SAFETY PROCEDURES AND PRACTICES MANUAL

Department of Aerospace Engineering and Engineering Mechanics

The University of Texas at Austin

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Department of Aerospace Engineering and Engineering Mechanics

SAFETY PROCEDURES AND PRACTICES MANUAL

TABLE OF CONTENTS

STATEMENT OF POLICY

It is the policy of the Department of Aerospace Engineering and Engineering Mechanics to make a continuous effort to reduce accidents and to maintain a healthy workplace by supporting an effective safety program.

Personnel include but are not limited to all graduate and undergraduate students, permanent and visiting faculty, staff, and anyone else authorized to use our facilities.

Safety is the joint responsibility of the department and its personnel. The department, on its part, strives to provide safe working conditions, full instructions covering safe working methods, and special equipment where necessary to protect employees against particular hazards.* All personnel on their part are expected to comply fully with all safety rules and regulations and to bring to the attention of their supervisors any unsafe conditions that they observe (See Section 7.0 - Addressing Safety Questions or Concerns).

All professors and supervisory personnel are directly responsible for seeing that activities under their control are carried out in a safe manner. All personnel under their supervision should:

1. Have been acquainted with all the safety rules and regulations applying to their operations and obey them at all times.

2. Understand fully the hazards of their assigned duties or those that are present in their work area.

3. Have been forewarned about any new hazards occasioned by a change in work assignment or job location.

4. Have been instructed not to start any new task or operate any unfamiliar equipment without full understanding of safety hazards.

5. Carry out all tasks or operate all equipment in a safe manner using all prescribed safety devices or equipment.

6. Have fulfilled all training requirements of the Office of Environmental Health and Safety.

In this regard, violations of the safety rules and regulations such as smoking in a no-smoking area, failure to wear safety glasses in areas where required, etc., will be considered serious.

The department's Safety Procedures and Practices will apply to all personnel in the ASE/EM department both on and off campus.

Personnel needing additional information or further explanation about any Safety Procedures and Practices should contact the appropriate advisor or supervisor. Advisors or supervisors desiring additional information or further explanation should contact the Department Chairman, the Department Safety Committee, or the Office of Environmental Health and Safety.

* If an item is required by either the Department or the Office of Environmental Health and Safety, it will be paid for by the Department.

1.0 ADHERENCE TO SAFETY PRACTICES AND POLICIES

The department intends to provide a safe work place and a clean environment. Safety, however, is an item that requires constant attention. The possibility of an accident is always present. Therefore, the wearing of proper work attire and Personal Protective Equipment (PPE) (i.e. - proper footwear, safety glasses, etc.) is required as a routine safety precaution.

The use of Personal Protective Equipment (PPE) and proper workplace attire is the responsibility of each individual. This Policy endeavors to provide a consistent means of ensuring that all personnel are afforded the maximum protection. Violations will be reported to the Safety Committee, the employee's supervisor, and the chairman. Corrective action is expected promptly.

2.0 DEVIATIONS FROM POLICY

Any request for deviation from these departmental policies and procedures shall be initiated by the supervisor in writing to the Department Safety Committee for consideration and approval.

3.0 SMOKING, DRINKING, AND EATING IN LABORATORIES

Smoking is prohibited by the University of Texas in any building on UT property. Eating, drinking, and the storing or preparing of food or beverages in laboratories are potentially dangerous to an employee's health and such practices are prohibited. By definition, laboratories include all areas where laboratory operations are carried out, including desk or open space areas not separated from laboratory areas by stationary floor-to-ceiling partitions. Eating, drinking, and preparation of food or beverages (tea or coffee making, warming food) will be permitted only in non-laboratory areas, subject to the following constraints:

1. All chemicals are absolutely prohibited from eating and drinking areas at all times.

2. Laboratory equipment or supplies may not be used for storage, preparation, or consumption of food or beverages.

3. No food or beverages may be stored together with chemicals, such as on the same shelves, in the same cabinets or refrigerators.

4.0 BICYCLES

Storage of bicycles in University buildings is prohibited by University regulations. They can restrict access in an emergency. Bicycles discovered during fire life safety inspections conducted by the Office of Environmental Health and Safety (OEHS) will be cited as deficiency and reported to the chairman.

5.0 SAFETY COMMITTEES

Safety in the Department of Aerospace Engineering and Engineering Mechanics is a top priority and is the joint responsibility of the department and its personnel. Therefore, all personnel have important roles to play in ensuring a safe working environment.

The primary responsibility for safety rests with the individual student, classified employee, and faculty member who will be assisted in this function by the Department Safety Committee, as required. The overall safety program of the Aerospace Engineering and Engineering Mechanics Department will be overseen by the Department Safety Committee.

The Department Safety Committee will help coordinate the overall safety program of the department. The role of the Department Safety Committee is as follows:

1. Establish objectives and expectations for the Department Safety Program.

2. Take action to encourage and support a positive attitude toward safety in the department.

3. Ensure that safety issues have the proper visibility and full faculty, administration and personnel involvement.

4. Provide a Safety Council for discussing safety problems and identifying constructive solutions.

5. Provide work groups to:

   a. perform quarterly housekeeping inspections
   b. perform semesterly equipment inspections of instructional laboratories
   c. perform annual detailed inspection of all laboratory and shop facilities (Graduate Safety Committee)

6. Monitor safety-related activities in the department and report findings to the Department Chair.

7. Provide an information base on safety matters for the department.

The Department Safety Committee will be made up of the following individuals:

1. Faculty Representatives (two minimum)

2. Staff Representatives (two minimum)

3. Representative(s) from the Office of Environmental Health and Safety

The Department Safety Council will be made up of the following individuals:

1. The Department Safety Committee members

2. Administrative Staff representative

3. Technical Staff representative

4. Graduate Student Safety Committee representative

5. AIAA representative (undergraduate)

6. Additional members selected by the Department Safety Committee

The Department Safety Committee will make policy recommendations for the department and shall report to the Department Chair. The operating procedures of the Department Safety Committee are established by the Committee itself.

In addition to the activities of the Department Safety Committee, each laboratory and shop will have a local safety program. A minimum laboratory safety program for research facilities shall consist of:

1. Quarterly housekeeping inspections

2. Annual detailed inspection (see 6.2a on page 5)

A minimum safety program for shop and instructional laboratories shall consist of:

1. Quarterly housekeeping inspections

2. Equipment inspections at beginning of each semester

6.0 SAFETY INSPECTIONS

In accordance with the policy of the department to support an effective safety program and make a continuous effort to reduce accidents, a safety inspection program has been established. The objectives of this program are to create uniform safety standards throughout the department and to allow for occasional safety inspections of each laboratory/shop by departmental personnel from other laboratories/shops. Fresh input from personnel not involved in the day-to-day activities of a particular laboratory/shop should strengthen our safety program and further reduce the potential for accidents. An outline for the execution of the program is presented below:

1. Safety Inspection Team

    a. Graduate Student Safety Committee captain and assistants

    The Safety Inspection Team will be responsible for scheduling and coordinating all phases of the inspection program.

2. Inspection Procedure

    a. Annual Inspection. Each laboratory/shop will be inspected by the Inspection Team once per year.
    b. The Inspection Team will be guided by the supervisor for the laboratory/shop to be inspected.
    c. The Inspection Team will use the department “Safety Inspection Form” as the Standard Operating Procedure (SOP).

        NOTE: See following pages for copy of Safety Inspection Form.

3. Follow-up Procedure

    a. Corrective action is expected to be initiated as soon as possible. Written confirmation that corrective action has been completed should be submitted to the Laboratory supervisor - within two weeks of notification.

Copies of the Inspection and Follow-up confirmation will be filed with the Department Safety Committee.4. During the quarterly inspections the Emergency Instructions Pocket and the Safety Information Rack will be examined for the following minimum contents.

The Emergency Instructions Pocket should contain:

1. Cover Sheet with “Emergency Instructions Pocket” visible.
2. Contents list (list of all sheets in Pocket).
3. Emergency Instructions Sheet.
4. Evacuation Map for floor or building.
5. Completed Emergency Information Form.
6. Completed Hazard Evaluation Checklist.
7. Completed Hazardous Chemical and/or Compressed Gas Summary Sheet.
8. Selected Material Safety Data Sheets (MSDS).
9. Equipment Emergency Shutdown Procedures.

The Safety Information Rack should contain (in the following order):

Top Rack

1. Safety Procedures and Practices Manual.

Middle Rack

2. Contents list (list of all information in Rack).
3. Completed Emergency Information Form.
4. Accident or Near Miss Incident Report Form.
5. Last completed Safety Inspection Form.
6. Information on location of Material Safety Data Sheets (MSDS).
7. Equipment Emergency Shutdown Procedures.
8. Floor Map
9. Emergency Instruction Sheet

Bottom Rack

10. Request for Disposal forms and tags.
11. OEHS Hazard Communication Program booklet.
12. OEHS MSDS Pocket dictionary.
13. OEHS Laboratory Safety Manual.
14. Current OEHS newsletter
15. OEHS Safety Training Checklist

The University of Texas at Austin
Department of Aerospace Engineering and Engineering Mechanics

SAFETY INSPECTION FORM

Building: _____ Room: _____ Inspection Date: _____

Responsible Person(s): _____ Inspected by: _____

_____ _____

_____ _____

_____ _____

_____ _____

S = Satisfactory **N** = Needs Improvement **N/A** = Not Applicable

Personal Protective Equipment

Available				Used		
S	N	N/A		S	N	N/A
_	_	_	Eye Protection	_	_	_
_	_	_	Gloves	_	_	_
_	_	_	Respirators	_	_	_
_	_	_	Aprons	_	_	_
_	_	_	Lab Coats	_	_	_
_	_	_	Hearing Protection	_	_	_
_	_	_	Safety Shoe Guards	_	_	_
_	_	_	Other: _____	_	_	_

Facility

S	N	N/A	
_	_	_	Exit doors unobstructed
_	_	_	Minimal "storage" of items
_	_	_	Uncluttered laboratory
_	_	_	Emergency information sheets at entrance
_	_	_	Eyewash unobstructed
_	_	_	Eyewash tested
_	_	_	Shower unobstructed
_	_	_	Shower tested
_	_	_	Fire Extinguisher(s) in proper place
_	_	_	unobstructed
_	_	_	pin intact and seal not broken
_	_	_	fully charged (if not call OEHS (1-3511) for recharge)
_	_	_	Random question: Where is nearest fire extinguisher?

Additional Comments:

Facility (continued)

S	N	N/A	
_	_	_	First Aid Kit(s) in proper place
_	_	_	properly stocked
_	_	_	Random question: Where is nearest first aid kit?
_	_	_	Add 1 quart of water to each drain monthly
_	_	_	Working flashlight available?
_	_	_	SHARPS container available?
_	_	_	Random question: Do you feel you hac appropriate training for your job?
_	_	_	All lab personnel have fulfilled all training requirements on the OEHS "Safety Training Checklist"
_	_	_	Is HAZCOM "Employee Notification Form" posted (one per floor?)

Chemical

S	N	N/A	
_	_	_	Fume hoods not obstructed or cluttered
_	_	_	Check flow rate of fume hood
_	_	_	No food in refrigerators containing chemicals
_	_	_	Material Safety Data Sheets readily accessible
_	_	_	Random question: Can you find the MSDS for this chemical?
_	_	_	No flammable chemicals in non-explosion-proof refrigerators
_	_	_	All containers labeled with contents
_	_	_	Chemical containers adequate and spill protected
_	_	_	Incompatible chemicals separated
_	_	_	Gas cylinders properly secured
_	_	_	Caps or regulators on cylinders
_	_	_	Chemical waste containers properly labeled
_	_	_	No excess (over 55 gallons) chemical waste
_	_	_	All liquid-containing tubing inspected
_	_	_	All gas-containing tubing inspected

Radiation

S	N	N/A	
_	_	_	"LASER IN USE" signal available
_	_	_	LASER radiation warning sign posted

Electrical

S	N	N/A	
_	_	_	No frayed cords or exposed electrical contacts
_	_	_	Electrical equipment properly grounded
_	_	_	No overloaded circuits

Mechanical

S	N	N/A	
_	_	_	Machinery has guards over moving parts

Additional Comments:

7.0 ADDRESSING SAFETY QUESTIONS OR CONCERNS

If anyone (faculty, staff, student, or visitor) has a safety question or concern, PLEASE complete a "Safety Suggestion or Concern" form and submit it to the Department Safety Committee or a Council member. It can also be turned in to the Department Mail Room (WRW 222). See form on following page. Copies are available from floor secretaries or the Department Mail Room (WRW 222) or the Safety Suggestion/Concern Box on the second floor, south wall of WRW or PRC Building 7 (Wind Tunnel Labs) Room 6 lunchroom.

SAFETY COUNCIL
SAFETY SUGGESTION/CONCERN FORM

ITEM # :_____
Descriptive Key:
Electrical/Mechanical/Chemical
(Circle One)

Contributors Name: _____

Reporting Date: _____

Safety Item Description:

Possible Solution Options:

RETURN COMPLETED FORM TO SAFETY COUNCIL VIA
SAFETY SUGGESTION BOX OR DEPARTMENT MAIL ROOM (WRW 222)

8.0 FIRE, EXPLOSION, ESCAPE OF FLAMMABLE GAS

In the event of an emergency such as fire, explosion, escape of flammable gas, etc., the person discovering such emergency shall take the appropriate actions outlined in the EMERGENCY INSTRUCTIONS – FIRE OR FLAMMABLE GAS on the following page:

EMERGENCY INSTRUCTIONS

Is the situation immediately health or life threatening?

YES

SPILL / LEAK / RELEASE

- Use safety shower or eyewash - remove affected clothing and rinse for 15 minutes
- Shut doors to the spill area
- Evacuate the area, if necessary
- Contact the Office of Environmental Health and Safety at 1-7137 (or 1-2020 after work hours)
- Meet responders at main entrance to building
- Contact your supervisor
- Prepare a short summary of incident and file with Departmental Safety Committee

MEDICAL EMERGENCY

- Administer First Aid while someone calls 9-911 (Austin Emergency Services) from UT phone
- Report the incident to your supervisor
- Contact UTPD at 911
- Contact the Office of Environmental Health and Safety at 1-3511 (during work hours)
- Meet the responders at main entrance to building
- Prepare a short summary of incident and file with Departmental Safety Committee

FIRE OR FLAMMABLE GAS

- Evacuate the area, if necessary
- Shut doors to the area and alert others
- Pull the nearest fire alarm and call 9-911 from UT phone
- Contact your supervisor
- Contact UTPD at 911
- Contact the Office of Environmental Health and Safety at 1-7137 (or 1-2020 after work hours)
- Meet the responders at main entrance to building
- Prepare a short summary of incident and file with Departmental Safety Committee

NO

MINOR SPILL / LEAK / RELEASE

- Alert your neighbors
- Call the Office of Environmental Health and Safety at 1-7137 for advice if needed
- Follow steps in the Office of Environmental Health and Safety's Laboratory Safety Manual, dated February 1995, or later, or in spill kit
- Contact your supervisor
- Prepare a short summary of incident and file with Departmental Safety Committee

MEDICAL INCIDENT

- Administer First Aid to victim
- Report the incident to your supervisor
- Contact the Office of Environmental Health and Safety at 1-3511
- Prepare a short summary of incident and file with Departmental Safety Committee

FIRE

- Use extinguisher as appropriate for fire
- Contact the Office of Environmental Health and Safety at 1-3511 (or 1-2020 after work hours)
- Report the incident to your supervisor
- Prepare a short summary of incident and file with Departmental Safety Committee

NOT SURE?

ODD ODOR?

- Report the incident to your supervisor
- Contact the Office of Environmental Health and Safety at 1-7137 (or 1-2020 after work hours)
- Stay to inform the Office of Environmental Health and Safety response personnel
- Prepare a short summary of incident and file with Departmental Safety Committee

POSSIBLE FIRE?

