SAFETY IN THE LABORATORY

As a junior officer, your basic responsibility is for the safety and well-being of your shipmates. The naval history of the last few years has included carrier fires, explosions in paint lockers and numerous other serious accidents with fatalities. In all of the cases investigated since 1970, the underlying cause was failure to follow prescribed safety practices. A number of Navy careers ended because of bad fitness reports arising from these events.

Working in a laboratory should be a safe experience. This will happen, however, only if certain precautions are followed without exception. The practice of safety requires (1) the desire on the part of the individual to protect himself or herself as well as those around him or her and (2) the need to rigidly follow a well-defined set of laboratory rules. The safety rules to be followed by all midshipmen in the Chemistry Department laboratories will be discussed by your instructor during the first laboratory class period of the semester. These rules are posted in the laboratory spaces and are outlined on the following pages of this manual. While it is the obligation of the instructor to explain these rules, it is the responsibility of everyone in the laboratory to follow the safety regulations. They will be rigidly and impartially enforced, with non-compliance resulting in the dismissal of the guilty party from the laboratory.

A. Safety Equipment

The location and use of the safety equipment in laboratory will be discussed by your instructor the first day that the class meets in the lab space. All midshipmen should become familiar with the proper use of the:

safety shower
eye-wash fountain
fire extinguisher
neutralizing solutions for spills

The location of the equipment is important, as well as when to use each piece of equipment.

Safety goggles for eye protection are to be worn by all midshipmen while in the laboratory. The instructor may decide to override this when all hood sashes are down. Goggles will be issued to each midshipman during the fall semester book issue. If a midshipman fails to bring the goggles to class, he or she will be sent back to Bancroft Hall to get the goggles.

Laboratory aprons are provided on the hooks outside each laboratory and are to be worn by all midshipmen while in the lab. A midshipman who is especially short can obtain a shortened apron by seeing their instructor. An apron which is too long and drags on the floor can be as much of a hazard as no apron at all.

B. Laboratory Do's and Don'ts

The following is a list of do's and don'ts which must be adhered to by all midshipmen.

1. If any ventilation hood sash in your laboratory is up, you must wear your approved chemical splash goggles. **Hood up – Googles on!**

2. **The laboratory stools belong to the lab islands.** They are not designed to be used by the hood – the stools are too wide to fit two per hood and though the passageways are wide, they are not wide enough to allow someone to pass easily by a stool that has someone sitting on it. You may only move them away from the island with instructor permission.

3. **The slide-out writing surfaces are to be stowed whenever not in use.** We have orange tape on the front top edge, but they are difficult to see when you have your goggles on and they are at a height that will maximize discomfort if you walk into it (I will not elaborate, but use your imagination.).

4. Bring only the necessary materials into the laboratory: lab manual, pencil/pen, calculator, graph paper, ruler, goggles and apron. Coats and covers should be left in the hallway on the hooks. Bookbags, briefcases, books, notebooks, menus, rate books, newspapers, etc., should be stowed below the island.

5. Do not touch chemicals with your hands. Spatulas and forceps have been provided for handling solid materials.

6. No wet chemicals should ever be placed on the islands or the pull-out writing surfaces. In addition, no stock solutions bottles are to go to individual lab stations. Midshipmen should take an appropriate container to the stock solution to obtain the needed amount.

7. **Do not eat or drink** in the laboratory. **Do not taste** any chemical. **Do not smell any chemicals directly.** Use your hand to waft the odor to your nose. **Wash your hands** before leaving lab.

8. Do not pipet solutions by mouth. Rubber pipet bulbs are provided at each lab station.

9. Do not put flammable liquids near an open flame.

10. When heating a test tube, make certain that the open end of the tube is directed away from other students. If overheating or superheating causes the contents to bump out, no one in the laboratory will be splashed.

11. When finished with your bunsen burner for a given portion of an experiment, turn it off. Be careful not to place lit burners under the shelf above the lab station.

12. Do not sit on the lab benches. We give you nice stools – use them and save your uniform from damage.

13. Do not engage in games or horseplay in the laboratory. Failure to follow this rule will result in immediate dismissal from the lab and subsequent conduct action.

