CHEMICAL HYGIENE PLAN

MOUNT SINAI SCHOOL OF MEDICINE

MOUNT SINAI SCHOOL OF MEDICINE

INSTITUTIONAL BIOSAFETY PROGRAM

03/2003 Edition

MOUNT SINAI SCHOOL OF MEDICINE

CHEMICAL HYGIENE PLAN

TABLE OF CONTENTS

PART 1

MOUNT SINAI SCHOOL OF MEDICINE

CHEMICAL HYGIENE PLAN

TABLE OF CONTENTS

PART 2

GENERAL INFORMATION

In the event of a Fire or other Emergency that may involve personnel while working with chemicals, the following information and list of telephone numbers is presented:

IN CASE OF FIRE OR VISIBLE SMOKE PULL THE NEAREST FIRE ALARM AND EVACUATE IMMEDIATELY!! CALL EXT. 43473 (4-FIRE)

IN ALL OTHER EMERGENCY SITUATIONS NOTIFY:

SAFETY OFFICER

4-SAFE

Safety……4-SAFE..... **241-7233 (47233)**
Evenings, Nights, Wkends:Page the Nursing Administrator on duty **41800**

Medical Emergency…… 60
Inform Security that there is a need for a Paramedic team at (give location)

Biosafety Officer……241-1451

MSMC Employee Health Services..... 241-6086

Ventilation, Power, Steam System Failures..... **241-6201(46201)**
MSSM Engineering Services

Mount Sinai Security……..... 60

Radiation Safety…… 241-2269 (42269)

CHEMICAL HYGIENE PLAN

Advisory Notice to Department Chairs
and Faculty Members

The Faculty member in charge of a laboratory is responsible for ensuring that all work carried out in that laboratory involving the use of chemicals is carried out in a safe manner consistent with the practices described in this Chemical Hygiene Plan.

The Faculty member is also responsible for assuring that each worker in his / her laboratory has access to: this Chemical Hygiene Plan; a copy of the OSHA Laboratory Standard; all Material Safety Data Sheets related to the research project.

In addition, it is the Faculty member's responsibility to see that each worker has received appropriate instruction regarding the Chemical Hygiene and has received annual training in the safe handling of all chemicals with which he/she is working.

Departmental Chairs are responsible for seeing that faculty members within their departments fulfill the above responsibilities.

I CHEMICAL HYGIENE PLAN

1. LABORATORY PRACTICES

Each laboratory, and more specifically, each laboratory project has its own collection of chemicals which singularly or in combination can present firematic, reactive or toxicity hazards to the laboratory worker. The Faculty member in charge of a laboratory is responsible for controlling hazardous conditions and ensuring compliance by all laboratory personnel with the Chemical Hygiene Plan.

The responsibility of working safely with chemicals rests ultimately with the person handling the reagent. No safety plan, chemical hygiene plan, protective equipment or chemical fume hood can provide protection if a researcher ignores basic principles of safety, intentionally or unintentionally.

Section E, *Basic Rules and Procedures for Working with Chemicals* (Part 2, Appendix A, page 24 of this booklet) should be read and understood by all employees prior to performing any experiments and adhered to when performing any work involving chemicals.

a. Obtaining and Using Material Safety Data Sheets

Material Safety Data Sheets (MSDS) must be provided to the individual purchasing a chemical reagent, by the manufacturer, vendor or supplier in accordance with the OSHA Hazard Communication Act, N.Y.S. Right-To-Know Law, and the Occupational Exposure-Laboratories Standard. In some cases, the manufacturers and suppliers have sent to Mount Sinai School of Medicine a bulk collection of MSDS's covering the range of chemicals shipped to the institution. Other vendors send a sheet along with each shipment either to the laboratory or to the MSMC Safety Officer.

MSDS's are obtained from the MSSM Safety Officer at 4-SAFE and the Biosafety Officer, extension 41451, and are available from 9:00 A.M. to 5:00 P.M., Monday through Friday. The MSSM Safety Officer will provide MSDS's and other chemical safety data, and their interpretation for any reagent requested.

The MSDS will contain most of the pertinent information needed with respect to chemical and physical hazards, toxicity and storage incompatibilities. *Please NOTE*: the MSDS should be regarded as a summary only and not a complete description of all the hazards associated with a chemical. If further clarification or information is needed, contact MSSM Safety Officer, 4-SAFE or the Biosafety Officer at extension 41451.

Annual training in the use of the MSDS is required by OSHA regulations for all employees working with chemicals, and is incorporated into the Chemical Hygiene Plan training session. The MSMC Safety Officer will announce when these training sessions will be held. On-site specific training is available by arrangement. Attendance is mandatory for all employees working with any chemicals.

b. Additional Sources

To supplement the information contained in the MSDS, several additional sources can be utilized:

i. Various Texts

There are several toxicology texts available in the Medical School library, which are helpful in the evaluation of health hazards of chemicals, including the following:

- Annual Report on Carcinogens; published by The National Toxicology Program (NTP), U.S. Public Health Service.

- IARC Working Group on the Evaluation of [Subject of Monograph]; A Series of Mongraphs published by The International Agency for Research on Cancer (IARC) covering specific agents, groups of agents or selected industries in which cancer has been caused or a suspected relationship exists with the chemicals under study.

- The Merck Index; A Compendium of Chemical Information.

- Sigma - Aldrich Library of Chemical Safety Data; C-D ROM Program.