- Report the incident to your supervisor
- Contact the Office of Environmental Health and Safety at 1-3511 (or 1-2020 after work hours)
- Stay to inform the Office of Environmental Health and Safety response personnel
- Prepare a short summary of incident and file with Departmental Safety Committee

9.0 EMERGENCY/EVACUATION ALARM PROCEDURE

Whenever the EMERGENCY/EVACUATION ALARM sounds in a building, **all personnel shall evacuate the building immediately. Do not use elevators to exit.** Personnel shall leave by the nearest exit unless otherwise directed by Emergency personnel. The person pulling the alarm must follow the procedure listed on the **EMERGENCY INSTRUCTIONS** on the previous page. Evacuation of guests is the responsibility of the host.

All personnel are to remain outside the building at a safe distance of **no less than 150 feet** until the Police or Fire Chief indicates the building is safe to reenter.

NOTE: See maps in Appendix E for evacuation routes. BE PREPARED! Know your exit(s).

10.0 AFTER-HOURS EMERGENCIES AND UNATTENDED OPERATIONS PROCEDURES

After-Hours Emergencies: Detailed below are procedures regarding after-hours laboratory emergencies and alarms for the detection of laboratory equipment malfunction.

1. Installation of Equipment Alarms: Prior to the installation of equipment alarms, the laboratory supervisor should consult with the Office of Environmental Health and Safety on the most appropriate alarm system to be installed.

2. Emergency Information Forms (see following page): To advise laboratory personnel and service/facilities personnel of equipment alarms and other laboratory hazards.

    a. Each laboratory will post emergency information in the Emergency Instructions Pocket on the outside of the laboratory entrance door.

    b. If no equipment alarms or potential hazards exist, these facts will also be posted.

    c. During monthly laboratory safety inspections, inspectors will check for the presence of emergency information at the entrance of each laboratory.

3. Reporting an After-Hours Emergency: If a person observes an emergency laboratory situation immediately health or life threatening, refer to the EMERGENCY INSTRUCTIONS on page 17.(also printed on the back cover) and be prepared to provide the following information:

    a. Location, including building and room number.

    b. Names listed on the emergency information sheet.

    c. The extension from where they are calling.

    d. The nature of the emergency.

    e. After calling the emergency number you should call the names listed on the Emergency Information sheet in the Emergency Instruction Pocket.

4. Equipment Alarm - Call person listed on the Emergency Information Form.

    NOTE: Unattended Operations: To minimize the potential hazards associated with the unattended operation of laboratory equipment/systems, an emergency shutdown procedure should be posted for each piece of major equipment and included in Emergency Instruction Pocket.

EMERGENCY INFORMATION FORM

(Place into Emergency Instructions Pocket at your lab entrance.)

Date:

Name of persons in charge of laboratory or project. (Name at least three persons, in decreasing order of responsibility and familiarity with the specific potential hazard.)

Name 1. _____ Office Phone _____

Home Phone _____

Name 2. _____ Office Phone _____

Home Phone _____

Name 3. _____ Office Phone _____

Home Phone _____

Any Alarm(s) in use?
(Describe)

Type of potential hazard.

11.0 UTILITY OUTAGE

All planned utility (water, steam, power) outages should be announced in a timely manner so that laboratory work can be planned accordingly. It is essential that personnel be prepared to react to an unexpected outage in a controlled manner.

Pre-planning:

1. Each laboratory will establish procedures to secure the area based on the nature of the equipment and materials in use and insert them in the Emergency Instructions Pocket. This is especially important in the case of an electrical outage where hazardous materials could be released.
2. Each laboratory will purchase and maintain a functioning, readily accessible flashlight compatible with the area.

During outage:

1. During a water outage no experiments that could result in a SPILL/LEAK/RELEASE or MEDICAL EMERGENCY will be run, since eyewashes and safety showers are inoperable.
2. Laboratory personnel will implement procedures for securing any fail-safe environment. These should include:
   a. Turning off all electrical equipment and utilities (cooling water, vacuum, air, gas) which could create a hazard when power is restored. This does not apply to any equipment with back-up generators (BUG), or uninterrupted power supply (UPS).
   b. Lowering chemical fume hood sashes as far as possible. This should be done in a timely manner since ventilation systems will not be operational.

12.0 INJURIES AND SUDDEN ILLNESS

All Aerospace Engineering and Engineering Mechanics personnel must be aware of the location of the eye wash stations, showers, and first aid kits. This information will be in the laboratory's Safety Information Rack as well as the Emergency Instructions Pocket kept at the main entrances to the building and floor. Personal injury or illness of an emergency nature requires, primarily, the rapid attention of competent medical personnel. The person witnessing or sustaining a disabling injury or illness should follow the EMERGENCY INSTRUCTIONS – MEDICAL EMERGENCY on the following page (also printed on the back cover).

12.1 Administering First Aid

Gloves must be worn whenever first aid is administered in situations where there is a potential for contact with blood. Any materials with a significant amount of blood contamination should be turned over to the Office of Environmental Health and Safety (OEHS) for proper disposal.

a. Cleanup of blood spills should be handled by Environmental Health and Safety (471-3511).
b. Anything more than a few drops of blood should be disposed of in the biohazard bags, provided in the safety kits.
c. All biohazard bags should be disposed of through the Environmental Health and Safety (471-3511).

EMERGENCY INSTRUCTIONS

Is the situation immediately health or life threatening?

YES

SPILL / LEAK / RELEASE

- Use safety shower or eyewash - remove affected clothing and rinse for 15 minutes
- Shut doors to the spill area
- Evacuate the area, if necessary
- Contact the Office of Environmental Health and Safety at 1-7137 (or 1-2020 after work hours)
- Meet responders at main entrance to building
- Contact your supervisor
- Prepare a short summary of incident and file with Departmental Safety Committee

MEDICAL EMERGENCY

- Administer First Aid while someone calls 9-911 (Austin Emergency Services) from UT phone
- Report the incident to your supervisor
- Contact UTPD at 911
- Contact the Office of Environmental Health and Safety at 1-3511 (during work hours)
- Meet the responders at main entrance to building
- Prepare a short summary of incident and file with Departmental Safety Committee

FIRE OR FLAMMABLE GAS

- Evacuate the area, if necessary
- Shut doors to the area and alert others
- Pull the nearest fire alarm and call 9-911 from UT phone
- Contact your supervisor
- Contact UTPD at 911
- Contact the Office of Environmental Health and Safety at 1-7137 (or 1-2020 after work hours)
- Meet the responders at main entrance to building
- Prepare a short summary of incident and file with Departmental Safety Committee

NO

MINOR SPILL / LEAK / RELEASE

- Alert your neighbors
- Call the Office of Environmental Health and Safety at 1-7137 for advice if needed
- Follow steps in the Office of Environmental Health and Safety's Laboratory Safety Manual, dated February 1995, or later, or in spill kit
- Contact your supervisor
- Prepare a short summary of incident and file with Departmental Safety Committee

MEDICAL INCIDENT

- Administer First Aid to victim
- Report the incident to your supervisor
- Contact the Office of Environmental Health and Safety at 1-3511
- Prepare a short summary of incident and file with Departmental Safety Committee

FIRE

- Use extinguisher as appropriate for fire
- Contact the Office of Environmental Health and Safety at 1-3511 (or 1-2020 after work hours)
- Report the incident to your supervisor
- Prepare a short summary of incident and file with Departmental Safety Committee

NOT SURE?

ODD ODOR?

- Report the incident to your supervisor
- Contact the Office of Environmental Health and Safety at 1-7137 (or 1-2020 after work hours)
- Stay to inform the Office of Environmental Health and Safety response personnel
- Prepare a short summary of incident and file with Departmental Safety Committee

POSSIBLE FIRE?

- Report the incident to your supervisor
- Contact the Office of Environmental Health and Safety at 1-3511 (or 1-2020 after work hours)
- Stay to inform the Office of Environmental Health and Safety response personnel
- Prepare a short summary of incident and file with Departmental Safety Committee

13.0 ODORS OF UNKNOWN IDENTITY OR ORIGIN

In the event of the detection of an odor of unknown identity or origin, any person detecting such odor shall take immediate action. That person should consult co-workers in an attempt to identify the odor and its source. If the odor is suspected of being hazardous, an immediate attempt must be made to locate and eliminate the generation of the odor. If a hazardous odor source cannot be eliminated, all persons should leave the area. Emergency procedures, outlined in the EMERGENCY INSTRUCTIONS - SPILL/LEAK/RELEASE - ODD ODOR? on the preceding page (also printed on the back cover) should be followed.

NOTE: To prevent odors from the Sanitary Sewer System migrating back into the work area, water (approximately 1 quart or 1 liter) should be added to all drains once per month in order to fill the trap (see below).

14.0 ACCIDENT & NEAR-MISS INCIDENT REPORTING AND ACCIDENT INVESTIGATION

Safety and the prevention of accidents requires constant attention; the possibility of an accident is always present. Everyone should constantly strive to prevent accidents. The purpose of the procedures and practices described herein is to prescribe a course of action in the event of an accident or a near-miss incident.

Accident Reporting

An accident is any occurrence which results in personal injury or illness. Accident reporting is important for several reasons:

1. Reporting ensures that any injured/ill person receives prompt medical attention.

2. The University may be required by law - the Occupational Safety and Health Administration (OSHA) to report certain accidents.

3. Accident reports can be used to learn how to prevent future accidents

4. If serious complications result from an accident, the report serves as a basis for compensation.

The primary goals are to safeguard human health and to avoid another accident. Do not fail to report any accident/or near miss incident because you think it may spoil the safety record.

In the event of an accident:

1. Personal injuries and illness of an emergency nature, where a quick response of medical assistance is required, should be handled according to the EMERGENCY INSTRUCTIONS - MEDICAL EMERGENCY (see page 17, also printed on back cover).

2. All accidents or near miss incidents must be reported promptly to the Departmental Safety Committee and the immediate faculty supervisor. Any illness suspected to be job related should be reported as soon as possible. Use the "Accident or Near Miss Incident Report" form, as shown on page 21. Copies of this form should be kept in the Safety Information Rack.

Accident Investigation

When an accident has been reported, the faculty supervisor and persons involved are responsible for taking appropriate action to prevent recurrence. In the case of a serious incident involving a lost-time injury, OSHA-recordable injury, evacuation of the building, a formal investigation of the incident, and written report must be prepared within two weeks of the event, in order to:

1. Obtain a complete understanding of the details and likely causes.

2. Communicate to the rest of the department any information that could eliminate the recurrence of a similar event.

The following information should be included in the investigative report:

1. Description of the accident/or near miss incident - how it occurred and what emergency actions were taken

2. Immediate cause - unsafe act or conditions

3. Basic cause - specific personnel or job factors

4. Corrective actions - either temporary or permanent actions

This report will be prepared, with the cooperation the Safety Committee and supervising professor, by the personnel involved.

ACCIDENT OR NEAR MISS INCIDENT REPORT
The University of Texas at Austin
Department of Aerospace Engineering & Engineering Mechanics

CASE # :_____

Type of Activity/Condition/Incident: Accident/Near Miss _____

_____

_____

Location: _____ Date: _____ Time: _____

Reported by: _____ Respondent(s): _____

Other Witnesses:

_____

Description (cause/material/source/circumstances): _____

_____

_____

_____

Were there any injuries associated with this incident? YES NO

If yes, please elaborate:

_____

_____

Were there any evacuations? YES NO If yes, how many? _____

How long did it last (in minutes/hours)? _____

Approximately how many people were evacuated? _____

When was clean-up complete? Date: _____ Time: _____

Date of Report: _____ Signed: _____

1. Safety Committee _____
2. Department _____
3. Department Files

NOTE: IF INJURY OCCURS, NO MATTER HOW MINOR,
AN EMPLOYERS FIRST REPORT OF INJURY MUST BE FILED.
CONTACT THE ASE/EM BUSINESS OFFICE.

15.0 HAZARD EVALUATION CHECKLIST FOR NEW AND EXISTING RESEARCH AND/OR DEVELOPMENT OPERATIONS

A hazard evaluation checklist is to be prepared and reviewed for each new and existing laboratory operation. Each individual performing the operation for the first time will be reviewed on their project and proposed procedures. The checklist must be reviewed by the supervising professor. One copy is to be kept in the laboratory's Safety Information Rack so that another person can review the checklist before performing the operation for the first time and one copy in the Emergency Instructions Pocket outside the laboratory. The following checklist provides a guideline, to be supplemented by specific items for each laboratory.

Implementation of the hazard evaluation is the direct responsibility of the responsible faculty member.

Hazard Evaluation Checklist for New and Existing Research and/or Development Operations

1. Summary of operation.

2. Chemistry: reactions, heats and rates of reactions, material balances, expected and possible products, and by-products.

3. Equipment list: includes ratings, materials of construction, compatibility.

4. Operating procedure: start-up, shutdown, waste disposal.

5. Safety: summary of potential hazards. (Add additional potential hazards as necessary)

Hazard	Yes	No	Type	Precautions
Toxic Materials				
Corrosive				
Flammable				
Explosive				
Radioactive				
High Temperature				
High pressure				
Exothermic				
Vacuum				
Electrical Shock				
Moving Equipment				

6. What happens when something goes wrong?

   - loss of power, water, air, etc.
   - runaway reactions

7. Material Safety Data Sheets (MSDS's) including Threshold Limit Values (TLV's).

8. Signature of supervising professor and operators.

16.0 HAZARDOUS CHEMICAL AND/OR COMPRESSED GAS INVENTORY WORKSHEET AND SUMMARY

A Hazardous Chemical and/or Compressed Gas Inventory Worksheet and its accompanying Summary Sheet are to be completed for each laboratory, shop or research area. The Inventory Summary Sheet is to be kept up to date as new chemicals or compressed gases are added or deleted from your inventory. A copy of the Summary Sheet is to be kept in the Emergency Instructions Pocket. See Appendix D for a copy of the worksheet and summary including instructions.

17.0 USE OF LABORATORY HOODS

Laboratory work involving the possible release of fumes, gases, or vapors must be performed inside a hood with the exhaust fan running. Hoods are not to be used for dust control, as dust will settle and accumulate in the building's air supply system. Hoods are meant to contain accidental releases, NOT as a method of material disposal. If, in a normal course of operations, a toxic or noxious substance is expected to be released on a regular basis, the experimenter should contact the Chairman of the Department Safety Committee with a plan to remove (scrub or adsorb) the substance rather than release directly to the environment.

Hood air flow rates will be monitored on a regular basis to verify proper hood operation. As part of the Monthly Safety Inspection, individual researchers will check the air flow rate of the hoods in their areas of responsibility. In addition, an annual check of the hood air flow rate will be performed by the Office of Environmental Health and Safety (OEHS) personnel.

The following guidelines describe proper hood operation:

1. Whenever possible keep the sash lowered and the glass doors closed so as to maximize containment and air flow rates, and also to provide a protective barrier.

2. Keep hoods clean, free of unnecessary clutter, and unobstructed at all times. Keep air slots in the hood free from obstruction by apparatus or containers. *Do not use a hood as a storage unit.*

3. Use an appropriate barricade if there is a chance of explosion or eruption.

4. Do not place one's head inside the hood when toxic or noxious substances are likely to be generated unless wearing proper respiratory equipment.

5. Inspect the hood sash before use. If the sash fails to operate properly, contact your supervisor so that corrective maintenance can be requested. Keep the sash window clean and clear.

6. Avoid placing electrical receptacles and outlet strips in the hood. If placement of such electrical outlets in the hood is necessary, use a plastic safety socket insert.

7. If possible keep all equipment in the hood a sufficient distance away from the sash so that it can be completely closed. As a reminder, mark a line behind the sash a minimum of 6 inches with colored tape. All bulky equipment (water baths, heating mantels, and large distillation/receiving flasks) that will significantly block air flow in the hood should be elevated at least two inches off the counter to allow air movement below.

8. Where toxic or waste substances are routinely used, prepare an emergency plan that specifies actions to be taken in the event of unexpected occurrences such as a fire, explosion or ventilation failure in the hood.

9. Adjust air baffle intakes for light or heavy gases only if qualified to do so. If you wish to be qualified, contact the Office of Environmental Health and Safety for training.

18.0 PREVENTION OF BACK INJURY

Improper lifting and transporting of objects are primary causes of on-the-job back injuries. A back injury may result in a lengthy disability. If an injury does occur, an "Accident or Near Miss Incident Report" form (see page 21) should be immediately filed with your supervisor and the Department Safety Committee so the proper Workman's Comp forms can be submitted.

