report to EEM-EHS within x hours. The fax number is 934-4018. (This fax number is also located on the form.)

Richard Lemoine
Director of EH&S
Tel. 978-934-2618
Fax 978-934-4018

University of Massachusetts Lowell
One University Avenue
Lowell, Massachusetts 01854
Tel. 978-934-4000

Environmental Health and Safety

University of Massachusetts Lowell Emergency Incident Report Form

Name of Person making report	Phone Number	Date	Time	Building & Room location of incident

Description of Incident

Injured Person(s):	**Address:**	**Contact#**	**Type of Injury:**

Actions Taken

Forward copy to EHS Office Fax# 4018

Section 11 – Safety Program Correspondence

Please insert any letters or memos of correspondence from EEM-EHS into this section. You may also insert documentation of safety topics discussed during lab meetings.

Section 12 – Personal Protective Equipment Assessment

Date:_____ Principal Investigator:_____

Department:_____ Analysis By:_____

Location:_____ Signature:_____

Task	Potential Hazards	PPE Recommended

Here is an example of a PPE assessment that has been filled out for a lab group. Once you check the manufacturer's glove compatibility chart, please list the specific type of glove to wear under "PPE Recommended." If it is best to double glove, this information can also be placed in the "PPE Recommended" section.

PERSONAL PROTECTIVE EQUIPMENT

CERTIFICATION OF HAZARD ASSESSMENT

Tasks	Potential Hazard	PPE Recommended
Working with small volumes of corrosive liquids < 1 liter	Skin and eye damage	Safety glasses (safety goggles if splash hazard) Appropriate gloves* (check manufacturer's glove compatibility chart) Lab coat, closed shoes, pants
Working with small volumes of organic solvents < 1 liter	Skin and eye damage Slight poisoning potential through skin absorption	Safety glasses (safety goggles if splash hazard) Appropriate gloves* Lab coat, closed shoes, pants
Working with non-human/non-primate cells classified as biosafety level 1 (BSL1) work	BLS1 work are strains of viable microorganisms not known to consistently cause disease in healthy adult humans. Many agents not ordinarily associated with disease processes in humans are, however, opportunistic pathogens and may cause infection in the young, the aged, and immunodeficient or immunosuppressed individuals.	Lab coat and gloves Safety glasses if there is a splash hazard
Working with acutely toxic hazardous powders	Great potential skin and eye damage. Great potential for poisoning through skin absorption.	Safety goggles Appropriate gloves* Lab coat, closed shoes, pants Coveralls and booties if necessary
Working with hazardous powder – Trypan Blue	Suspect carcinogen. May cause heritable genetic damage. Suspect teratogen. Eye and skin irritant.	Safety goggles Appropriate gloves* Lab coat, closed shoes, pants
Working with hazardous powder - acrylamide	Suspect carcinogen and suspect teratogen. Severe neurotoxin. Eye, skin, and respiratory	Safety goggles Appropriate gloves* Lab coat, closed shoes, pants

	irritant.	Coveralls and booties if necessary
Working with cryogenic liquids	Major skin, tissue and eye damage	Safety glasses or safety goggles for large volumes or splash hazards Face shield Heavy insulated gloves Lab coat, closed shoes, pants
Working with very cold materials and equipment (freezers, dry ice)	Skin damage	Safety glasses Insulated gloves Lab coat, closed shoes, pants
Working with hot liquids, equipment and/or open flames (autoclave, Bunsen burner, water bath, oil bath)	Skin damage Eye damage	Safety glasses or goggles for large volumes or splash hazards Insulated gloves Lab coat, closed shoes, pants
Glassware washing	Skin lacerations	Heavy rubber gloves Lab coat, closed shoes, pants

*Please reference the specific glove manufacturer's selection chart for proper selection of all gloves based on the specific hazard.