- The Chemical Abstracts; a serial collection maintained in the School of Medicine Library, providing detailed bibliographies and abstracts on original research papers on hazards, toxicity and related topics. These citations are based on the CAS number, which is the Chemical Abstracts Services registry number. This number for most chemicals can be found conveniently in both Aldrich and Sigma Chemical Catalogs.

The catalogs of many of the chemical vendors contain the RTECS numbers, CAS numbers and a few have the entry numbers for the most recent edition of the Merck Index, allowing you to access valuable information on the chemical being used.

The MSSM BioSafety Officer maintains a small collection of publications in Room Annenberg 20-86. Information can be reproduced when requested in writing.

Personal copies of many Federal Agency publications can be obtained through the U.S. Superintendent of Documents, Government Printing Office (consult "Government Section" in the telephone directory).

The Educational Services Librarians of the School of Medicine Library can provide assistance in selecting a number of Databases and websites that can provide additional information on chemical hazards. Many references are available at: http://fusion.mssm.edu/levy/databases/ site.

ii. Manufacturers / Suppliers

In addition to providing the MSDS, many manufacturers / suppliers have telephone numbers that access customer service or technical representatives of the company, who may be able to provide additional information about the product. Additionally, many manufacturers / suppliers have websites on the Internet that will allow you to access information regarding their chemicals.

In the event that a manufacturer / supplier refuses to supply an MSDS or information on the chemicals they have provided, contact The MSMC Safety Officer and give a description of the incident. The MSMC Safety Officer will contact the manufacturer/ supplier on your behalf, and attempt to obtain the information. If the product is a non-research item The MSMC Safety Officer will attempt to obtain information on its constituents under the New York State Right-To-Know Law and the OSHA Hazard Communication Standard.

iii. NIOSH and Other Governmental Sources

The National Institute of Occupational Safety and Health (NIOSH) promulgates various documents on chemical exposures under the series title *"Criteria for a Recommended Standard...Occupational Exposure to* [specific chemical]". Other titles are also available as "Technical Reports" or specific titles for a given chemical with respect to its hazards.

The Centers for Disease Control and Prevention, NIOSH and OSHA have published Material Safety Data Sheets and guidelines on chemical hazards/exposures on their websites. These are available at: the web location, http://www.cdc.gov/niosh/homepage.html . NIOSH and several other associated agencies (ASTDR, FDA, USDA) have links with click-on icons at this site. The Select Agent Transfer regulation which controls the purchase and use of several toxins, and filing procedures under this regulation are available under the http://www.cdc.gov/od/ohs/ "***OHASIS"*** icon location at this site.

The web address http://osha.gov/ is the official OSHA home page, where the full text of the Laboratory Standard and all the standards regulating respirators, chemical hazards, emergency responses and compliance documents can be found.

c. Using Proper Personal Protective Equipment (PPE)

i. Selection

Selecting the appropriate gloves, respirators, eye protection and disposable clothing is important, and should not be done haphazardly. What will work for one group of chemicals may be totally useless and dangerous to the wearer for another group. The MSMC Safety Officer maintains catalogs and NIOSH Certification lists for PPE. Respirators and other safety equipment have to be fit-tested in order to comply with OSHA standards and ensure proper wearing where fit is a contributor to safety. Assistance in selecting the right equipment should be obtained from The MSMC Safety Officer before purchase and use.

ii. Care and Maintenance

The equipment will serve you only as its condition permits. Gloves, eyewear, aprons, etc. should be checked carefully for leaks, cracks or degradation on a regular basis. Defective equipment should be replaced immediately. PPE should be stored carefully according to manufacturer's recommendations and in a clean location.

In particular, respirators require a rigorous maintenance and inspection program as specified in the OSHA regulation 29 CRF 1910 Part 134. Strict adherence is required in order to use respirators effectively. It has been the policy of Safety Officers to discourage the use of respirators in most situations, preferring to use chemical fume hoods. OSHA considers prevention of exposure through Engineering controls preferable to reliance upon respirators for protection. Individuals requiring a respirator must have a medical evaluation performed by the MSMC Employee Health Service prior to being fit-tested for a respirator by The MSMC Safety Officer.

d. Arrival of Shipments and Safe Storage

When a shipment of chemicals arrives in the laboratory, those individuals responsible for inventorying and storing the materials should check the overall condition of the containers and remove any MSDSs that were forwarded along with the shipment and retain these in each laboratory where the chemical will be used.

All hazard warnings such as "**FLAMMABLE**", "**CORROSIVE**", etc. should be circled in red. The date of receipt should be written on the label. In addition it is recommended strongly that opening dates should be written as well, since materials such as diethylether, tetrahydrofuran and other ethers develop peroxides on long-term exposure to air. Highly reactive chemicals should be treated as having a shelf life of six months to one year, depending on the reagent. FDNY Fire Prevention Directive 3 RCNY 10-01 requires circling (if present) or writing the expiration date on the container label (See page 37, Part 2, Appendix III, this manual).

Care should be taken to ensure that the storage amounts of flammables, oxidizers, and acids do not exceed the amounts specified for your laboratory in **FP Dir. 3 RCNY 10-01** (Tables 1 and 2, page 9). If you are not certain of the regulation, please contact the MSMC Safety Officer, who will assist you in determining storage amounts. Segregation of hazard classes must be practiced at all times, especially with respect to incompatible items that can increase the chances of a reaction, fire or explosion. Refer to the appendix to this manual for a listing of incompatibles. Many individuals continue to store chemicals alphabetically, which unfortunately, can situate incompatible chemicals together in the same storage area. This method of storage is dangerous and undesirable. Chemicals should be segregated according to reactive groups and an inventory system employed to locate them. The MSMC Safety Officer will assist you in planning such storage.