Physical Condition

1. Consider your overall strength and know your physical limitations. Be particularly careful in lifting if you have a prior history of back problems.

2. Obtain assistance, especially for lifting heavy or awkward loads, and make use of any equipment, such as two-wheel hand trucks or four-wheeled carts.

3. Do not work for long periods of time in a bent-over position. When standing for a long time in one place, stand with one foot up (e.g. resting one foot on a small platform) and your back straight.

4. When either standing or sitting in the same position for a long period of time, take periodic stretch breaks.

5. Items should be stored in such a manner as to make them retrievable with the least amount of effort. Heavy and large items should be kept near ground level, preferably no higher than 12´´ above the floor. If shelves at various heights are used, these should be stocked also with the heavier items on the lower shelves.

Lifting Technique

1. Get a firm footing. Put one foot a little ahead of the other, feet no farther apart than your shoulders, and toes pointing slightly outward.

2. Bend at the knees. Squat as close as possible to the load. Keep your back straight, nearly vertical. Tuck in you chin and tighten stomach muscles.

3. Lift with your legs. Draw the load close to the body to minimize the strain on your back.

4. Keep your back upright. Avoid arching the back during lifting and <u>never</u> twist your back to make a turn. To turn, move <u>only</u> your legs and feet.

5. Squat to set down the load. Ease it onto one corner or on blocks to prevent pinching your fingers.

Note: Check the weight of the load before you lift. Obtain assistance if the load is too heavy to lift comfortably, or because of its bulk. If forward vision is obstructed by the load use appropriate two wheel hand trucks or four wheel carts. If additional help is needed, contact the Departmental Mail Room (1-4008) for assistance.

Hand Truck

Four wheeled trucks are recommended for maximum stability. For lighter loads, a two-wheeled truck may be used. The following procedure is recommended:

1. Keep the center of gravity of the load as low as possible. Place heavy objects below lighter objects, in the center of the cart.

2. It is very important to place the load so it will not slip, shift, or fall. Load only to a height that will allow a clear view ahead.

3. Let the truck carry the load; the operator should only balance and push. Do not pull trucks unless they have a fifth wheel and a handle designed for pulling.

4. When going down an incline, keep the truck ahead. When going up, keep the truck behind. Maintain control at all times. Never walk backwards.

19.0 SAFE HANDLING OF CHEMICALS

19.1 Abstract

Maintenance of a safe working environment is the responsibility of the department and its employees. The Department strives to provide safe working conditions, full instructions covering safe working methods, and special equipment where necessary, to protect personnel against particular hazards. All personnel are expected to comply fully with all safety rules and regulations, and bring the attention of the appropriate supervisors any unsafe conditions which they observe (see Section 7.0).

Nowhere are the above points more important than in the safe handling of chemicals. Nearly all chemicals are harmful to humans to some extent. Personnel should not assume that a chemical is harmless just because it does not produce an immediate and noticeable injury. Particular care should be taken to avoid chemical vapors (handle chemicals in a hood), accidental swallowing or direct contact with the materials. Careless handling of chemicals, whether they be acids, bases, solids, liquids, or gases can create real health hazards.

This section is divided into five general topics:

- Working safely with chemicals
- Labeling/tagging of chemicals
- Storage of chemicals
- Transport of chemicals on site
- Waste disposal of chemicals

These topics cover the safe handling of chemicals from the time they are received in the laboratory until they are taken for disposal. A more detailed breakdown of each section is given in the Table of Contents.

19.2 Working Safely with Chemicals

19.2.1 Safe Handling of Chemicals

Before handling any chemicals, it is the responsibility of each individual and supervisor to determine the potential hazards involved by:

1. Obtaining the Material Safety Data Sheet (MSDS) for the chemical and assuring that all personnel who work with the chemical understand its properties and are able to use prudent work procedures as indicated in the Material Safety Data Sheet (MSDS). Material Safety Data Sheets (MSDS's) are also available in the Office of Environmental Health and Safety (OEHS) or on UTCAT.

2. Participating in Texas Hazard Communication Act (Right-to-Know Seminars), offered by the Office of Environmental Health and Safety.

3. Assuring that all chemical containers carry adequate hazardwarning labels.

19.2.2 Safe Handling of Toxic Chemicals

If the Material Safety Data Sheet (MSDS) indicates the chemical you are working with is an allergen, embryotoxic mutagen, carcinogen, teratogenor generally toxic, the following guidelines should be followed. (See Appendix A for definitions).

1. Working with Allergens and Embryotoxins.

   a. Allergens (examples: diazomethane, isocyanates, dichromates): Wear suitable gloves to prevent hand contact with allergens or substances of unknown allergenic activity.

   b. Embryotoxins (examples: organomercurials, lead compounds, formamide): handle these substances only in a hood whose satisfactory performance has been confirmed, using appropriate protective apparel (especially gloves) to prevent skin contact. Women of childbearing age have additional risk when handling such compounds.

   Review each use of these materials with the Research Supervisor or the Office of Environmental Health & Safety and review continuing uses annually, or whenever a procedural change is made.

   Store these substances, properly labeled, in an adequately ventilated area in an unbreakable secondary container.

   Notify Supervisors of all incidents of exposure or spills; consult a qualified physician when appropriate.

2. Working with Chemicals of Moderate Chronic (International Agency for Research on Cancer (IARC) Categories 2A or 2B) or High Acute Toxicity - (Health hazard code 3 or 4) - Hydrogen cyanide is a good example. The following are supplemental rules to be followed in addition to those generally followed.

   a. Aim: To minimize exposure to these toxic substances by any route using all reasonable precautions.

   b. Applicability: These precautions are appropriate for substances with moderate chronic or high acute toxicity used in significant quantities (>100 grams).

   c. Location: Use and store these substances only in areas with special warning signs.

      Always use a hood (previously evaluated to confirm adequate performance with a face velocity of at least 100 linear feet per minute), or other approved containment devices. For procedures which may result in the generation of aerosols or vapors containing the substance, and additional protection system should be used.

   d. Personal Protection: Always avoid skin contact by use of gloves and long sleeves (and other protective apparel as appropriate). Always wash hands and arms immediately after working with these materials.

   e. Prevention of Spills and Accidents: Be prepared for accidents and spills.

Store breakable containers of these substances in chemically resistant trays. Also work and mount apparatus above such trays or cover work and storage surfaces with removable, absorbent, plastic backed paper.

If a major spill occurs outside the hood, immediately evacuate the area. Then refer to and follow the EMERGENCY INSTRUCTIONS - SPILL/LEAK/RELEASE on page 17 (also printed on the back cover).

3. Working with Chemicals of High Chronic Toxicity (International Agency for Research on Cancer (IARC) Category 1).

Note: Normally such substances should be avoided. When used, a Hazard Evaluation Checklist (page 23) must be submitted to the Safety Committee to ensure proper handling. A copy will also be put in the Emergency Instruction Pocket.

Further supplemental rules to be followed in addition to all these mentioned above for work with substance of known high chronic toxicity (in quantities above a few grams).

a. Access: Conduct all transfers and work with these substances in a "controlled area": i.e. a restricted access hood, glove box, or portion of a lab designated for the use of highly toxic substances. All personnel with access should be aware of the substances being used and practice the necessary precautions therein.

b. Approvals: Prepare a plan for use, monitoring, and disposal of these materials.

c. Non-contamination/Decontamination: Protect vacuum pumps against contamination of the air by using scrubbers or High Efficiency Particulate Absolute (HEPA) filters and vent them into the hood. Decontaminate vacuum pumps or other contaminated equipment, including glassware, in the hood before removing them from the controlled area.

d. Exiting: On leaving a controlled area, remove any protective apparel (placing it in an appropriate, labeled container) and thoroughly wash hands, forearms, face, and neck.

e. Medical Exposure/Surveillance: If using toxicologically significant quantities (above a few grams) of such a substance on a regular basis (e.g., 3 times per week) and you have concerns about your health, contact your advisor for guidance and/or the Office of Environmental Health and Safety.

f. Signs and Labels: Assure that the controlled area is conspicuously marked with warning signs and that all containers of these substances are appropriately labeled with identity and warning labels.

g. Spills: See EMERGENCY INSTRUCTIONS - SPILL/LEAK/ RELEASE on page 17 (also printed on the back cover).

h. Storage: Store containers of these chemicals only in ventilated, limited access area inside appropriately labeled, unbreakable, chemically resistant, secondary containers.

i. Glove Boxes: For a negative pressure glove box, ventilation rate must be at least 2 volume changes/hour and pressure at least 0.5 inches of water. For a positive pressure glove box, thoroughly check for leaks before each use. In either case, trap the exhaust gases or filter them through a High Efficiency Particulate Absolute (HEPA) filter before releasing them into the hood.

19.3 Labeling/Tagging of Chemicals

In our laboratories we often handle chemicals. For this reason, extra precautions are necessary to insure that all students are alerted to the need for special care in the safe handling of any material known to or suspected to be toxic or hazardous.

This will be done by labeling or tagging all containers of chemicals, materials, and waste. Containers of a non-hazardous material need only be labeled with their contents. In the case of materials known or suspected to be hazardous or toxic, the label or tab must also indicate the nature of the hazard (labels/tags need not be applied to materials in their original containers if adequate warning is given on the label). Waste containers should be labeled using the appropriate "Waste Disposal Tag (a.k.a. "Hazardous Chemical Inventory Tag") and correspond with the "Request for Disposal Forms" provided by the Office of Environmental Health and Safety (OEHS). This form should be returned to the Office of Environmental Health and Safety (OEHS) for pick-up (see back of form for procedures).

1. All containers of materials, whether retained in the laboratory, stored elsewhere as samples or materials supply, or transferred to others for use or testing, will be labeled or tagged.

2. It is the responsibility of each student to see that all containers of materials which are used or handled in any way are properly labeled or tagged.

19.4 Storage of Chemicals

19.4.1 General Storage of Chemicals

Compatibility of chemicals should always be considered in storage. For example, acids and bases (oxidants, reductants) must not be stored together. If chemicals are stored on open shelves, the shelves must have a raised lip extending a minimum of one-half inch above the shelf surface on the front and sides of the shelf.

Specific storage precautions are required for certain types of toxic chemicals. This storage information is included in Section 19.2.2, Safe Handling of Toxic Chemicals.

19.4.2 Flammable/Combustible Liquids

Flammable and combustible liquids may be found in a laboratory. All flammable and combustible liquids will be kept in closed containers sealed by means of a lid or other

device. Keeping these containers closed at all times will help prevent spillage and minimize the escape of flammable vapors. All flammable chemicals that are not in active use should be stored in a cabinet designed for flammable storage.

19.5 Transport of Chemicals within the Aerospace Engineering and Engineering Mechanics Buildings

In order to minimize hazards from spills of chemicals during transport, such as from stockroom to laboratory, between laboratories, or in glass containers, exercise extreme caution and protect against accidental breakage.

Transport all containers to your laboratory in the protective packages in which they are shipped. Consider saving these packages for future transport of other containers (e.g., waste). This should prevent breakage of the glass container and, if breakage does occur, it will help contain the spill.

Special attention should be given when transporting strong acids, toxic materials, or highly flammable materials that could cause severe injuries if spilled.

19.6 Handling

Inventories of chemicals should be limited to what is needed to perform current work. No chemicals, including solvents, are to be placed in the wastepaper baskets, trash containers or abandoned in hallways, loading platforms, etc. An abandoned chemical becomes an even greater disposal problem since its identity is uncertain. No quantities of any chemicals, either liquid or solid, may be disposed of "down the drain." Chemicals allowed to enter our sink or floor drains could disrupt the public sewer treatment facility.

The disposal of chemicals down the drains is grounds for disciplinary action. In the event of an accidental spill into the drainage system, the student's advisor should be notified immediately. Proper action must be taken to dispose of any material spilled in a laboratory without getting it into the drains.

Laboratory wastes should be disposed of in accordance with Procedures of the Office of Environmental Health and Safety (OEHS). Dispose of waste chemicals frequently; do not allow large quantities to build up.

The primary responsibility for the safe disposal of chemical lies with the individual and his/her supervisor. In the event that disposal problems arise which cannot be handled safely by the standard procedures, it is the user's responsibility to seek assistance. Further information can be obtained from the "Laboratory Safety Manual" dated February 1995 or later, available from the Office Of Environmental Health and Safety (OEHS) and "Right to Know" training seminars.

20.0 TRANSPORT OF CHEMICALS OFF DEPARTMENT PREMISES

In order to insure strict compliance with government regulations, and to minimize delay and potential interruptions to travel plans, all travelers carrying chemicals can first contact the Office of Environmental Health & Safety (1-7137) for assistance. NOTE: If you can't buy it at a grocery store, hardware store, or department store CHECK! Even a pharmacy sells laboratory grade chemicals.

21.0 SAFE HANDLING AND OPERATION OF GAS CYLINDERS, GAS

Receiving

1. Cylinder contents must be properly identified. Do not accept cylinders that do not identify contents by name. Do not rely on color codes for identification. Do not destroy identification tags or labels or change cylinder color.

2. Cylinder valves must be protected. Accept only cylinders provided with cylinder valve protective caps. Leave cap in place until cylinder has been secured and regulator is ready to be attached.

Storage

1. Attempt to minimize the safety hazard of gas cylinders by storing only in-use cylinders. When critically needed, additional cylinders for backup may be installed for immediate back up. Mark empties clearly. Smoking is not permitted while handling cylinders.

2. Stabilize cylinders. Secure cylinders by **chaining** or **strapping**, at above mid-cylinder height, to keep them from falling accidentally.

Transporting

1. Transport correctly. Transport cylinders by means of a "cylinder" hand truck. Cylinders transported on a moving vehicle must be secured by blocking and chaining. Cylinder caps must be in place. **Never** transport a gas cylinder with a regulator connected or uncapped.

2. Don't drop. Avoid dropping cylinders or permitting them to strike each other violently.

3. The buddy system must be employed when handling toxic gas cylinders. In other words, don't transport these cylinders by yourself.

Using

1. Know and understand the properties, uses, and safety precautions of the gas before using the gas and/or associated equipment. Consult supplier information and Material Safety Data Sheets (MSDS's) for the particular gases being used.

2. Secure cylinder before use with chains or straps and tubing connections. Purge tubing prior to connecting. Regardless of the size of the cylinder, the chain or

belt used to support the cylinder must be located at above mid-cylinder height. Secure cylinder before removing valve protection cap.

3. Use proper discharge controls. Use automatic pressure regulators approved for the specific gas to reduce cylinder outlet pressure to a safe value. Be sure to use the correct "Compressed Gas Association (CGA)" fitting on the regulator to avoid an improper connection and possible leak. When cylinder is not in use, close valve and release pressure in regulator. Manually operated valves can be used for liquid discharge or intermittent gas flow control. Do not use cylinder valve to dispense gas.

4. Connections and Piping. Do not force connection fittings. Make sure connections to cylinders match the valve outlet. Do not interchange various controls on different gases. Remember, left-handed nuts are coded with a notch.

   Do not use polymer tubing, such as Teflon or Tygon, on permanent or pressurized apparatus, since it can rupture and/or slip off from the connections.

   If you don't have experience with tubing fittings/connections, find someone who does before connecting gas cylinders. Poorly connected fittings are a serious safety threat, and also cause waste of expensive gases and introduce impurities to your system.

5. Keep cylinders away from heat. Do not subject any part of a cylinder to temperatures above 125°F. Do not heat cylinders unless permitted by supplier, following his instructions.

6. Prevent contamination. When more than one cylinder is in use in a system, use trap, check valve, or vacuum break to prevent suck-back of foreign material into cylinder. Never refill cylinders or attempt to mix gases in a cylinder. Notify supplier if it is known that foreign material has entered a cylinder.

7. Prevent fire or explosion. Do not store or discharge flammable gases where flames or sparks could possibly ignite diffusing gas.

8. Prevent corrosion. Before making any connections to a gas cylinder, verify the chemical compatibility of the gas and the material of construction of the metal tubing and connectors. Do not allow a cylinder to continuously stand on a wet surface.

9. Keep gas out of breathing air. Use toxic and irritating gases in a hood, and only in areas with forced ventilation. Use smallest practical cylinder size. Note: As of June 1993, "Lecture" size cylinders are no longer permitted unless the Supplier will accept them as a return.