14. Do not pour any chemical into a sink without authorization from the instructor.

16. All broken glassware should be reported to your instructor immediately. In most cases the instructor will deal with it as a minor cut on a Mid requires quite a bit of action, but a minor cut on an instructor can be dealt with at a lower level (See Section E below). If the instructor designates you to clean up, a dust pan and foxtail brush are located in each lab under the back sink to assist with cleanup. Broken glass should be disposed of in the specially marked receptacles.

18. Do all reactions, particularly those involving malodorous, noxious or dangerous chemicals, in a ventilation hood.

19. If a chemical gets on your skin, immediately wash the affected area with large quantities of water. The instructor should be notified, no matter how insignificant the incident might seem.

20. When pouring one liquid into another, do so slowly and cautiously. To dilute an acid, pour the acid into the water; never pour water into an acid.

21. No student shall be permitted to work alone in the lab. You may not do unauthorized experiments or variations of any experiment.

22. Exercise good housekeeping practices in the laboratory. Be sure that the lab benches remain free of clutter during the experiment. In the event of a spill, clean the area immediately. Be sure to use a wet sponge to wipe off the work station at the conclusion of the lab. In addition, all midshipmen should help police the shared areas of the lab for debris before dismissal.

23. Know what you are to do before entering the lab. Read the experiment carefully before coming to the lab. Be cautious and think about what you are doing. Use common sense.

C. "Material Safety Data Sheets (MSDS)" and "National Fire Protection Association (NFPA)" Labels

All midshipmen should become familiar with two safety items in particular. These are "Material Safety Data Sheets (MSDS)" and "National Fire Protection Association (NFPA)" labels. A "Material Safety Data Sheet" is a required document which describes a given, chemically-based material. While the actual format of the sheet might vary (see an example MSDS in Figure IA and IB), the information included on the sheet is prescribed by law and must comply with the Occupational Safety and Health Administration (OSHA) Hazard Communication Standard. Such information as label name, manufacturer, hazardous ingredients, physical and chemical characteristics and fire/explosion hazard data must be delineated in detail. Four other sections must be included. These deal with: reactivity; health hazards in the event of inhalation, ingestion or skin exposure; precautions for proper handling and disposal of the material; and protective clothing required while working with the substance.

Chemical manufacturers are required to supply a complete MSDS with any chemical purchased. The purchaser is required to maintain a file of these data sheets in an area accessible to those individuals working directly with the chemical. Such forms will be common-place in all working areas throughout Naval installations and as a result, all midshipmen should be aware of their existence and the types of information which they contain.

In addition to MSDS forms, all midshipmen should become conversant with the information encoded on the labels referred to as "NFPA" labels. These are diamond-shaped labels placed on bottles, cylinders, doors, cabinets, etc., in a conspicuous place to identify health, flammability and reactivity associated with the contents of the container. Health hazards are identified by a blue-coded area including a number from zero through four, with "4" indicative of a deadly hazard. In a similar fashion, flammability information is included by number on a red background and reactivity precautions are encoded in a yellow section. For these three sections, "0" indicates a normal or stable material and "4" indicates an extremely hazardous material. A fourth section of the NFPA label is a white section, reserved for designation of a specific hazard such as acid, corrosive or oxidizer. The information included on such labels and how the label is encoded is outlined in Figure II.

Material Safety Data Sheet

Identity (Trade Name As Used On Label)

Manufacturer

Address

Phone Number (For Information)

Emergency Phone Number Telex*

MSDS Number*

CAS Number*

Date Prepared

Prepared By*

Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that.

SECTION 1 - MATERIAL IDENTIFICATION AND INFORMATION

COMPONENTS — Chemical Name & Common Names (Hazardous Components 1% or greater; Carcinogens 0.1% or greater)	% *	OSHA PEL	ACGIH TLV	OTHER LIMITS RECOMMENDED
Non-Hazardous Ingredients				
TOTAL	100			

SECTION 2 - PHYSICAL / CHEMICAL CHARACTERISTICS

Boiling Point	Specific Gravity (H_2O = 1)
Vapor Pressure (mm Hg and Temperature)	Melting Point
Vapor Density (Air = 1)	Evaporation Rate (_____ = 1)
Solubility in Water	Water Reactive

Appearance and Odor

SECTION 3 - FIRE AND EXPLOSION HAZARD DATA

Flash Point and Method Used	Auto-Ignition Temperature	Flammability Limits in Air % by Volume	LEL	UEL