2. STORAGE PRACTICES

Chemicals will be identified upon arrival from Receiving & Shipping with respect to Hazard class. This information is available on the label as a D.O.T. (Department of Transportation) listing, or is present on the Material Safety Data Sheets, that accompany the shipment or can be obtained through The MSMC Safety Officer.

Chemical containers are stored according to hazard class, in specific locations in order to prevent commingling or locating reactive chemicals next to each other. In certain situations additional measures such as secondary containers to protect the stock container may be required to safely store a particular chemical. Water-reactive chemical containers stored in larger watertight containers are one example of this practice. The US EPA has a manual available to address these issues in more detail, and it is provided at:
http://www.epa.gov/sbo/labguide.htm .

All containers should have the original container label intact and legible at all times. Defaced, faded or separating labels should be addressed immediately, either by correcting the label or offering the chemical for disposal through the MSMC Safety Officer if it is of no immediate use.

All care must be taken to store chemicals safely i.e. water reactives are not stored under sinks or sprinkler heads, or flammables stored near ignition sources.

Expiration dates that are printed on the labels are to be circled, and if not present, are to be recorded in a clear and legible manner for chemicals that are in reactive groups or develop hazardous functional groups on long-term storage. The MSMC Safety Officer has a list of chemicals with short shelf lives that should be examined and removed when the expiration date or maximum storage duration has been reached.

Storage of chemicals should be consistent with FDNY storage limits found in the Section II of this "*Chemical Hygiene Plan*." Please note that irrespective of whether the chemical is "pure product" or is "used-waste" the total quantities of both cannot exceed FDNY limits at any time.

3. INVENTORY CONTROL

Chemicals in storage should be examined periodically for: changes in the condition of the chemical itself; the condition of the container holding the chemical; the storage area surrounding the chemical. Obvious signs of degradation are: split caps, accretion of deposits on the exterior of bottles or on shelf surfaces in the storage area; formation of two phases or a change in physical state; formation of crystalline structures within liquids. All of these examples are considered by the US EPA as ***"inherently waste-like",*** and should be addressed immediately by contacting the MSMC Safety Officer for removal.

Some changes are subtle, and not readily noticeable. For example the reagent picric acid is shipped as a *flammable solid* with 15% water by weight. When the water evaporates, a bright yellow color develops in place of the original orange color, indicating that the picric acid is dry and is now a shock sensitive *Class A high explosive*. Become familiar with each chemical in your laboratory and its physical and chemical hazards before using or storing it.

Aliquots that are removed from stock containers should have a label on the secondary container that has the FULL CHEMICAL NAME and all hazard information, i.e. Flammable, Corrosive, Poison, on the container label. Extremely dangerous chemicals should never be abbreviated- this poses a risk to anyone handling this container and may misidentify the material if the abbreviation can stand for two or more compounds.

Chemical containers with no labels, abbreviations that are not intelligible, wax crayon, or "sharpie" markings on stock bottles are **"red flags"** to external agency inspectors and should be addressed immediately. If the contents are known, the container has to be labeled in a legible manner. If the contents are not known, this material should be considered as an ***"unknown"*** and contact made with the MSMC Safety Officer immediately for pick-up and disposal as soon as possible. ***Do not open*** a container with which you have no familiarity. The MSMC Safety Officer will arrange to open and identify the contents of an unknown in a safe manner.

It is good practice to make up labels with the responsible individual's initials and date, which can be applied to the container yearly to indicate that the chemical has been inspected and will be kept in inventory until the next inspection. Application of "dot stickers" or labels should be made to the container and *not to the label*, preventing the obliteration of information on the label. Chemicals with no immediate use, or that have developed ***"inherently waste-like"*** characteristics should be discarded through the MSMC Safety Officer immediately. Chemicals with opening dates or inventory dates that are more than two years old, or past manufacturer's expiration dates can be considered to be ***"inherently waste-like"*** by external inspectors and incur substantial fines for the institution.

4. DISPOSAL PRACTICES

All unwanted out-of-date chemicals and containers that could be considered "inherently waste-like" should be offered to the MSMC Safety Officer as soon as possible. Containers should be in good condition, and should be sealable by way of a screw cap. Open containers, or containers with "parafilm", "Saran-wrap" or tape are not acceptable for storage or disposal. The original stock container manufacturer's label with a "Hazardous Waste" label attached or a the MSMC Safety Officer "Hazardous Waste" label for mixtures is placed on all collection containers giving the full chemical names for all chemicals and the percentage of the total volume of the mixture in use.

Containers not meeting these conditions will not be accepted for disposal until the problem is corrected. If you need assistance in labeling or obtaining a container for repackaging the chemical, call the MSMC Safety Officer. If the chemical is an unknown, mark the container with an "unknown" label and notify The MSMC Safety Officer for disposal.

Special Note: For all waste collection containers, a **"Hazardous Waste"** label obtainable from the MSMC Safety Officer is filled out and permanently attached to the container with the full chemical name, or names of all component chemicals in the mixture and the percentages of each. The date that **the first quantity of waste is collected** in the container is recorded on the label. The collection container can remain within the laboratory **only thirty days** beyond that date, after which it has to be offered to the MSMC Safety Officer whether it is completely full or not. (In accordance with US EPA law, the MSMC Safety Officer has to ensure that the total time that a container remains on site is less than 90 days). Full containers cannot remain past three days in a collection area, and should be offered to the MSMC Safety Officer immediately after filling.