10. Prevent chemical burns. Use protective clothing--rubber gloves, aprons, goggles--when handling corrosive gases.

11. In the event of a gas release that is toxic in nature, consult the EMERGENCY INSTRUCTIONS - SPILL/LEAK/RELEASE on page 38 (also printed on back cover).

12. Never tamper with safety devices on cylinders or valves. Practically all cylinders and outlet valves have safety devices of various types which are important for safe usage of the gas. Never tamper with these devices in any way.

13. Prevent leaks. Check all connections for leaks with soap solution (e.g., Snoop) or detectors. Never use a flame. Contact supplier if leaks occur in cylinder valve, and remove cylinder to a well ventilated area outside of the building. Any leaks detected in the regulator or line should be corrected while the system is at atmospheric pressure, not at tank pressure or any intermediate pressures. Recheck for leakage whenever cylinders are moved.

14. Determine contents correctly. Observe tank pressure for nonliquified gases and do not empty to less than 25 psig. With liquefied gases, determine contents by weighing since cylinder pressure remains constant until almost empty. To prevent suck-back contamination, do not completely empty any cylinder.

15. Never lift a cylinder by the cap.

16. Never permit oil, grease or other readily combustible substances to come in contact with oxygen (or other oxidizer gas) cylinders, valves or regulators.

17. Cylinders must not be interconnected with in-house services.

18. Never use oxygen as a substitute for compressed air.

19. If a cylinder protective cap is extremely difficult to remove, do not apply excessive force or pry the cap loose with a bar inserted into the ventilation openings. Return cylinder to supplier with a tag attached identifying the problem.

20. Wrenches should not be used on cylinders equipped with a hand wheel. If the valve is faulty, attach a tag to the cylinder identifying the problem and return it to supplier.

Empty Cylinder Handling

1. Return in condition received. Close valve, replace cylinder valve protective cap. Securely attach a tag marked “Empty” or “Part Full”, to the head of the cylinder. Use standard tags available from the Department Mail Room, WRW 222; do not write directly on the gas cylinders. Return all empty or partially full cylinders. Do not permit unused cylinders to accumulate.

2. Prevent confusing empties with full cylinders. Store empties apart from full cylinders to await return to supplier. Connecting empty cylinder by mistake to a pressurized system could cause contamination or violent reaction in cylinder.

22.0 IONIZING RADIATION SAFETY

The University of Texas at Austin has established a comprehensive Safety Program which controls exposures of individuals to ionizing radiation, radioactive materials, Lasers, and non-ionizing radiation. Ionizing radiation is electromagnetic or particulate radiation of energy above the visible spectrum. Non-ionizing radiation is energy below this level, which includes light by which we see. The University holds (1) a License to possess and use radioactive materials in open form and sealed sources; (2) a Registration of X-ray producing machines; and (3) a Registration of Sources of Laser radiation. These documents have been issued by The State of Texas Department of Health Bureau of Radiation Control (BRC). The use of these items is controlled by The University's Radiation Safety Manual, which is formally part of the Radioactive Materials license and is approved by the State and signed by the President of The University. The Radiation Safety Program is operated under authority of the Radiation Safety Committee and administered by the Radiation Safety Officer. The Radiation Safety Officer administers the program for convenience to The University as the Radiation Safety Section of the Office of Environmental Health and Safety. All decisions and information needed regarding radiation, whether produced by machines or radioactive materials, or whether ionizing or non-ionizing, should be cleared by the Radiation Safety Section. The University's License and Registration, as well as the Texas Regulations for Control of Radiation, are public documents and may be viewed at any time at the offices of the Radiation Safety Section, SER 202.

NOTE: If at any time an individual feels at risk for exposure to radiation at The University, that person should call 471-3511 and ask for the Radiation Safety Section to find the answer required.

23.0 GROUNDING OF ELECTRICAL EQUIPMENT

Unless otherwise designed, electrical equipment used in the offices, laboratory, and shop areas of the Aerospace Engineering and Engineering Mechanics Department shall be grounded before being used. This includes all office-type equipment, research and test equipment, and machinery.

24.0 EQUIPMENT LOCK OUT PROCEDURE

This procedure is necessary to prevent an unauthorized or accidental turning ON of services which were intentionally turned OFF for some required maintenance work. It is designed to avoid injury as a result of inadvertent activation of power. It applies to technical personnel, maintenance personnel and contractors at the Aerospace Engineering and Engineering Mechanics Department and is specifically directed to situations involving interruption of electrical service or other power source where unforeseen power return might be hazardous to the individual performing a maintenance or service operation.

Lockout procedures may include blocks against heavy machinery to prevent movement as well as locked valves or switches. For example, the service locked out may be steam, hot water, or air. This procedure is particularly applicable to situations where the lockout point is remote from the location where the service operation is being performed.

PROCEDURE

1. The person needing to lockout a service shall use an appropriately sized lock (with chain if needed). Only one key shall be available for that lock. The locked out services shall also be appropriately tagged. The lock will be under the individual's control until completion of the maintenance operation.

2. If a lock is used on a switch or control valve, it must be tagged. The tag must be filled in completely, including the individual's name and date.

3. It is the individual's responsibility to check that the lockout is effective before commencing work. Some equipment may require more than one lockout; for example, a pneumatic or hydraulic block as well as the electrical lockout.

4. If the disconnect or block cannot be effectively locked under the individual's control, then the tag must be attached to warn others not to remove the safety device.

5. Upon completion of the task, the individual shall remove the tag and/or lock and restore the interrupted service.

25.0 DISPOSAL OF WASTE CHEMICAL LIQUIDS AND SOLIDS

Summary:

Each researcher is responsible for the disposal of waste chemicals generated by their individual activities. The procedure is as follows:

1. Do not mix waste indiscriminately. Keep segregated.

2. Each bottle must be labeled with one of the cardboard tags provided by the Office of Environmental Health and Safety (1-7137). You can also pick them up in the Department Mail Room, WRW 222.

3. "Hazardous Materials Pick-Up Request Form." A form should be completed in its entirety and should exactly match the tags to which it corresponds.

4. **Note: remember a full bottle requires at least 10% free head space for expansion.**

5. When the bottle is full and ready to be picked up by the Office of Environmental Health and Safety (OEHS), make sure that the "Hazardous Material Pick-Up Request" form is completed. Make sure the tag is securely fastened to the container with wire or rubber band. Put the bottle(s) in a sturdy cardboard box (usually you can get these from the research storeroom in Welch Hall). **Note: these boxes must have dividers.**

6. Fax, mail or hand-carry this pick-up form to the Office of Environmental Health and Safety (OEHS).

26.0 DISPOSAL OF NONHAZARDOUS SOLID WASTE

Only non-toxic, non-hazardous materials should be placed in the ordinary trash cans. This includes paper, plastic bags, packaging materials and etc. No glass, broken or not, or sharps of any kind should be placed in the ordinary trash containers.

Each work area should have a Sharps Container for razor blades, X-acto blades, utility knife blades, needles, small quantities of broken glass, etc.

All empty non-returnable chemical glass containers should be placed in a 5 gallon "glass only" bucket in the Departmental Mail Room (WRW 222) and specimen preparation room (WRW 103). Any labeling should be removed or defaced.

NOTE: Empty containers that held "Acutely Hazardous" material must be submitted to the Office of Environmental Health and Safety (OEHS) for disposal (refer to appendix in OEHS Lab Safety Manual).

27.0 SMALL LIQUID SPILLS

Liquid spills can pose significant safety or health risks. These risks can range from injuries occurring from slips and falls to exposure to toxic chemicals. The procedures and practices detailed below are designed to minimize injury from spills.

General Procedures

A. Non-Hazardous Material (water, beverage)

1. If any personnel causes or comes across a spill of this type, they should clean up the spill themselves.

B. Chemical Spills

1. The EMERGENCY INSTRUCTIONS - SPILL/LEAK/RELEASE on the next page (also printed on the back cover) outlines the actions that are to be taken in the event of a chemical spill.

EMERGENCY INSTRUCTIONS

Is the situation immediately health or life threatening?

YES

SPILL / LEAK / RELEASE

- Use safety shower or eyewash - remove affected clothing and rinse for 15 minutes
- Shut doors to the spill area
- Evacuate the area, if necessary
- Contact the Office of Environmental Health and Safety at 1-7137 (or 1-2020 after work hours)
- Meet responders at main entrance to building
- Contact your supervisor
- Prepare a short summary of incident and file with Departmental Safety Committee

MEDICAL EMERGENCY

- Administer First Aid while someone calls 9-911 (Austin Emergency Services) from UT phone
- Report the incident to your supervisor
- Contact UTPD at 911
- Contact the Office of Environmental Health and Safety at 1-3511 (during work hours)
- Meet the responders at main entrance to building
- Prepare a short summary of incident and file with Departmental Safety Committee

FIRE OR FLAMMABLE GAS

- Evacuate the area, if necessary
- Shut doors to the area and alert others
- Pull the nearest fire alarm and call 9-911 from UT phone
- Contact your supervisor
- Contact UTPD at 911
- Contact the Office of Environmental Health and Safety at 1-7137 (or 1-2020 after work hours)
- Meet the responders at main entrance to building
- Prepare a short summary of incident and file with Departmental Safety Committee

NO

MINOR SPILL / LEAK / RELEASE

- Alert your neighbors
- Call the Office of Environmental Health and Safety at 1-7137 for advice if needed
- Follow steps in the Office of Environmental Health and Safety's Laboratory Safety Manual, dated February 1995, or later, or in spill kit
- Contact your supervisor
- Prepare a short summary of incident and file with Departmental Safety Committee

MEDICAL INCIDENT

- Administer First Aid to victim
- Report the incident to your supervisor
- Contact the Office of Environmental Health and Safety at 1-3511
- Prepare a short summary of incident and file with Departmental Safety Committee

FIRE

- Use extinguisher as appropriate for fire
- Contact the Office of Environmental Health and Safety at 1-3511 (or 1-2020 after work hours)
- Report the incident to your supervisor
- Prepare a short summary of incident and file with Departmental Safety Committee

NOT SURE?

ODD ODOR?

- Report the incident to your supervisor
- Contact the Office of Environmental Health and Safety at 1-7137 (or 1-2020 after work hours)
- Stay to inform the Office of Environmental Health and Safety response personnel
- Prepare a short summary of incident and file with Departmental Safety Committee

POSSIBLE FIRE?

- Report the incident to your supervisor
- Contact the Office of Environmental Health and Safety at 1-3511 (or 1-2020 after work hours)
- Stay to inform the Office of Environmental Health and Safety response personnel
- Prepare a short summary of incident and file with Departmental Safety Committee

Chemical Spill Kits

The chemical spill kits are intended for spills up to about 2 liters. The particular kit to be used depends on the type of chemical spill. For example, kits are available for

1. Acid Spill Cleanup
2. Caustic Spill Cleanup
3. Flammable Solvent Spill Cleanup

The types of kits to be placed in any particular location will depend on the type of work being carried out in the labs in the immediate vicinity. It is the responsibility of the professional in charge to make sure that the appropriate kits are in place near his/her work area, alternately any spill can be dealt with by contacting the Office of Environmental Health and Safety (OEHS) for cleanup.

It is the responsibility of the supervisor to make sure that personnel understand how the kits are to be used. When a spill does occur, it should only be necessary to quickly review the instructions before using the kit. Call the Office of Environmental Health and Safety (1-7137) for information on the disposal of spill material.

Mercury Spill

In the event of a mercury spill, contact your supervisor and call the Office of Environmental Health and Safety for cleanup.

28.0 PERSONAL PROTECTIVE EQUIPMENT (PPE)

Open flames, moving machinery, toxic gases, and chemical spills create hazards for all employees. The preferred way to protect personnel from these hazards is through the use of engineering controls (barricades, process isolation, ventilation, etc.) Unfortunately, engineering controls are not always completely effective in all laboratory situations. This fact makes it necessary for all personnel to use supplementary personal protective equipment.

Protective equipment that is damaged or contaminated through use must be repaired or decontaminated before any further use.Personal Protective Equipment (PPE)

EYE PROTECTION

Personnel are required to familiarize themselves with the locations of the eye wash stations. Eye wash station(s) should be tested on a monthly basis.

The wearing of approved safety glasses is mandatory for all personnel while in experimental laboratory areas, or other designated hazardous areas. Contact lenses may be worn, but are not recommended, even in combination with safety glasses, in any laboratory, or other designated hazardous areas. The department will provide a pair of safety glasses for the undergraduate laboratories as needed. Each research group will be responsible for providing safety glasses for their respective personnel.

The personnel of each laboratory or other hazardous area are responsible for providing visitors with the appropriate eye protection.

LABORATORY ATTIRE

It is the responsibility of the laboratory/shop supervisor to insure that the following simple rules are followed:

1. Protective clothing, e.g., rubber aprons, gloves, laboratory coats, should be worn as required by the nature of the work.

   NOTE: Personal Protective Equipment (PPE) must not leave the work area and must not be worn in places where food is consumed or other designated break areas.

2. Loose-fitting apparel such as neckties, jewelry, or ID badges can present a hazard, especially near machinery using rollers, gears, or other rotating equipment. All loose-fitting apparel should be firmly tucked in, clipped on, or removed before operating such machinery or equipment.

3. Jewelry can present special hazards around certain chemicals, electricity or mechanical operations in the laboratory. It is recommended that the use of jewelry be kept to a minimum.

4. Hair should be secured in such a way as not to present a hazard near open flames and moving machinery or equipment, especially when leaning forward.

SAFETY SHOES

The wearing of steel-toed safety shoes is recommended when dealing with heavy materials, containers, equipment, tools, etc., which could damage toes if dropped or mishandled.

Supervisors may also determine, consistent with the above guidelines, that the wearing of safety shoe guards is mandatory for other areas, specific tasks or jobs, or for the duration of work on specific projects. If there is uncertainty about whether safety shoe guards are required the Office of Environmental Health and Safety should be consulted.

29.0 HAND PROTECTION

The use of gloves is required whenever any hazardous material is being handled in a manner capable of causing injury or impairment through absorption or physical contact.

The selection of the proper glove is no simple task. Among the factors to be considered are the task requirements, e.g. tactility needs, abrasion potential, duration of exposure; and material properties, e.g. toxicity, carcinogenicity, skin absorbency and irritant potential.

1. Chemical Protection

   Three key parameters to consider in glove selection are:

   a. Breakthrough time - how soon the material will pass through the glove.

   b. Permeation rate - amount of material which passes through the glove assuming there are no pinholes or other visible openings.

   c. Degradation - reduction in one or more physical properties of a glove.

2. Physical Protection

   The properties to be considered in selection include:

   a. Tactility.

   b. Heat or cold protection.

   c. Abrasion or cut resistance.

If there is no reference to your specific chemical or the gloves presently available are not suitable, a recommendation may be obtained by contacting the Office of Environmental Health and Safety.

30.0 RESPIRATORS

The decision to use a respirator at a departmental work site is made jointly between the personnel and supervisor. The first obligation of the supervisor is to eliminate the need for a respirator. This can be done by implementing engineering controls at the work site, modifying work practices, or changing the materials being used. If conditions exist such that a respirator is necessary, then the following procedures are to be followed.

ADMINISTRATIVE PROCEDURES

1. Disposable dust masks are not considered acceptable respiratory protection and are not to be used.

2. No personnel shall use any respirator equipment until he/she has been authorized by the Office of Environmental Health and Safety (OEHS).

3. Respirators will be issued only for specific working environments involving specified chemicals and atmospheres, and categorized as either a Self Contained Breathing Apparatus, a respirator, or filter. Whenever personnel must use a respirator or filter in an atmosphere for which the person has not previously been approved, they must first obtain approval for the proper equipment to be used in the new environment.

4. Selection of approved equipment, filters, and/or cartridges will be made jointly between the supervisor and the Office of Environmental Health and Safety (OEHS).

5. The personnel's supervisor is responsible for seeing that the personnel uses only the respirator and filters for which he/she has been approved.

6. Both supervisors and workers must receive training in how to properly use a respirator. Training will include how the equipment should be worn, how to adjust the fit, how to perform both a positive and a negative field Fit Test, and how the equipment is maintained and stored.