Extinguisher Media

Special Fire Fighting Procedures

Unusual Fire and Explosion Hazards

*Optional

Figure IA

SECTION 4 - REACTIVITY HAZARD DATA

STABILITY ☐ Stable ☐ Unstable	Conditions To Avoid

Incompatability (Materials to Avoid)

Hazardous Decomposition Products

HAZARDOUS POLYMERIZATION ☐ May Occur ☐ Will Not Occur	Conditions To Avoid

SECTION 5 - HEALTH HAZARD DATA

PRIMARY ROUTES OF ENTRY	☐ Inhalation ☐ Skin Absorption	☐ Ingestion ☐ Not Hazardous	**CARCINOGEN LISTED IN**	☐ NTP ☐ IARC Monograph	☐ OSHA ☐ Not Listed

HEALTH HAZARDS	Acute
	Chronic

Signs and Symptoms of Exposure

Medical Conditions Generally Aggravated by Exposure

EMERGENCY FIRST AID PROCEDURES - Seek medical assistance for further treatment, observation and support if necessary.

Eye Contact

Skin Contact

Inhalation

Ingestion

SECTION 6 - CONTROL AND PROTECTIVE MEASURES

Respiratory Protection (Specify Type)

Protective Gloves	Eye Protection

VENTILATION TO BE USED	☐ Local Exhaust	☐ Mechanical (general)	☐ Special
	☐ Other (specify)		

Other Protective Clothing and Equipment

Hygienic Work Practices

SECTION 7 - PRECAUTIONS FOR SAFE HANDLING AND USE / LEAK PROCEDURES

Steps to be Taken If Material Is Spilled Or Released

Waste Disposal Methods

Precautions to be Taken in Handling and Storage

Other Precautions and/or Special Hazards

NFPA Rating* Health___ Flammability___ Reactivity___ Special___	HMIS Rating* Health___ Flammability___ Reactivity___ Personal Protection___