All waste collection containers are to be sealed with a cap immediately after each use; funnels, tubing, pipettes or other introduction devices ***should not*** be left in the container between each use. Containers should not be removed from the generation site and collected in "common areas" before offering to the MSMC Safety Officer.

Such common areas become ***Satellite Accumulation Sites***, and come under strict regulation and control under US EPA laws. All waste collection containers should remain in proximity to devices such as HPLC chromatography units, amino acid sequencers and other processing equipment that have a chemical waste discharge port. Waste collection containers are required by US EPA laws to remain under constant control and supervision of the individuals using these containers.

II. Fire Safety in the Chemical Laboratory

(Summary of Fire Prevention Directive 3 RCNY 10-01)

The following is a listing of **"DO'S"** and **"DON'TS"** that summarize the Fire Protection Directive 3RCNY 10-01 for the protection of Employees from the hazards of Fire, Explosion and Spill in Laboratories. These recommendations are derived from three main sources:

1. The N.Y.C. Fire Code and the OSHA General Industry Standards, Subpart L.

2. Important practices which are derived from the Prudent Man / Woman principle.

3. Generally known facts derived from the latest research in fire science.

DON'T operate a Laboratory anywhere in New York City unless there is one person holding a Certificate of Fitness (C of F) issued by the Fire Commissioner.

Should there be an accident in a laboratory when there is no C of F holder present, the legal complications can be far reaching.

DO call The MSMC Safety Officer (ext. 47233) to get information on how a Certificate of Fitness can be obtained.

DO label all reagents, reaction products, solutions and waste in the laboratory, clearly and legibly with the full chemical name of all constituents.

DO note a date of expiration on the containers of all substances in the laboratory that fall into the following functional groups:

a) picrates
b) perchlorates
c) peroxides
d) peroxidizable materials
e) polymers that react violently on polymerization
f) All substances that are known to become unstable or reactive over time

DON'T work with any chemical or gas if the chemical and physical properties are unknown to you.

DON'T place trash into the sodium bicarbonate bucket that is in your laboratory.

DO apply the sodium bicarbonate that is in the bucket in your laboratory, to any acid spill. Leave the laboratory, close the door and call the The MSMC Safety Officer, ext. 47233 **(4-SAFE).**

DON'T attempt to clean any chemical spill yourself. Call the The MSMC Safety Officer ext. 47233 in case of a spill of any carcinogen, chemical, or a gas cylinder leak.

DO keep the fire extinguisher that is in your laboratory on the mounting provided for it. Do not remove the fire extinguisher for storage in another place.

DON'T store containers of chemicals or chemical waste on the floor. Always store chemicals and chemical waste in the cabinets provided.

DO know the location of your emergency shower/eye wash station ***BEFORE*** it is needed. Most of these safety devices are located within 25 feet of laboratory doors.

DON'T keep a laboratory fire a secret. Report all fires even fires that have been extinguished, to The MSMC Safety Officer. It is the law, and failure to do so may result in fines to you.

DO turn in a fire alarm for **ANY** fire, no matter how small. Close the door and leave the building by the shortest means of egress.

DO be aware of alternate means of egress from your laboratory to the outside of the building. The way you came into the building may be blocked by smoke, flame, hot gases or toxic substances, during a fire.

DON'T use an open flame apparatus to distill any flammable liquid or flammable solid. Use only an approved heating mantle or a steam bath.

DO secure all compressed gas cylinders in an upright position, to a permanent building fixture other than plumbing or an electrical conduit.

Have Engineering Services (ext. 46201) install chains for compressed gas cylinders in your laboratory. Then keep the chain secured across the UPPER THIRD of the cylinder.

DO obtain a Material Safety Data Sheet (MSDS) for EVERY chemical in your laboratory. Read, understand and know all the physical and chemical properties of the chemicals you work with. MSDS can be obtained from the company that supplied the chemical or call The MSMC Safety Officer or the MSSM Biosafety Officer for the MSDS.

DON'T exceed the amounts of chemicals shown in the table below.

TABLE 1

MAXIMUM LABORATORY UNIT STORAGE LIMITS**

LAB TYPE	FIRE RATING	FIRE PROTECTION	FLAMMABLE LIQUIDS & VFOS	FLAMMABLE SOLIDS	OXIDIZING MATERIALS	UNSTABLE REACTIVE
I	2 HRS	SPRINKLERS	30 GALLONS	15 LBS	50 LBS	12 LBS
II	1 HR	SPRINKLERS	25 GALLONS	10 LBS	40 LBS	6 LBS
III	2 HRS	NO SPRINKLERS	20 GALLONS	6 LBS	30 LBS	3 LBS
IV	1 HR	NO SPRINKLERS	15 GALLONS	3 LBS	20 LBS	2 LBS

**Except for Chemical Research Laboratories, no permit shall be required for laboratories storing or using less than 32 oz. flammable liquids or VFOS, 0.5 lb oxidizing materials and/or 0.15 cubic feet water container capacity of flammable gases
Call The MSMC Safety Officer to determine the classification (type) of your laboratory.

DON'T use, plan to use or store flammable gases, if your laboratory is below street level.
Note: **Oxygen is not a flammable gas.**

DON'T keep any flammable gas in your laboratory if you have no need for it, even if your laboratory is at or above street level.