7. Personnel with facial hair that comes between the sealing periphery of the face piece and the face or interferes with valve function will not be authorized to use a respirator.

8. Each user must be successfully qualitative Fit Tested annually. This will be done by the Office of Environmental Health and Safety.

9. Each respirator must be cleaned, disinfected, and inspected on a regular basis.

Usage Procedures

1. Before donning a respirator you have been authorized to use:

   a. Inspect the face piece and straps to ensure there are no tears or breaks. Make sure the sealing flange has not been distorted during storage.

   b. Be absolutely certain that the correct cartridges/filters for your use are attached to the unit.

c. For all Self Contained Breathing Apparatus make certain the air cylinder is full, the regulator operates properly by depressing the purge lever, and there are no leaks at any connections.

2. After donning the face piece and tightening the headband straps, you must perform a functional fit check using both a negative-pressure and a positive-pressure sealing test.

   a. Negative test: close off the inhalation valves (covering filters) and inhale gently. The fit is considered satisfactory if slight negative pressure can be induced and sustained inside the face piece without any evidence of leakage around the mask.

   b. Positive test: close off the exhalation valve and exhale gently into the face piece. The fit is considered satisfactory if slight positive pressure can be built up inside the face piece without any evidence of outward leakage.

3. The functional fit check must be repeated any time the respirator has been adjusted or disturbed in any way that would destroy the seal between the face and the sealing flange.

Air-Purifying Respirator (APR) Users

In addition to the general procedures for all users, personnel using Air-Purifying Respirators must adhere to the following:

1. Air-Purifying Respirator (APR) equipment is not to be used in atmospheres that are Immediately Dangerous to Life and Health (IDLH).

2. Personnel can only use the specific cartridges/filters for protection from the specific chemicals that are listed on their Respirator Authorization Sheet.

3. Air-Purifying Respirator (APR) equipment must not be used in work with a chemical that does not give a warning via the sense of smell below the level at which the chemical concentration exceeds the Threshold Limit Value (TLV).

31.0 NOISE EXPOSURE – HEARING PROTECTION

Background

Long-term exposure to continuous high noise levels, which may or may not be work related, can result in permanent hearing loss. The Occupational Safety and Health Administration (OSHA) has established a permissible exposure limit for occupational noise exposure (29 CFR 1910.95). The current permissible eight hour time-weighted average exposure limit is 90dB. The action level, a dose of fifty percent of the time-weighted average, is 85dB. Whenever an individual's exposure exceeds 90dB, engineering and/or administrative controls must be used to reduce exposure. Whenever an individual's exposure exceeds 85dB, the individual must be included in a comprehensive hearing conservation program.

Hearing loss in the workplace can be prevented with engineering and administrative controls. Engineering controls include the use of sound absorptive material, process or equipment isolation,

or equipment modification. Administrative controls usually involve noise exposure reduction by reducing the exposure time in the noisy environment. The Occupational Safety and Health Administration (OSHA) allows for the use of Personal Protective Equipment (PPE) as interim controls while developing engineering or administrative controls, and when the engineering or administrative controls are not adequate or feasible. The development and implementation of a comprehensive hearing conservation program will help to prevent hearing loss. This program includes personnel exposure monitoring, audiometric testing, and personnel training.

Action

If there is a concern that an individual is exposed to high noise levels associated with work, including environment or equipment, the supervisor should contact the Office of Environmental Safety (OEHS) and request an evaluation.

If hearing protective equipment is necessary, it will be obtained by the department. The type used will be dependent on exposure level and noise characteristic (frequency spectrum). The Office of Environmental Health and Safety (OEHS) will direct the user in selection.

APPENDIX A

DEFINITIONS

Carcinogen: (See Chronic Toxic below.) A chemical is considered to be a carcinogen if:

(a) It has been evaluated by the International Agency for Research on Cancer (IARC) and found to be a carcinogen or potential carcinogen; or
(b) It is listed as a carcinogen or potential carcinogen in the Annual Report on Carcinogens published by the National Toxicology Program (NTP) (latest edition); or,
(c) It is regulated by the Occupational Safety and Health Administration (OSHA) as a carcinogen (see Appendix B).

Embryotoxin: Chemicals which affect the reproductive capabilities including chromosome damage (mutations) and effects on fetuses (teratogenesis).

Sensitizer (Allergen): A chemical that causes a substantial proportion of exposed people or animals to develop an allergic reaction in normal tissue after repeated exposure to the chemical.

Toxicity:

Acute Toxicity: Refers to a health hazard which results from a single or short duration exposure to the chemical. Health hazard codes 4 and 3 (used in labeling) refer to highly acute toxins.

HEALTH HAZARD CODES

4 Fatal on short exposure
3 Extreme toxicity, contact or inhalation
2 Moderate irritant or toxicity
1 Slightly harmful-irritant, etc.
0 Minimal health hazard

Chronic Toxicity: Refers to a health hazard which occurs after a repeated, or long-duration exposures that become evident only after a long latency period. A carcinogen is a material that is considered a chronic toxin. The International Agency for Research on Cancer (IARC) has categorized carcinogens as follows (Appendix B):

Category 1: There is sufficient evidence to establish a causal relationship between the agent and human cancer.

Category 2: These are considered probable human carcinogens divided into two categories:

2A: There is at least limited evidence of causing carcinogenicity in humans.

2B: There is sufficient evidence of causing carcinogenicity in animals but inadequate data in humans.

Category 3: These chemicals could not be classified as to their carcinogenicity in humans.

Category 4: These chemicals are considered to be non-carcinogenic to humans.

APPENDIX B

Degrees of Evidence of Carcinogenicity in Humans and in Experimental Animals, and Overall Evaluations of Carcinogenicity to Humans for Agents Evaluated in "IARC Monographs," Volumes 1-42 (See Note Below)

Agent	Degree of evidence for carcinogenicity[a] Human	Animal	Overall evaluations[a]
A- - (2 - Amino -9 H-pyrido (2, 3-b) indole)[b] [40, 1986]	ND	S	2B
Acetaldehyde	I	S	2B
Acetarice[c]	ND	S	2B
Acrylamide[b] [39, 1986]	ND	S	2B
Acrylonitrile	L	S	2A
Adriamycin[e]	I	S	2A
AF-2[2-(2 Furyl) -3- (5 - nitro -2- furyl)acrylamide][b] [32, 1983] ND	S	2B	
Aflatoxins	S	S	1
para-Aminoazobenzene[c]	ND	S	2B
ortho-Aminoazoto luene[b] [8, 1975]	ND	S	2B
4-Aminobiphenyl S	S	1	
2-Amino-5- (5-nitro - 2 - furyl)-1, 3, 4- thiadiazole[b] [7, 1974]	ND	S	2B
Amitrole	I	S	2B
Androgenic (anabolic) steroids	L		2A
Oxymetholone	ND		
Testosterone		S	
ortho-Anisidine[b] [27, 1982]	ND	S	2B

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a ND, no adequate data; ESL, evidence suggesting lack of carcinogenicity; I, inadequate evidence; L, limited evidence; S, sufficient evidence. IARC Monographs.

b Overall evaluation based only on evidence of carcinogenicity in monograph volume, year (see Methods, P. 30) or in Supplement 4.

c Degree of evidence in animals revised on the basis of data that appeared after the most recent monograph and/or on the basis of present criteria (see Methods, pp. 39-40, IARC Monographs).

d Degree of evidence not previously categorized; evaluation made according to present criteria on the basis of data in monograph [volume, year] (see Methods, p. 39, IARC Monographs).

e Other relevant data, as given in the summaries here or in monograph [volume, year], influenced the making of the overall evaluation (see Methods, pp. 38-39, IARC Monographs).

* This evaluation applies to the group of chemicals as a whole and not necessarily to all individual chemicals within the group (see also Methods, p. 38, IARC Monographs).

NOTE: This list has been edited. Industrial processes, industries, and non-chemical products have not been included. Also all IARC 3 and 4 rated materials have not been included. A full list can be obtained from the Office of Environmental Health and Safety.

Agent	Degree of evidence for carcinogenicity[a] Human	Animal	Overall evaluations[a]
Aramite[b] [5, 1974]	ND	S	2B
Arsenic and arsenic compounds	S	L	1*
Asbestos	S	S	1
Auramine (technical-grade)	I	S	2B
Azaserine[b] [10, 1976]	ND	S	2B
Azathioprine	S	L	1
Benz[a]anthracene[b, e] [32, 1983]	ND	S	2A
Benezene	S	S	1
Benzidine	S	S	1
Benzidine-based dyes[e]	I		2A
Direct Black 38 (technical - grade)		S	
Direct Blue 6 (technical - grade)		S	
Direct Brown 95 (technical - grade)		S	
Benzo[b] fluoranthene[b] [32, 1983]	ND	S	2B
Benzo[f] fluoranthene[b] [32, 1983]	ND	S	2B
Benzo[k] fluoranthene[b] [32, 1983]	ND	S	2B
Benzp[a] pyrene[b, e] [32, 1983]	ND	S	2A
Benzyl violet 4B[b] [16, 1978]	ND	S	2B
Beryllium and beryllium compounds	L	S	2A
N, N- Bis(2-chloroethyl) -2-napathyiamine (Chiornaphazine)	S	L	1
Bis(chloromethyl) ether and chloromethyl methyl ether (technical grade)	S	S	1
Bitumens			
Extracts of steam-refined and air-refined bitumens		S	2B
Bleomycins[e]	I	L	2B
1, 3 - Butadiene	I	S	2B
1, 4 - Butanediol dimethanesulphonate (Myleran)	S	L	1
Butylated hydroxyanisole (BHA)[b] [40, 1986]	ND	S	2B
B-Butyrolactone[b] [11, 1976]	ND	S	2B
Cadmium and cadmium compounds	L	S	2A
Carbon-Black extracts		S	2B
Carbon tetrachloride	I	S	2B
Carrageenan			
Degraded[b] [31, 1983]	ND	S	2B
Chlorambucil	S	S	1
Chloramphenicol	L	I	2B
Chlordecone (Kepone)[b] [20, 1979]	ND	S	2B
-Chlorinated toluenes	I		2B
Benzyl chloride		L	
Benzal chloride		L	
Benzotrichloride		S	

Agent	Degree of evidence for carcinogenicity[a] Human	Animal	Overall evaluations[a]
Chloroethyl nitrosoureas			
Bischloroethyl nitrosourea (BCNU)	L	S	2A
1 - (2 - Chloroethyl) -3- cyclohexyl - 1 nitrosourea (CCNU)[e]	I	S	2A
1 - (2 - Chloroethyl) -3- (4-methylcyclohexyl) -1- nitrosourea (Methyl - CCNU)	S	L	1
Chloroform	I	S	2B
Chlorophenols	L		2B
Pentachlorophenol		I	
2, 4, 5 - Trichlorophenol		I	
2, 4, 6 - Trichlorophenol		S	
Chlorophenoxy herbicides	L		2B
2, 4 - D		I	
2, 4, 5 - T		I	
MCPA		ND	
4-Chloro-ortho-phenylenediamine[b] [27, 1982]	ND	S	2B
para-Chloro-orthno-toluidine[b] [30, 1983]	ND	S	2B
Chromium and chromium compounds			
Trivalent chromium compounds	I	I	3
Hexavalent chromium compounds	S	S	1*
Cisplatin[e]	I	S	2A
Citrus Red No. 2[b] [8, 1975]	ND	S	2B
Coal-tar pitches	S	S	1
Coal-tars	S	S	1
Creosotes	L	S	2A
para-Cresidine[b] [27, 1982]	ND	S	2B
Cycasin[b] [10, 1976] (see also Methylazoxymethanol and its acetate)			
Cyclophosphamide	S	S	1
Dacarbazine	I	S	2B
Daunamycin[b] [10, 1976}	ND	S	2B
DDT	I	S	2B
N, N' - Diacetylbenzidine[b] [16, 1978]	ND	S	2B
2, 4 - Diaminonisole [27, 1982]	ND	S	2B
4, 4' - Diaminodiphenyl ether[b] [29, 1982]	ND	S	2B
2, 4 - Diaminotoluene[b] [16, 1978]	ND	S	2B
Dibenz [a, h] acridine[b] [32, 1983]	ND	S	2B
Dibenz [a, f] acridine[b] [32, 1983]	ND	S	2B
Dibenz [a, h] anthracene[b, e] [32, 1983]	ND	S	2B
7 H-Dibenzo[c, g] carbazole[b] [32, 1983]	ND	S	2B
Dibenzo [a, e] pyrene[b] [32, 1983]	ND	S	2B
Dibenzo [a, h] pryene[b] [32, 1983]	ND	S	2B

* This evaluation applies to the group of chemicals as a whole and not necessarily to all chemicals within the group (see Methods, p. 38, IARC Monographs).

Agent		Degree of evidence for carcinogenicity[a] Human	Animal	Overall evaluations[a]
Dibenzo [a, f] pyrene[b] [32, 1983]		ND	S	2B
Dibenzo [a, l] pyrene[b] [32, 1983]		ND	S	2B
1, 2 - Dibromo -3- chloropropane		I	S	2B
para-Dichlor-obenzene		I	S	2B
3, 3' - Dichlorobenzidine		I	S	2B
3, 3' - Dichloro -4, 4' - diaminodiphenyl ether[b] [16, 1978]		ND	S	2B
1, 2 - Dichlcroethane[b] [20, 1979]		ND	S	2B
Dichloromethane	I	S	2B	
1, 3- Dichloropropene (technical-grade)		I	S	2B
Diepoxybutane[b] [11, 1976]		ND	S	2B
Di (2-ethylhexyl) phthalate[b] [29, 1982]		ND	S	2B
1, 2 - Diethylhydrazine[b] [4, 1974]		ND	S	2B
Diethyl sulphate		L	S	2A
Diglycidyl resorcincl ether[b] [36, 1985]		ND	S	2B
dihydrosafrole [10, 1976]		ND	S	2B
3, 3' - Dimethoxybenzidine (ortho-Dianisidine)		I	S	2B
para-Dimethylarinoazobenzene[b] [8, 1975]		ND	S	2B
trans - 2 - [(Dimethylamino) methylimino] -5- [2 - (5- nitro- 2 - furyl) vinyl] -1, 3, 3- oxadiazole[b] [7, 1974]		ND	S	2B
Dimethylcarbamoyl chloride[e]		I	S	2A
1, 1 - Dimethylhydrazine[b] [4, 1974]		ND	S	2B
1, 2 - Dimethylhydrazine[b] [4, 1974]		ND	S	2B
Dimethyl sulphate[e]		I	S	2A
1, 4 - Dioxane		I	S	2B
Ephichlorohydrin[e]		I	S	2A
Erionite	S	S	1	
Ethyl acrylate[b] [39, 1986]	ND	S	2B	
Ethylene dibromide[e]		I	S	2A
Ethylene oxide		L	S	2A
Ethylene thiourea	I	S	2B	
Ethyl methanesulphonate[b] [7, 1974]		ND	S	2B
N - Ethyl -N- nitrosourea[b, e] [17, 1978]		ND	S	2A
Formaldehyde		L	S	2A
2-(2- Formylhydrazino) - 4 - (5 - nitro -2- furyl) thiazole[b] [7, 1974]		ND	S	2B
Furazolidone[b] [31, 1983]		ND	1	3
Glu -P- 1 (2-Amino-6- methyldipyrido [1, 2-a: 3', 2'- d] imidazole)[b] [40, 1986)		ND	S	2B
Glu -P-2 (2 - Aminodipyrido [1, 2-a: 3', 2' - d] imidazole)[b] [40, 1986)		ND	S	2B
Glycidaldehyde[b] [11, 1976]		ND	S	2B
Griseofulvin[c]		ND	S	2B
Haematite and ferric oxide Underground haematite mining with exposure to radon		S		1
Hexachlorobenzene		I	S	2B
Hexachlorocyclohexanes (HCH)		I		2B

Agent	Degree of evidence for carcinogenicity[a] Human	Animal	Overall evaluations[a]
Hexamethylphosphoramide[b] [15, 1977]	ND	S	2B
Hydrazine	I	S	2B
Indeno [1, 2, 3 -cd] pyrene[b] [32,1983]	ND	S	2B
IC (2-amino -3- methylimicazo [4, 5- f] quinoline)[b] [40, 1986]	ND	S	2B
Iron-dextran complex	I	S	2B
Lasiocarpine[b] [10, 1976]	ND	S	2B
Lead and lead compounds			
Inorganic	I	S	2B
Organoleac	I	I	3
MeA- -C (2-Amino-3-methyl - 9H- pyrido [2, 3 - b] indole)[b] [40, 1986]	ND	S	2B
Melphalan	S	S	1
Merphalan[b] [9, 1975]	ND	S	2B
5 - Methoxypsoralen[e]	I	S	2A
8 - Methoxypsoralen (Methoxsalen) plus ultraviolet radiation	S	S	1
2 - Methylaziridine[b] [9, 1975]	ND	S	2B
Methylazoxymethanol and its acetate[b] [10, 1976]	ND	S	2B
5-Methylchrysene[b] [32, 1983]	ND	S	2B
4, 4' - Methylene bis (2-chloroaniline) (MOCA)[e]	I	S	2A
4, 4' - Methylene bis (2-methylaniline)	I	S	2B
4, 4' - Methylenedianiline[b] [39, 1986]	ND	S	2B
Methyl methanesulphonate[b] [7, 1974]	ND	S	2B
2 - Methyl - 1- nitroanthraquinone (uncertain purity)[b] [27, 1982]	ND	S	2B
N-Methyl -N'-nitro-N-nitrosaguanidine (MNNG)[e]	I	S	2A
N-Methyl - N - nitrosourea[b,e] [17, 1978]	ND	S	2A
N-Methyl - N - nitrosourethane[b] [4, 1974]	ND	S	2B
Methylthiouracil[b] [7, 1974]	ND	S	2B
Metronidazole	I	S	2B
Mineral oils			
Untreated and mildly-treated oils	S	S	1
Highly-refined oils	I	I	3
Mirex[b] [20, 1979]	ND	S	2B
Mitomycin C[b] [10, 1976]	ND	S	2B
Monocryotaline[b] [10, 1976]	ND	S	2B
MOPP and other combined chemotherapy including alkylating agents	S	I	1
5 - (Morpholinomethyl) - 3 - [(5-nitrofurfurylidene)amino] - 2-oxazolidinone[b] [7, 1974]	ND	S	2B

1 Combined therapy with nitrogen nustard, vincristine, procarbazine and prednisone

* This evaluation applies to the group of chemicals as a whole and not necessarily to all chemicals within the group.