*Optional

Figure IB

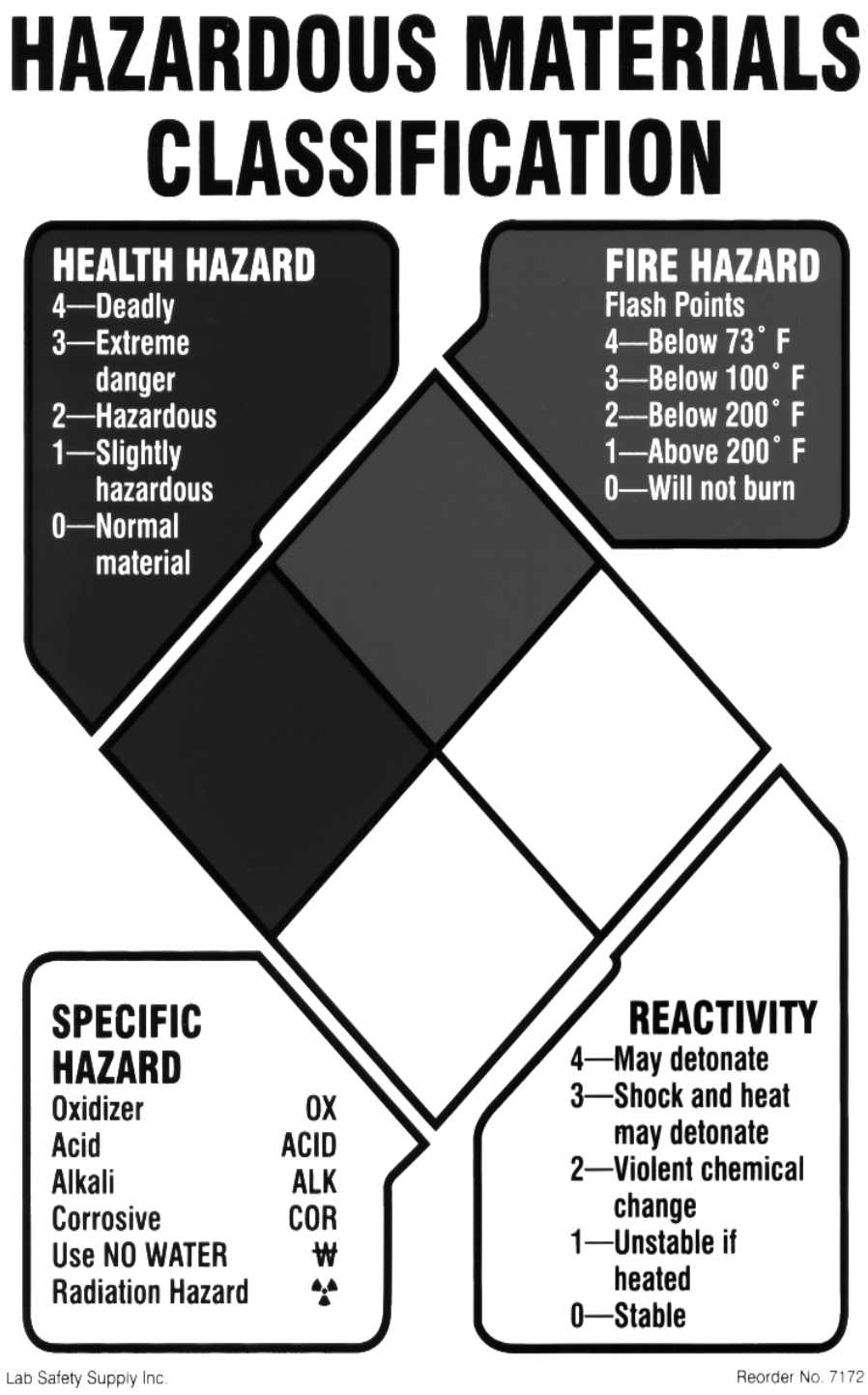
HAZARDOUS MATERIALS CLASSIFICATION
HEALTH HAZARD
4—Deadly
3—Extreme danger
2—Hazardous
1—Slightly hazardous
0—Normal material
FIRE HAZARD
Flash Points
4—Below 73° F
3—Below 100° F
2—Below 200° F
1—Above 200° F
0—Will not burn
SPECIFIC HAZARD
Oxidizer OX
Acid ACID
Alkali ALK
Corrosive COR
Use NO WATER ₩
Radiation Hazard
REACTIVITY
4—May detonate
3—Shock and heat may detonate
2—Violent chemical change
1—Unstable if heated
0—Stable
Lab Safety Supply Inc.
Reorder No. 7172

Figure II

D. Standard Operating Procedure of the Chemistry Department for Classroom or Laboratory Evacuation due to Fire, Fire Drill or Bomb Threat

In the event of a fire, fire drill or bomb threat during a class period, a quite distinguishable alarm will sound. In response to the alarm, the midshipmen will take the following actions.

1. All students will exit the class in an orderly and safe fashion. All students will form-up, by section, in a pre-designated area. This area will be specified by your instructor on the first day of class, each semester.

2. Section leaders will take a muster of the section as soon as possible after evacuation of the building. The section leaders should promptly report the results of the muster to the instructor.

3. No midshipmen will be allowed to leave the muster area until directed to do so by the instructor.

4. Instructors will advise the department chairman (or designate) of the results of the muster for his or her sections.

5. Fire department personnel will advise the instructors when it is safe to return to the building to resume the normal schedule of classes.

E. Standard Operating Procedure for Student Injuries in Laboratory

1. Students should report *all* injuries, no matter how small, to the instructor.

2. The instructor will use conservative judgment about the severity of the injury. For anything more serious than a paper cut the student will be sent, with escort, to the Medical Clinic.

3. If the injury is a chemical burn, the burned area is to be flushed with water for fifteen minutes before departure to Medical. During this time Medical is to be informed of the situation and given the Prep Room phone number. The MSDS for the specific chemical will be obtained by the instructor from the Lab Manager's office and this MSDS will be sent to Medical with the injured student and his/her escort.

4. The escort accompanying an injured student to Medical should deliver the Prep Room phone number to medical personnel at the reception desk, along with the MSDS, if appropriate. The escort should then report back to the instructor with any pertinent information.

5. The instructor will enter time and date of injury, a detailed description of the injury, and remedial steps taken in the injury log in Prep Room office. If appropriate, Form NDW-USNA-DME 1500/07 should be completed and sent to the Safety office within three days.

6. Follow up inquiry should be made by contacting Medical or the injured student.