DON'T exceed the water container volume of flammable gases that may be safely stored. The safe volume of flammable gas is shown in the Table 2 below and is dependent on the floor area of your laboratory. Call the The MSMC Safety Officer to obtain a calculation of the "Water container capacity" of your cylinders.

TABLE 2
STORAGE OF FLAMMABLE GASES

AREA OF LABORATORY IN SQUARE FEET	UP TO 500 SQUARE FEET	PER ADDITIONAL 100 SQUARE FEET	MAXIMUM PER LABORATORY UNIT
MAXIMUM CAPACITY IN CUBIC FEET**	9.24	1.54	15.4

**WATER CONTAINER CAPACITY: A 9"X52", 1H CYLINDER IS 1.54 FT^2 CAPACITY.

DON'T store incompatible chemicals in close proximity to each other. See the appendix at the end of Part 1 for a chart of incompatible chemicals.

DON'T store flammable gases, flammable liquids or any flammable solid, in a domestic type refrigerator, or in any cold room or "environmental room". Call The MSMC Safety Officer for a recommendation on how to obtain (by purchase) an "explosion proof refrigerator".

Caution: Many manufacturers "say" their refrigerators are explosion proof but only specific types are allowed in New York City. Check with the The MSMC Safety Officer BEFORE you buy one.

DON'T store acids on bare metal surfaces. A spill of an acid onto bare metal produces toxic fumes, heat and can produce HYDROGEN GAS.

DON'T store nitric acid on cardboard, paper, wood or any other surface that may contain cellulose. A spill of nitric acid (HNO_3) on cellulose-base material can produce NITROCELLULOSE otherwise known as GUN-COTTON, a substance that can explode with great force and heat on receiving slight to moderate shock.

DO store water reactive chemicals in appropriate watertight secondary containers.

DO call the The MSMC Safety Officer for "Water Reactive Chemicals" sign for your lab.

DO call the The MSMC Safety Officer if your laboratory needs new signs.

DO use a fume hood when working with flammable, toxic or noxious substances. A hood should be used when dispensing scintillation fluids, even if they are not flammable to prevent exposures to their vapors.

DO ask The MSMC Safety Officer to determine the airflow rate in your fume hood, if you have any doubt regarding its protective efficiency.

DON'T heat perchloric acid to above ambient temperatures before calling The MSMC Safety Officer for advice. Special safety equipment is needed for this procedure.

DON'T perform any reaction known to be explosive or that could result in an explosive decomposition without first calling The MSMC Safety Officer for assistance.

DON'T store DMSO (dimethylulfoxide) with highly toxic chemicals as it facilitates absorption through the skin in the event of an accidental exposure.

DON'T wash any azide down a sink that is served by a metal drain line - you may form explosive Lead Azide or Copper Azide.

DO call The MSMC Safety Officer for advice, if hydrogen fluoride is to be used. Special spill kits and first aid procedures have to be available before work begins.

DO call The MSMC Safety Officer if you or anyone in your laboratory has a physical disability that could prevent them from evacuating the building without using an elevator.

III. Operation and Use of Fume Hoods

Proper use of the fume hood is one of the best approaches to reducing exposure to chemicals in the laboratory. Exposure to gases, vapors and aerosols is prevented when experiments are performed within the hood. This section will provide information on the concepts and principles involved in fume hood operation.

The fume hood is a type of local ventilation system. It is designed to capture vapors and gases and directs them away from the source and the person(s) using the hood. The hood is designed to capture these vapors and gases internally, within the booth, and *not* at the face. The general formula for capture velocity at the face of the hood is:

$$\mathbf{Q = V (10x^2 + A)}$$

Where: Q = volume in CF/M
V = velocity
x = distance from hood face opening
A = Area of hood face opening

For a standard 6 foot x 1 foot opening (6 ' bench and hood sash opening at 1 foot), and a **100 lf/m** minimum velocity, **V**, the point at where **x**, the capture velocity begins is calculated as follows:

$Q = 100$ lf/m x 6 ft^2 opening; **$Q = 600$ cfm**

with sill slot

$600 \text{ cfm} = 100 \text{ lf/m } (10x^2 + 6ft^2)$

$6ft^2 = 10x^2 + 6ft^2$

$0 = 10x^2$

$x = 0$

without sill slot

$600\text{cfm} = (.75)(100) \times (10x^2 + 6ft^2)$

$8ft^2 = 10x^2 + 6ft^2$

$x = 0.45$ ft or 5.4"

This demonstrates that there is virtually **no capture velocity** at any point outside of the hood sash. Therefore, working on the sill should be discouraged at all times and work should be performed at least 8 inches within the hood.

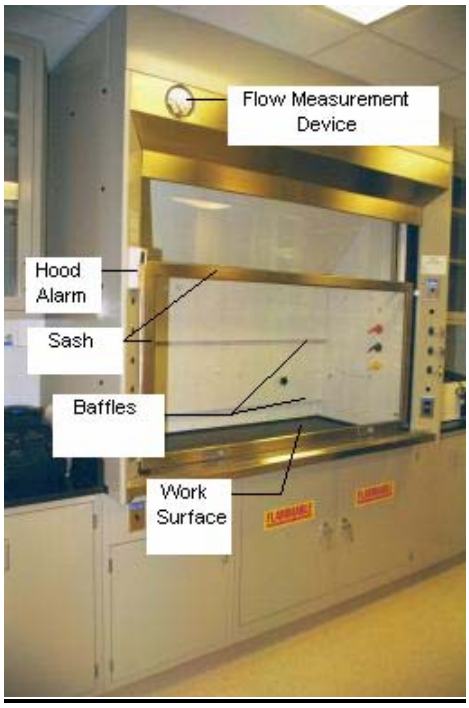
For most laboratory hoods, the average face velocity is between 125-200 lf/m, with the FDNY minimum required face velocity of 100 lf/m being maintained across the face, with no point below 75 lf/m. Usually, a one-foot opening is used since the velocities given above are harder to maintain when the sash is open more than one foot. In general the hood sash should be brought to the one-foot mark when chemicals are being used in the hood.