Agent	Degree of evidence for carcinogenicity[a] Human	Animal	Overall evaluations[a]
Mustard gas (Sulphur mustard)	S	L	1
Nafenopin[b] [24, 1980]	ND	S	2B
2-Naphthylamine	S	S	1
Nickel and nickel compounds	S	S	1*
Niridazole[b] [13, 1977]	ND	S	2B
Nitroacenaphthene[b] [16, 1978]	ND	S	2B
Nitrofen (technical-grade)[b] [30, 1983]	ND	S	2B
1-[(5 - Nitrofurfurylidene) amino] -2- imidazclidinone[b] [7, 1974]	ND	S	2B
N- [4-(5-Nitro-2-furyl) -2-thiazoly] acetamide[b] [7, 1974]	ND	S	2B
Nitrogen mustard	L	S	2A
Nitrogen mustard N-oxide[b] [9, 1975]	ND	S	2B
2-Nitropropane[b] [29, 1982]	ND	S	2B
N-Nitrosodi-n-butylamine[b] [17, 1978]	ND	S	2B
N-Nitrosodiethanclamine[b] [17, 1978]	ND	S	2B
N-Nitrosodiethylamine[b, e] [17, 1978]	ND	S	2A
N-Nitrosodimethylamine[b, e] [17, 1978]	ND	S	2A
N-Nitrosodi-n-propylamine[b] [17, 1978]	ND	S	2B
3- (N-Nitrosomethylamino) propionitrile[b] [37, 1985]	ND	S	2B
4-(N- Nitrosomethylamino) -1- (3-pyridyl) -1- butanone (NNK)[b] [37, 1985]	ND	S	2B
N-Nitrosomethylethylamine[b] [17, 1978]	ND	S	2B
N-Nitrosomethylvinylamine[b] [17, 1978]	ND	S	2B
N-Nitrosomorpholine[b] [17, 1978]	ND	S	2B
N'-Nitrosonornicotine[b] [37, 1985]	ND	S	2B
N-Nitrosopiperidine[b] [17, 1978]	ND	S	2B
N-Nitrosopyrrolidine[b] [17, 1978]	ND	S	2B
N-Nitrososarcosine[b] [17, 1978]	ND	S	2B
Oestrogens, progestins and combinations			
Oestrogens			
Nonsteroidal oestrogens	S		1*
Diethylstilboestrol	S	S	1
Dienoestrol		L	
Nexoestrol		S	
Chlorotrianisene		I	
Steroidal oestrogens	S		1*
Oestrogen replacement therapy	S		1
Conjugate oestrogens		L	
Destradiol - 17 and esters		S	
Destriol	L		
Destrone		S	

* This evaluation applies to the group of chemicals as a whole and not necessarily to all within the group.

Agent	Degree of evidence for carcinogenicity[a] Human	Animal	Overall evaluations[a]
Ethinyloestradiol		S	
Mestranol		S	
Progestins	I		2B
Medroxyprogesterone acetate	I	S	2B
Direthisterone		L	
Ethynodiol diacetate		L	
17 - Hydroxprogesterone caproate		I	
Lynoestrenol		I	
Megestrol acetate		L	
Norethisterone		S	
Norethynodrel		L	
Norgestrel		I	
Progesterone		S	
Oestrogen-progestin combinations			
Sequential oral contraceptives	S		1
Dimethisterone and oestrogens		I	
Combined oral contraceptives	S		1[1]
Chlormadinone acetate and oestrogens		L	
Ethynodiol diacetate and oestrogens		L	
Lynoestrenol and oestrogens		I	
Megestrol acetate and oestrogens		L	
Norethisterone and oestrogers		L	
Norethynodrel and oestrogens		S	
Norgestrel and oestrogens		I	
Progesterone and oestrogens		L	
Investigational oral contraceptives		L	
Orange SS[b] [8, 1975]	ND	S	2B
Panfuran S (containing dihydroxymethylfuratrizine)[b] [24, 1980]	ND	S	2B
Phenacetin	L	S	2A
Analgesic mixtures containing phenacetin	S	L	1
Phenazopyridine hydrochloride	I	S	2B
Phenobarbital	I	S	2B
Phenoxybenzamine hydrochloride[b] [24, 1980]	ND	S	2B
Phenytoin	L	L	2B
Polybrominated biphenyls	I	S	2B
Polychlorinated biphenyls	L	S	2A
Ponceau MX[b] [8, 1975]	ND	S	2B
Ponceau 3R[b] [8, 1975]	ND	S	2B
Potassium bromate[b] [40, 1986]	ND	S	2B
Procarbazine hydrochloride[e]	I	S	2A

1 There is also conclusive evidence that these agents have a protective effect against cancer and endometrium.

Agent	Degree of evidence for carcinogenicity[a] Human	Animal	Overall evaluations[a]
1, 3- Propane sultone[b] [4, 1974]	ND	S	2B
B- Propiclactone[b] [4, 1974]	ND	S	2B
Propylene oxide[e]	I	S	2A
Propylthiouracil	I	S	2B
Saccharin	I	S	2B
Safrole[b] [10, 1976]	ND	S	2B
Shale-oils	S	S	I
Silice			
Crystalline slilica	L	S	2A
Sodium ortho-phenylphenate[c]	ND	S	2B
Soots	S	I	1
Sterigmatocystin[b] [10, 1976]	ND	S	2B
Streptozotocin[b] [17, 1978]	ND	S	2B
Styrene[e]	I	L	2B
Styrene oxide[b,e] [36, 1985]	ND	S	2A
Sulfallate[b] [30, 1983]	ND	S	2B
Talc			
Not containing asbestiform fibres	I	I	3
Containing asbestiform fibres	S	I	1
2, 3, 7, 8 - Tetrachlorodibenzo-para-dicin (TODD)	I	S	2B
Tetrachloroethylene	I	S	2B
Thioacetamide[b] [7, 1974]	ND	S	2B
4, 4' - Thiodianiline[b] [27, 1982]	ND	S	2B
Thiouracil[d] [7, 1974]	ND	L	3
Thiourea[b] [7, 1974]	ND	S	2B
Toluene diisocyanates[b] [39, 1986]	ND	S	2B
ortho-Toluidine	I	S	2B
Toxaphene (Polychlorinated campheres)[b] [20, 1979]	ND	S	2B
Treosulphan	S	ND	1
Tris(l-aziridinyl) phosphine sulphide (Thiotepa)[e]	I	S	2A
Tris (2, 3 - dibromopropyl) phosphate[e]	I	S	2A
Trp-P-l (3-Amino-1,4 - dimethyl -5H-pyrido [4, 3-b] indole)[b] [31, 1983]	ND	S	2B
Trp-P-2 (3-Amino-1 - methyl -5H-pyrido [4, 3-b] indole)[b] [31, 1983]	ND	S	2B
Trypan blue [8, 1975]	ND	S	2B
Uracil mustard	I	S	2B
Urethane[b] [7, 1974]	ND	S	2B
Vinyl bromide[b,e] [39, 1986]	ND	S	2A
Vinyl chloride	S	S	1

APPENDIX C

DEFINITIONS OF FLAMMABLE AND COMBUSTIBLE LIQUIDS

"Flammable liquid" means any liquid having a flashpoint (found on Material Safety Data Sheet (MSDS)) below 100°F (37.8°C), except any mixture having components with flashpoints of 100°F (37.8°C) or higher, the total of which makes up to 99 percent or more of the total volume of the mixture. Flammable liquids shall be known as Class I liquids. Class I liquids are divided into three classes as follows.

1. Class IA shall include liquids having flashpoints below 73°F (22.8°C) and having a boiling point below 100°F (37.8°C).

2. Class IB shall include liquids having flashpoints below 73°F (22.8°C) and having a boiling point at or above 100°F (37.8°C).

3. Class IC shall include liquids having flashpoints at or above 73°F (22.8°C) and below 100°F (37.8°C).

"Combustible liquids" means any liquid having a flashpoint at or above 100°F (37.8°C). Combustible liquids shall be divided into two classes as follows:

1. "Class II liquids" shall include those with flashpoints at or above 100°F (37.8°C) and below 140°F (60°C), except any mixture having components with flashpoints of 200°F (93.3°C) or higher, the volume of which makes up 99 percent or more of the total volume of mixture.

2. "Class III liquids" shall include those with flashpoints at or above 140°F (60°C). Class III liquids are subdivided into two subclasses:

   (a) "Class IIIA liquids" shall include those with flashpoints at or above 140°F (60°C0 and below 200°F (93.3°C), except any mixture having components with flashpoints of 200°F (93.3°C) or higher, the total volume of which makes up 99 percent of more of the total volume of the mixture.

   (b) "Class IIIB liquids" shall include those with flashpoints at or above 200°F (93.3°C).

3. When a combustible liquid is heated for use to within 30°F (16.7°C) of its flashpoint, it shall be handled in accordance with the requirements for the next lower class of liquids.

APPENDIX D

HAZARDOUS CHEMICAL AND/OR COMPRESSED GAS INVENTORY WORKSHEET

Please indicate both the **average quantities** and **maximum quantities** (in the units specified) for each of the following types of materials that are stored in your laboratory. A precise definition of each type of material is given in italics.

Explosives
Materials which may cause a sudden, almost instantaneous release of pressure, gas, and/or heat when subjected to sudden shock, pressure, or elevated temperatures. Examples include dry picric acid, nitroglycerin, and lead azide.

Average quantity stored in the lab: _____ pounds

Maximum quantity stored in the lab: _____ pounds

Flammable Liquids
Flammable liquids are those liquids having a flash point below 100 degrees F (37.8 degrees C) at atmospheric pressure and having a vapor pressure not exceeding 40psi (2.72 atmospheres) at room temperature. Examples include diethyl ether, benzene, and n-hexane.

I. Flammable liquids that are miscible with water:

Average quantity stored in the lab: _____ gallons

Maximum quantity stored in the lab: _____ gallons

II. Flammable liquids that are water-insoluble:

Average quantity stored in the lab: _____ gallons

Maximum quantity stored in the lab: _____ gallons

Combustible Liquids
Combustible liquids are those liquids having a flash point between 100 degrees F (37.8 degrees C) and 200 degrees F (93.3 degrees C) at atmospheric pressure. Examples include dimethyl sulfoxide, cyclohexanone, and benzyl chloride.

I. Combustible liquids that are miscible with water:

Average quantity stored in the lab: _____ gallons

Maximum quantity stored in the lab: _____ gallons

II. Combustible liquids that are water-insoluble:

Average quantity stored in the lab: _____ gallons

Maximum quantity stored in the lab: _____ gallons

Flammable Solids

Materials which do not meet the definition of explosives that are prone to cause fire through friction or some other physical means, which have an ignition temperature below 212 degrees F (100 degrees C), or which burn so vigorously and/or persistently when ignited that they create a considerable hazard. Flammable solids include finely divided solid materials which when dispersed in air as a cloud may be ignited, thereby causing an explosion. Examples include powdered metals (e.g., magnesium).

Average quantity stored in the lab: _____ pounds

Maximum quantity stored in the lab: _____ pounds

Organic Peroxides

Organic compounds which contain either a peroxide (R_1OOR_2) or a hydroperoxide (ROOH) functionality in their molecular structure. Examples include peroxyacetic acid, cumene hydroperoxide, and benzoyl peroxide.

Average quantity stored in the lab: _____ pounds

Maximum quantity stored in the lab: _____ pounds

Oxidizers

Materials which do not meet the definition of explosives that either initiate or promote combustion in other materials, thereby causing fire either of themselves or through the release of oxygen and/or other gases. Examples include red fuming nitric acid, potassium permanganate, and chromium trioxide.

Average quantity stored in the lab: _____ pounds

Maximum quantity stored in the lab: _____ pounds

Water Reactive Materials

Materials which either explode, violently react, evolve flammable, toxic, or otherwise hazardous gases, or evolve enough heat to cause self-ignition or ignition of nearby combustibles upon exposure to water or moisture. Examples include lithium aluminum hydride and pure alkali metals.

Average quantity stored in the lab: _____ pounds

Maximum quantity stored in the lab: _____ pounds

Pyrophoric Materials
Materials which will spontaneously ignite in air at or below a temperature of 130 degrees F (54.4 degrees C). Examples include phenylmagnesium bromide, n-butyllithium, and diethyl chlorophosphite.

Average quantity stored in the lab: _____ pounds

Maximum quantity stored in the lab: _____ pounds

Cryogenic Fluids
Fluids that have a normal boiling point below 150 degrees F (65.6 degrees C) at atmospheric pressure. An example is liquid nitrogen.

Average quantity stored in the lab: _____ gallons

Maximum quantity stored in the lab: _____ gallons

Radioactive Materials
Materials which spontaneously emit ionizing radiation. Examples include ^{14}C, ^{235}U, and ^{3}H compounds.

Average quantity stored in the lab: _____ pounds

Maximum quantity stored in the lab: _____ pounds

Extremely Toxic Materials
Materials which pose an unusual hazard or risk due either to the fact that they are lethal or acutely toxic at relatively low concentrations. Examples include ricin, strychnine, and sarin.

Average quantity stored in the lab: _____ pounds

Maximum quantity stored in the lab: _____ pounds

Corrosive Materials
Typical aqueous acids and bases. Examples include hydrochloric acid, sulfuric acid, and aqueous potassium hydroxide.

Average quantity stored in the lab: _____ gallons

Maximum quantity stored in the lab: _____ gallons

Compressed Gases

Any material or mixture that, when enclosed in a container, has an absolute pressure exceeding 40psi at 21.1 degrees C or, regardless of the pressure at 21.1 degrees C, has an absolute pressure greater than 140psi at 54.4 degrees C. Examples include ethylene oxide, carbon dioxide, and acetylene. **Please list each gas stored in the lab separately**.