Fume hoods in laboratories are equipped with flow meters or inclined manometers that are used to indicate the actual airflow in the hood duct. Before a hood is used for chemical manipulations the person using the hood should determine if there is adequate airflow across the work area. Hood flow can be checked by holding a tissue or other lightweight paper by the sash opening and within the hood.

This is a rough, rule of thumb, to be used only to determine if air is flowing into the hood. If there is no movement of the paper inward, then the hood should not be used until checked by the MSMC Safety Officer or MSSM Biosafety Officer. Similarly, if you can smell a chemical while working with it in the hood, have The MSMC Safety Officer or MSSM Biosafety Officer check the hood.

Hoods are only effective if used properly. Sash height should be as low as possible in order to contain vapors and ensure as small a face opening as possible. Chemicals should be handled with care, especially when mixing or adding reagents. Remember the fume hood is ***not a high-pressure enclosure nor is it explosion proof*** and should not be used to conduct experiments of a highly reactive nature.

DIAGRAM OF CHEMICAL FUME HOOD



If large amounts of vapor, or highly dangerous vapors are to be generated, such as in nitric acid or perchloric acid digestions, contact the MSMC Safety Officer for guidance. In addition, the fume hood should not be used with acutely toxic, microbiological agents or carcinogens. Some of the MSSM chemical hoods are commonly ducted and cannot handle acutely toxic materials safely. Biological Safety Cabinets and special glove boxes should be obtained for these operations. If the work you are doing may pose special hazards or if you are not certain of the hazards associated with use of the chemicals involved in the study, contact The MSMC Safety Officer (**x4SAFE**) before initiating any experiments.

IV. Chemical Waste Disposal

The MSMC Safety Officer provides a disposal service for chemical wastes, which is free to all research departments. The waste removal is contingent on the waste meeting the FDNY requirements and also detailed in the MSSM booklet, ***Waste Disposal Procedures***.

A laboratory desiring a waste drop-off will mark all containers as Waste and bring the chemicals to the Chemical Waste Room after notifying the MSMC Safety Officer, ext. 4-SAFE. The MSMC Safety Officer will schedule the drop-off upon receipt of the request.

The MSMC Safety Officer contracts with a hazardous waste disposal company to package and ship waste to permitted treatment, storage and disposal facilities in accordance with U.S. D.O.T., U.S. E.P.A. and N.Y.S. D.E.C. regulations. (See: US EPA's **SMALL LABORATORY GUIDE** ; http://www.epa.gov/sbo/labguide.htm).

Except for routine procedures in histology and microbiology during which stains are rinsed from slides, no chemical is to be disposed of down sinks, floor drains, toilets or other entrances to the domestic sewer lines or waste lines. This is a direct violation of US EPA regulations and can result in fines to the institution and to the person responsible.

No chemical waste is to be placed in the clear waste bags in the domestic waste cans in each room or in Red bags that are ONLY used for the disposal of pathological and biomedical waste. Any laboratory generating these bags of waste will have them returned for remediation.

Your cooperation in following the disposal procedures mentioned above, will not only make MSSM a safer place to work, but will help the environment in general by lessening the burden placed on that environment by improper waste disposal.

V. Chemical Spills

Report all spills to the MSMC Safety Officer, Immediately!

Spills of chemicals are not routine occurrences, and should be recognized as being potentially hazardous to all persons involved.

Do not attempt to clean up a spill of any chemical over 500 ml by yourself. With respect to very dangerous reagents, no attempt should be made at all to effect a clean up. You should make yourself knowledgeable as to the hazards associated with any chemical you are using by consulting the MSDS before using it, and know how to respond to a chemical spill.

a. Large Spills

Immediately evacuate the area, close the door, notify any persons in adjacent areas and call The MSMC Safety Officer at extension 47233:

~ Report chemical name(s) of spilled reagent(s)
~ Report approximate amount of chemical involved
~ Report location of spill by room number

Remain calm, leave the spill area but stay in a safe area near the spill where the MSMC Safety Officer can reach you and check your health status. (Report this location to the MSMC Safety Officer when calling in the incident).

If you have suffered an exposure to a chemical, and are feeling any symptoms as described on the MSDS, go to the MSMC Emergency Department immediately and tell the Emergency Department physicians you have been exposed to a chemical spill. (Supervisors should inform The MSMC Safety Officer of any staff requiring treatment in the Emergency Department). All employees should be aware of the location of the MSMC Emergency Department (GP B1) and the shortest route from their laboratory to the Emergency Department. Take the MSDS with you-the RTECS and CAS numbers can assist the physicians in obtaining treatment information. If someone is exposed to a spill and is unconscious, move them *if you can do so at no risk to yourself* and call the Provide all information they request. Call Security by telephone using “60” and give details about the incident.

It is advised that if you work with acutely toxic chemicals, allergens or sensitizers, that you prepare index cards with the chemical name(s) and brief descriptions of the health effects for each reagent you work and have them readily available on your person. These can be given to Emergency Department physicians, providing them with information that will facilitate prompt diagnosis and treatment. Contact The MSMC Safety Officer or the MSSM Biosafety Officer for guidance in preparing these cards.

The MSMC Safety Officer is trained in clean-up procedures and proper use of Personal Protective Equipment in accordance with OSHA and US EPA regulations. Do not subject yourself to an unnecessary exposure to a chemical reagent. Let The MSMC Safety Officer clean up the spilled material.

b. Small Spills

Small spills (500 mls or less) of dilute acids and bases can be handled by lab personnel, provided they use proper gloves, aprons, lab coats and eye protection doing so. Acid Spill Kits have been provided for this purpose in your laboratory. If you have any questions, contact The MSMC Safety Officer at extension 47233.

VI. Preventing Exposures

The purpose of the Chemical Hygiene Program is to minimize and or eliminate occupational exposures to all chemicals used within the research and clinical laboratory as much as possible.

There are several options used in controlling hazardous chemical exposures. Industrial hygienists recognize three main points at which exposures can be controlled, namely, **the Source, the Pathway, and the Receiver.**

a. **The Source** is the primary point to begin a control program. Substitution of hazardous chemicals with less hazardous chemicals can result in a significant exposure reduction. Using dilutions or prepared stocks produced by chemical suppliers reduces your exposure to more concentrated reagents. For example, Formalin (10%) can be purchased as a prepared solution eliminating the need to buy and dilute a Formaldehyde 37% w/v solution. Buying prepared Bouinn's fluid eliminates the need to buy, store and handle Picric acid. Buying smaller container sizes of chemicals reduces the amount of chemical involved in an accident.

b. **The Pathway** is the next point of control. If an exposure can be channeled away or blocked from an individual in some way, an exposure can be minimized or totally eliminated. The chemical fume hood is a good example of pathway control. Vapors and aerosols escaping from reagents are trapped and moved on air currents away from the source and the person manipulating the source. Lab coats, splash guards, face shields and goggles interrupt the direct pathway of liquids and solids that can become airborne and may splash on your exposed body parts.

c. **The Receiver** in some cases, a person can be isolated from the hazard instead of the hazard source or pathway being controlled. In an extreme example of this type of intervention, such as in a spill situation, the clean-up personnel wear self-contained breathing apparatus and full enclosure chemical protective suits, which effectively surround and contain the responder in a protective environment, while entering a hazardous environment.

On a daily basis, each person can use the same three approaches to control exposures in their own situation. The proper use of chemical fume hoods, covering measuring vessels with "Parafilm" while going through the steps of an experiment, using lab coats, gloves, face-shields or glasses, in appropriate combinations will result in reduced exposure to chemicals in the laboratory and should be carried out at all times. Using smaller containers and quantities of chemicals lessens the chance of a spill occurring. Consult with The MSMC Safety Officer if you have any questions about appropriate procedures to use in your specific work area.

In situations where acutely toxic, carcinogenic or tumorogenic chemicals will be used, consult The MSMC Safety Officer and the MSSM Biosafety Officer regarding the use of special enclosures. These chemicals require very specific engineering controls to eliminate all exposures to the reagent. Closed systems are often recommended--if not specifically required by OSHA with special waste handling procedures also required. A Standard Operating Procedure must be developed for these agents outlining risks and safety procedures and equipment to be used to counter the associated risks. Any plans to use such materials must be reported to the MSMC Safety Officer before initiation of the work so that proper safety and waste disposal procedures can be instituted.

The MSMC Safety Officer can assist in establishing safe handling procedures for any chemical used in the laboratory. Call The MSMC Safety Officer if you have any questions, if you are uncertain about appropriate safety measures, or if you feel you have not received adequate training in the safe handling of the materials with which you are working.

VII. Exposure Monitoring:

In appropriate situations The MSMC Safety Officer will monitor and evaluate exposures to chemicals in the workplace. This may be done to evaluate the success of a hazard control program, or to evaluate levels of exposures prior to designing a program.

Monitoring is accomplished through using direct reading tubes for "spot-checks", or sampling on charcoal or silica followed by processing and analysis by an independent environmental laboratory

The findings will be interpreted according to current, accepted industrial hygiene practices, and modifications in work practices will be made to correct potential over-exposures through the three management options described in Section VI above.

VIII. Inspections by The MSMC Safety Officer and MSSM Biosafety Officer

The MSMC Safety Officer and MSSM Biosafety officer will visit every laboratory in the School of Medicine within a given year to assure that safe work procedures are being employed in all work involving the use of chemicals. The cooperation of all employees (faculty, technical staff, students and other trainees) is essential if a safe work environment is to be maintained in the laboratory.

The inspection will be used to detect any deficiencies with respect to the Chemical Hygiene Plan, New York City Fire Department and US EPA regulations. Deficiencies will be noted and an evaluation of areas where retraining is necessary will be performed. All personnel in the laboratory in which the deficiencies occurred will receive on-site training on the nature of the hazard, detection of the hazard and prevention of the hazard, whether the deficiency is directly or indirectly related to the Chemical Hygiene Plan. A record of this training will be permanently retained on record. It is noted that the inspection will also cover other areas of safety addressed by the OSHA General Standards and the FDNY Fire Prevention Directive 3RCNY 10-01. (See Part 2 This booklet).