Gas #1: _____

Average quantity stored in the lab: _____ **ft^3 at STP**

Maximum quantity stored in the lab: _____ **ft^3 at STP**

Gas #2: _____

Average quantity stored in the lab: _____ **ft^3 at STP**

Maximum quantity stored in the lab: _____ **ft^3 at STP**

Gas #3: _____

Average quantity stored in the lab: _____ **ft^3 at STP**

Maximum quantity stored in the lab: _____ **ft^3 at STP**

Gas #4: _____

Average quantity stored in the lab: _____ **ft^3 at STP**

Maximum quantity stored in the lab: _____ **ft^3 at STP**

Gas #5: _____

Average quantity stored in the lab: _____ **ft^3 at STP**

Maximum quantity stored in the lab: _____ **ft^3 at STP**

Gas #6: _____

Average quantity stored in the lab: _____ **ft^3 at STP**

Maximum quantity stored in the lab: _____ **ft^3 at STP**

Gas #7: _____

Average quantity stored in the lab: _____ ft^3 at STP

Maximum quantity stored in the lab: _____ ft^3 at STP

Gas #8: _____

Average quantity stored in the lab: _____ ft^3 at STP

Maximum quantity stored in the lab: _____ ft^3 at STP

HAZARDOUS CHEMICAL INVENTORY

Explosives

Average Quantity ______________ pounds
Maximum Quantity ______________ pounds

Pyrophoric Materials

Average Quantity ______________ pounds
Maximum Quantity ______________ pounds

Flammable Solids

Average Quantity ______________ pounds
Maximum Quantity ______________ pounds

Flammable Liquids

I. Liquids that are miscible in water
Average Quantity ______________ gallons
Maximum Quantity ______________ gallons

II. Liquids that are water-insoluble
Average Quantity ______________ gallons
Maximum Quantity ______________ gallons

Combustible Liquids

I. Liquids that are miscible in water
Average Quantity ______________ gallons
Maximum Quantity ______________ gallons

II. Liquids that are water-insoluble
Average Quantity ______________ gallons
Maximum Quantity ______________ gallons

Oxidizers

Average Quantity ______________ pounds
Maximum Quantity ______________ pounds

Organic Peroxides

Average Quantity ______________ pounds
Maximum Quantity ______________ pounds

Water Reactive Materials

Average Quantity ______________ pounds
Maximum Quantity ______________ pounds

Corrosives

Average Quantity ______________ pounds **ACID**
Maximum Quantity ______________ pounds **ACID**
Average Quantity ______________ pounds **BASE**
Maximum Quantity ______________ pounds **BASE**

Radioactive Materials

Average Quantity ______________ pounds
Maximum Quantity ______________ pounds

Extremely Toxic Materials

Average Quantity ______________ pounds
Maximum Quantity ______________ pounds

Cryogenic Fluids

Average Quantity ______________ gallons
Maximum Quantity ______________ gallons

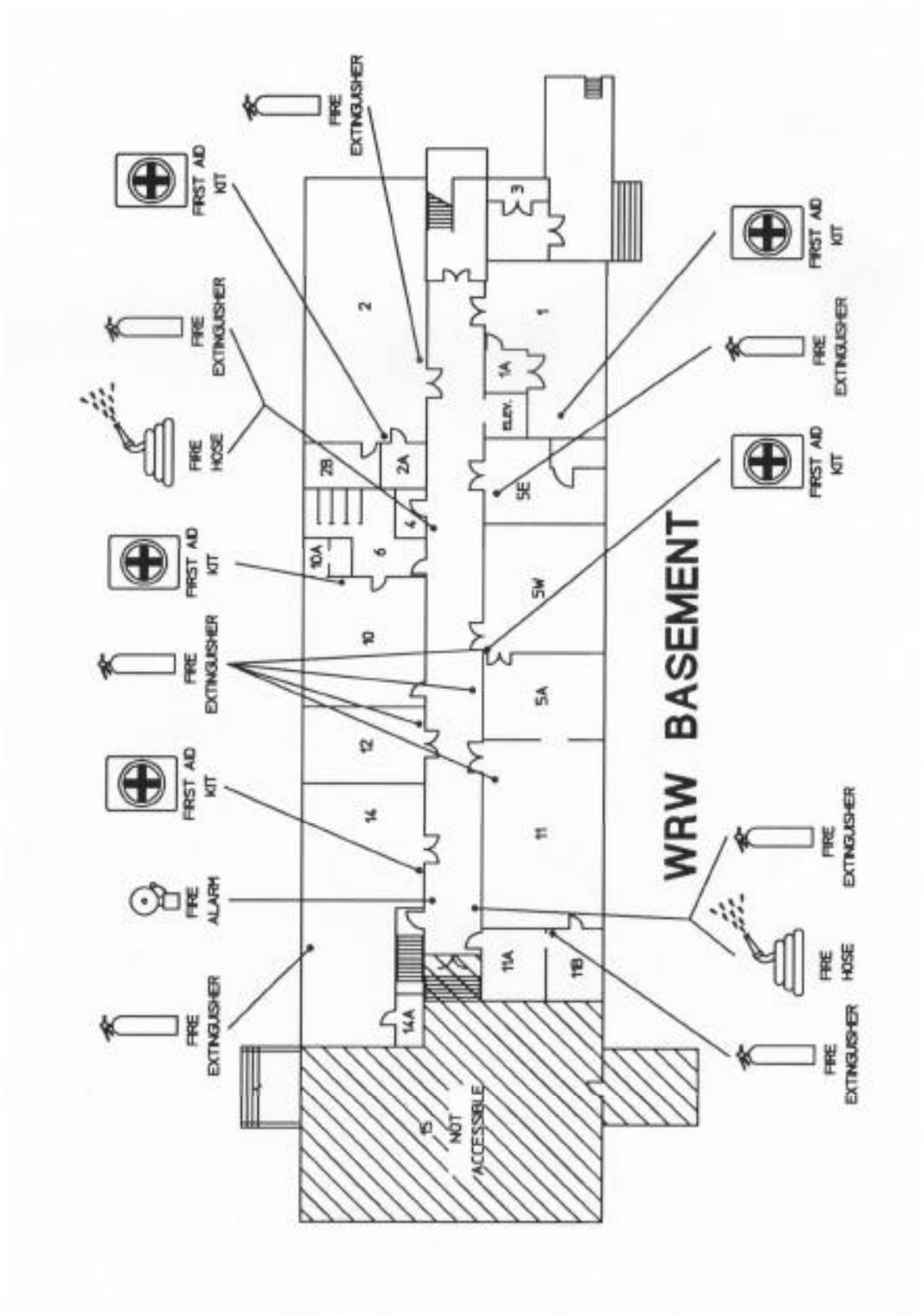
Compressed Gases

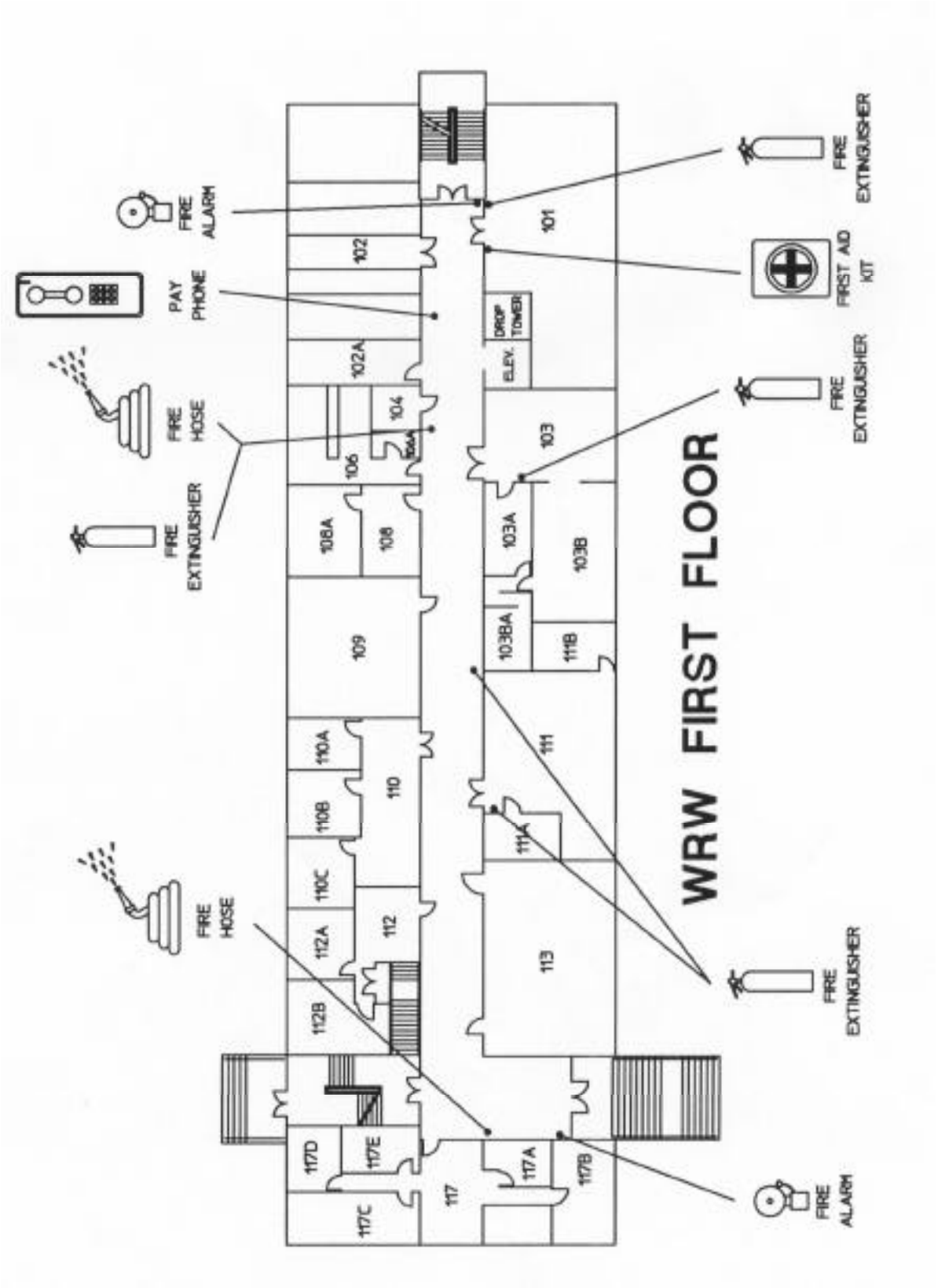
1. ______________ Average Quantity __________ cu.ft. @ STP Maximum Quantity __________ cu.ft. @ STP
2. ______________ Average Quantity __________ cu.ft. @ STP Maximum Quantity __________ cu.ft. @ STP
3. ______________ Average Quantity __________ cu.ft. @ STP Maximum Quantity __________ cu.ft. @ STP
4. ______________ Average Quantity __________ cu.ft. @ STP Maximum Quantity __________ cu.ft. @ STP
5. ______________ Average Quantity __________ cu.ft. @ STP Maximum Quantity __________ cu.ft. @ STP