IX. Prior Approval for Use of Hazardous Materials

Faculty planning to initiate studies which will use allergens, toxins, known or suspected carcinogens or chemicals known to have significant toxic (i.e. a toxicity less than 500 mg/kg oral or inhalation route), must report these plans to the Institutional Biosafety Officer and obtain assistance in preparing a ***Standard Operating Procedure*** that covers all storage, handling and disposal issues ***before*** ordering these materials. Several of the toxins are regulated by the Laboratory Registration / Select Agent Transfer regulations of the CDC, and require registration with the CDC before purchasing or otherwise transferring these toxins. Refer to the ***MSSM Biosafety Manual*** http://www.mssm.edu/biosafety/manual/manual.pdf for the correct registration procedures.
(See: http://www.mssm.edu/biosafety/policies/prior approval.shtml).

Prepared by: Philip G. Hauck, MS, MSHS, CIH
03/2003

X. Bibliography

1. *"Chemical Substances Control: BNA Policy and Practice Series."*
The Bureau of National Affairs, Washington D.C. 1989

2. *"Guide For Safety in the Chemical Laboratory"*
Second Edition. Manufacturing Chemists Association
Van Nostrand, Rheinhold Company ,1972

3. *"Handbook of Laboratory Safety"*
Norman V. Steere, Editor. The Chemical Rubber Co,.
Cleveland. 1976

4. *"Industrial Ventilation--A Manual of Recommended Practice"*
18 Edition American Conference of Governmental Industrial Hygienists,
Lansing, Michigan. 1984

5. *"Prudent Practices for Handling Hazardous Chemicals in Laboratories"*
National Research Council, National Academy Press
Washington, D.C. 1981

6. **SMALL LABORATORY GUIDE** ; US EPA Website:
http://www.epa.gov/sbo/labguide.htm .

XI. APPENDIX 1: EXAMPLES of POTENTIALLY INCOMPATIBLE WASTE*

Many hazardous wastes, when mixed together with other waste or materials at a hazardous waste facility, can produce effects which are harmful to human health and the environment such as (1) heat or pressure, (2) fire or explosion, (3) violent reaction, (4) toxic dusts, mists, fumes, or gases, or (5) flammable fumes or gases.

Below are examples of potentially incompatible wastes, waste components, and materials, along with the harmful consequences which result from mixing materials in one group with materials in another group. The list is intended as a guide to owners or operators of treatment, storage, and disposal facilities, and to enforcement and permit granting officials, to indicate the need for special precautions when managing these potentially incompatible waste materials or components.

This list is not intended to be exhaustive. An owner or operator must, as the regulations require, adequately analyze his wastes so that he can avoid creating uncontrolled substances or reactions of the type listed below, whether they are listed below or not.

It is possible for potentially incompatible wastes to be mixed in a way that precludes a reaction (e.g. adding acid to water rather than water to acid) or that neutralizes them (e.g. a strong acid mixed with a strong base), or that controls substances produced (e.g. by generating flammable gases in a closed tank equipped so that ignition cannot occur, and burning the gases in an incinerator).

In the lists below, the mixing of a Group A material with a Group B material may have the potential consequence as noted.

GROUP 1-A	GROUP 1-B
Acetylene Sludge	acid sludge
Alkaline caustic liquids	acid and water
Alkaline cleaner	Battery Acid
Alkaline corrosive liquids	chemical cleaners
Alkaline corrosive battery fluid	Electrolyte, acid
Caustic wastewater	Etching acid liquid or solvent
Lime sludge and other corrosive alkalines	
Lime wastewater	Pickling liquor and other corrosive acids
Lime and water	Spent acid
Spent caustic	Spent mixed acid
	Spent sulfuric acid

Potential Consequences: Heat generation; violent reaction

GROUP 2-A	GROUP 2-B
Aluminum Beryllium Calcium Lithium Magnesium Potassium Sodium Zinc Powder Other reactive metals and metal hydrides	Any waste in Group 1-A or 1-B

Potential Consequences: Fire or explosion; generation of flammable hydrogen gas

GROUP 3-A	GROUP 3-B
Alcohols	Any concentrated waste in Groups1-A or 1-B
Water	Calcium Lithium Metal hydrides Potassium SO_2Cl_2, $SOCl_2$, PCl_3, $CH_3SiCCCl_3$ Other water-reactive waste

Potential Consequences: Fire, explosion, or heat generation; generation of flammable or toxic gases

GROUP 4-A	GROUP 4-B
Alcohols	Concentrated Group 1-A or 1-B wastes
Aldehydes Halogenated hydrocarbons Nitrated Hydrocarbons Unsaturated Hydrocarbons Other reactive organic compounds and solvents	Group 2-A wastes

Potential Consequences: Fire, explosion or violent reaction

GROUP 5-A	GROUP 5-B
Spent cyanide and sulfide solutions	Group 1-B
Potential consequence: generation of toxic hydrogen cyanide or hydrogen sulfide gas	

GROUP 6-A	GROUP 6-B
Chlorates	Acetic acid and other Organic acids
Chlorine	Concentrated mineral acids
Chlorites	Group 2-A wastes
Chromic acid	Group 4-A wastes
Hypochlorites	Other flammable and combustible wastes
Nitrates	
Nitric acid, fuming	
Perchlorates	
Permanganates	
Peroxides	
Other strong oxidizers	
Potential Consequences: Fire, explosion or violent reaction	

Source:"*Law, Regulations and Guidelines for Handling of Hazardous Waste "*; California Department of Health, February 1975

***40 CFR Chapter 1, Part 264**