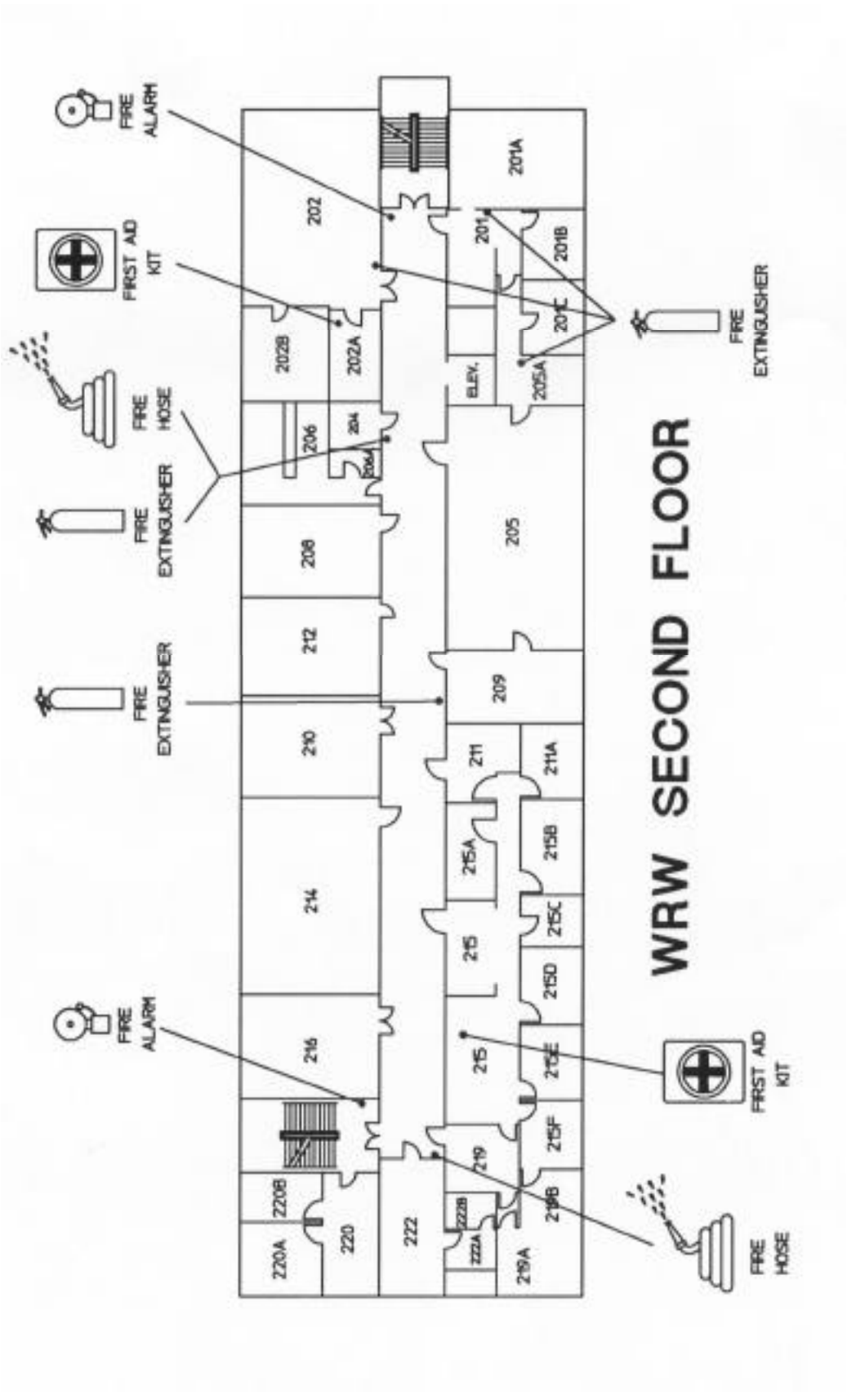
62

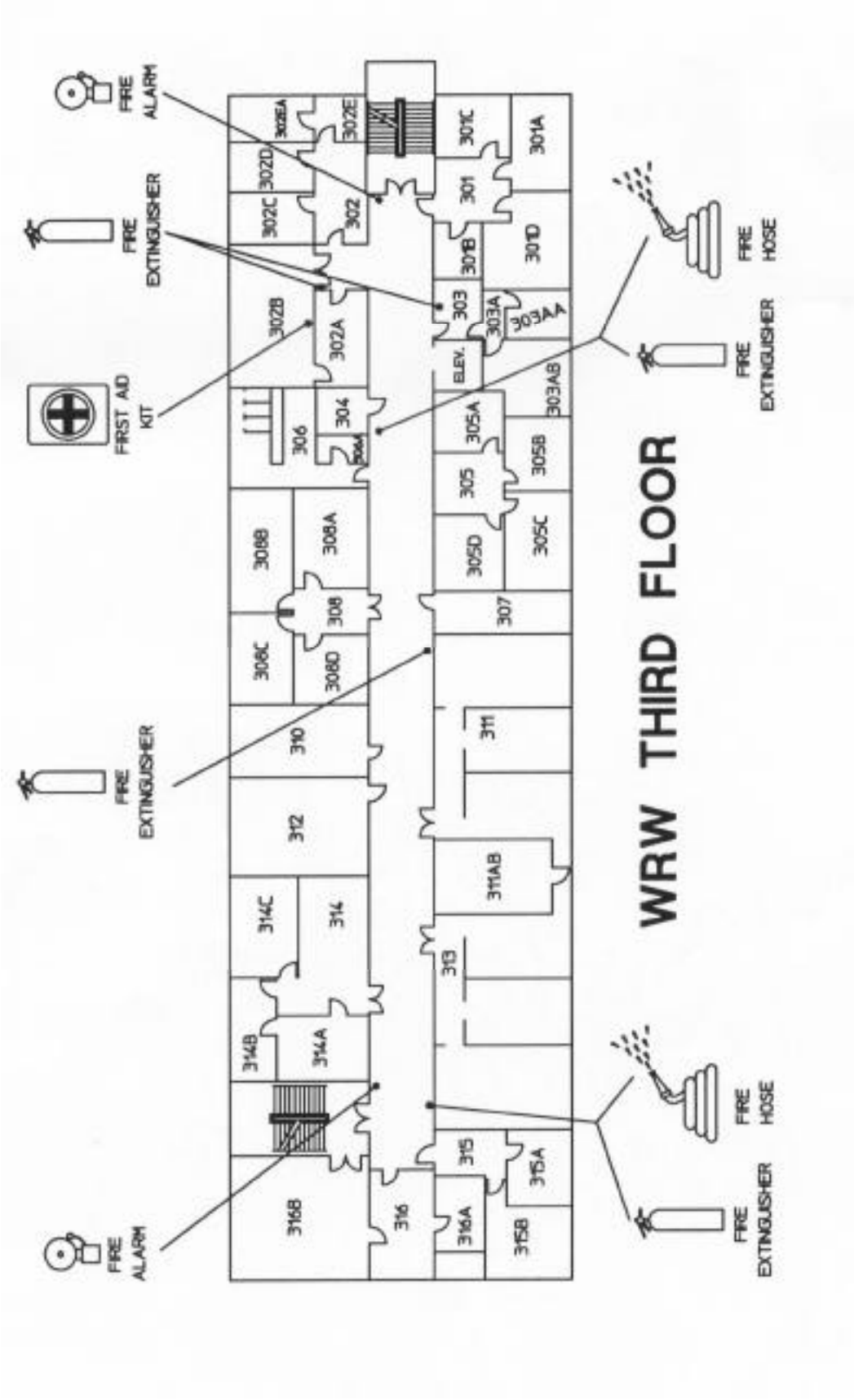
APPENDIX E

BUILDING MAPS


WRW BASEMENT
FIRE EXTINGUISHER
FIRST AID KIT
FIRE HOSE
FIRE ALARM
ELEV.
NOT ACCESSIBLE
1
1A
1B
2
2A
2B
3
4
5A
5E
5W
6
10
10A
11
11A
12
14
14A
15


WRW FIRST FLOOR
FIRE ALARM
PAY PHONE
FIRE HOSE
FIRE EXTINGUISHER
FIRE HOSE
FIRE EXTINGUISHER
FIRE EXTINGUISHER
FIRST AID KIT
FIRE EXTINGUISHER
FIRE EXTINGUISHER
FIRE ALARM
101
102
102A
104
106
106A
103
103A
103B
108A
108
109
103BA
111B
110A
110
110B
110C
112A
112
112B
111
111A
113
117D
117E
117
117A
117B
117C
DROP TOWER
ELEV.


WRW SECOND FLOOR
FIRE ALARM
FIRST AID KIT
FIRE HOSE
FIRE EXTINGUISHER
FIRE EXTINGUISHER
FIRE EXTINGUISHER
FIRE ALARM
FIRST AID KIT
FIRE HOSE
201A
201
201B
201C
202
202B
202A
205A
ELEV.
206
204
205
208
212
209
210
211
211A
214
215A
215B
215C
215
215D
215E
215F
216
219
219B
219A
220B
220A
220
222
222B
222A


WRW THIRD FLOOR
FIRE ALARM
FIRE EXTINGUISHER
FIRST AID KIT
FIRE EXTINGUISHER
FIRE HOSE
FIRE EXTINGUISHER
FIRE EXTINGUISHER
FIRE HOSE
FIRE ALARM
ELEV.
301
301A
301B
301C
301D
302
302A
302B
302C
302D
302E
303
303A
303AA
303AB
304
305
305A
305B
305C
305D
306
306C
307
308
308A
308B
308D
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311AB
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314
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314B
314C
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315B
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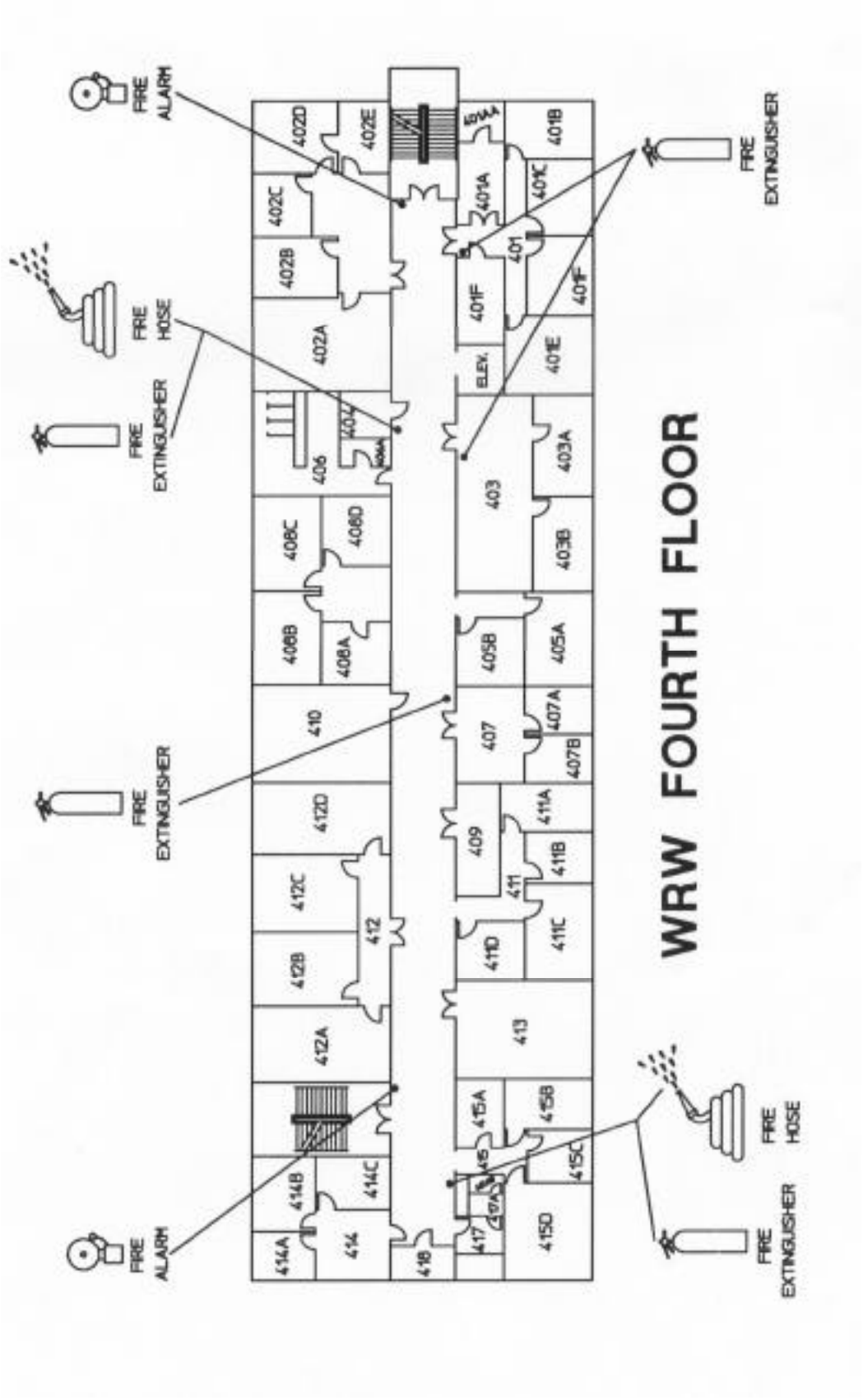
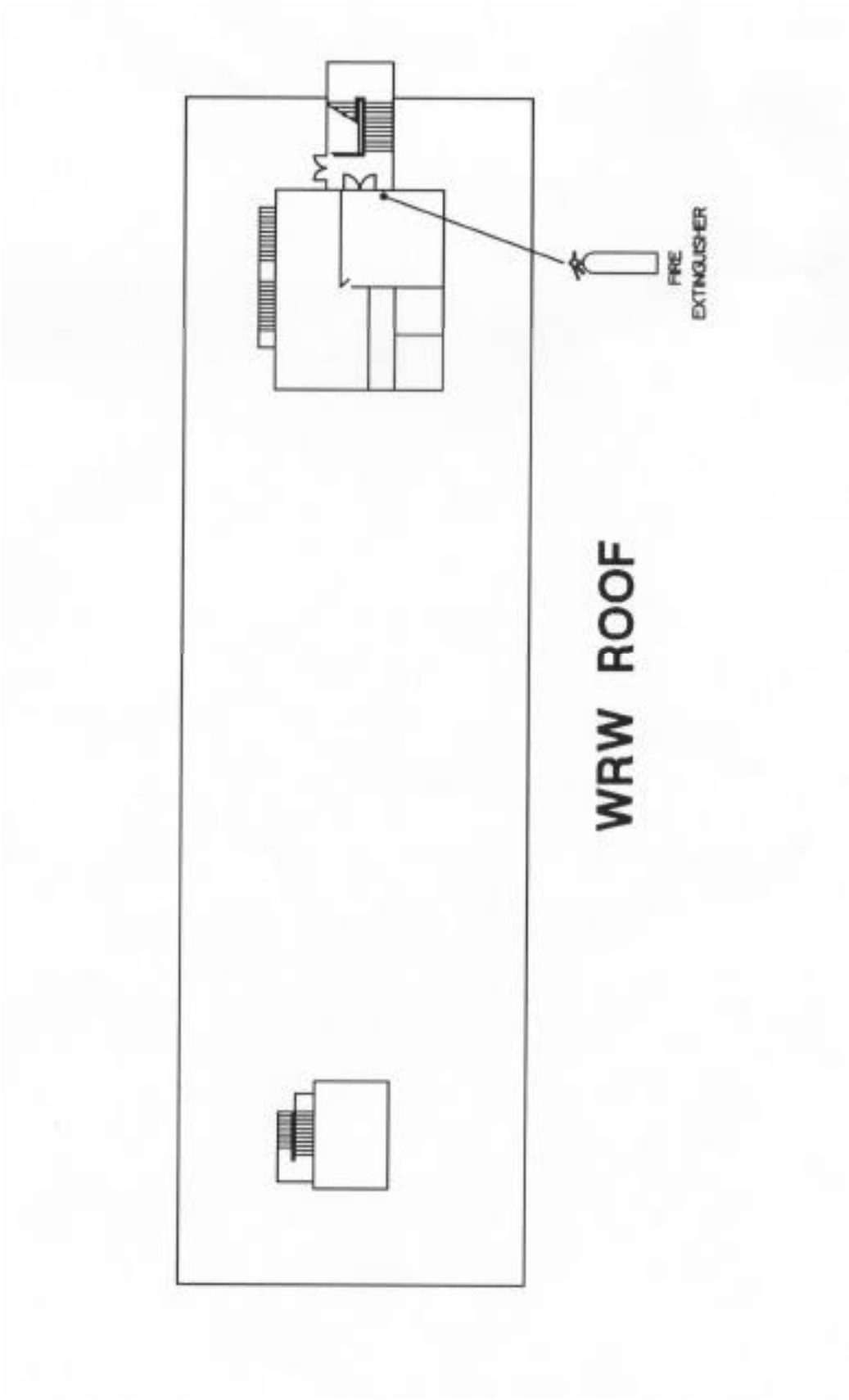
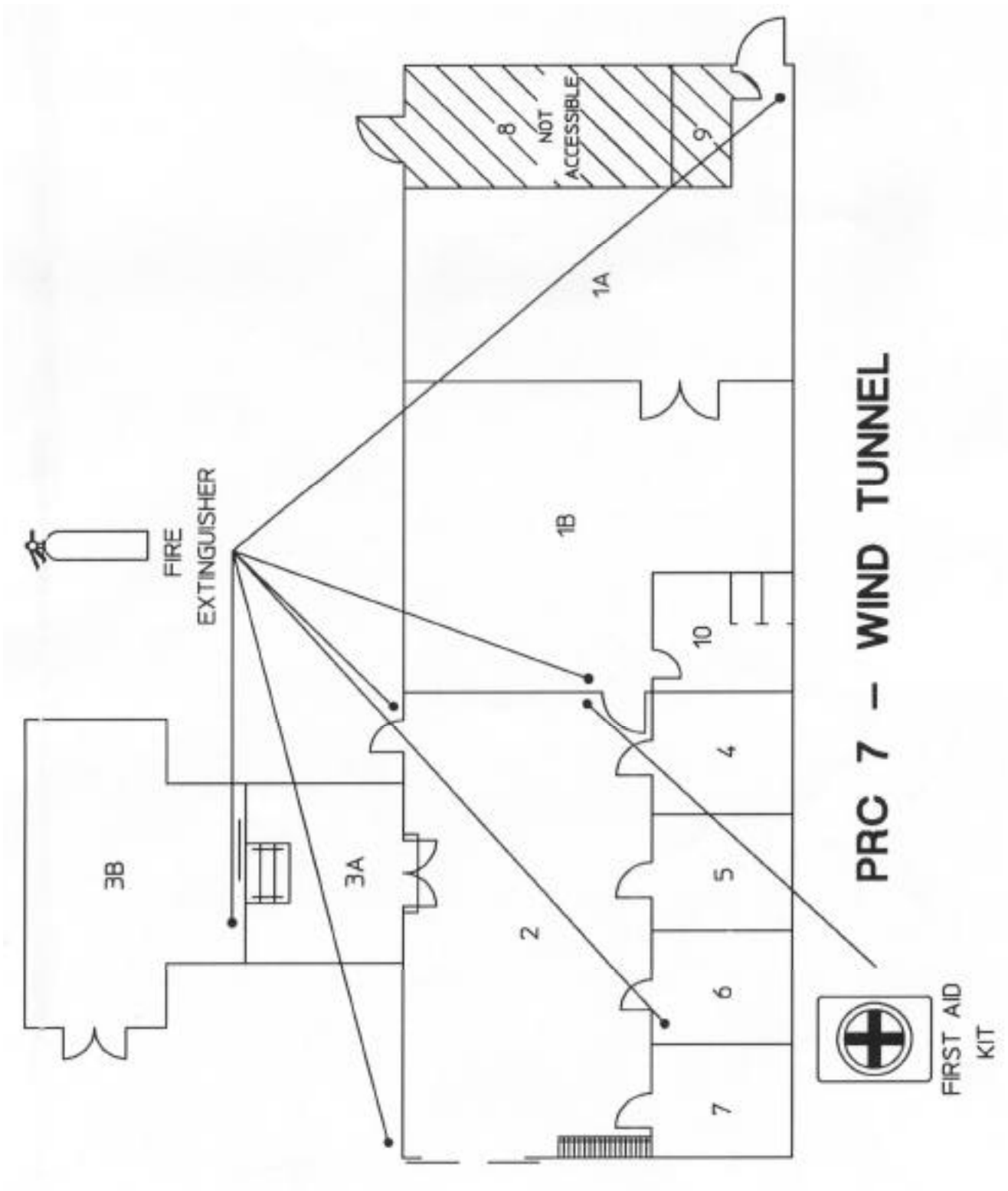
316A
316B


WRW FOURTH FLOOR
FIRE ALARM
FIRE EXTINGUISHER
FIRE HOSE
FIRE EXTINGUISHER
FIRE EXTINGUISHER
FIRE ALARM
FIRE HOSE
FIRE EXTINGUISHER
401
401A
401B
401C
401D
401E
401F
402
402A
402B
402C
402D
402E
403
403A
403B
404
405A
405B
406
407
407A
407B
408A
408B
408C
408D
409
410
411
411A
411B
411C
411D
412
412A
412B
412C
412D
413
414
414A
414B
414C
415A
415B
415C
415D
416
417
ELEV.


FIRE EXTINGUISHER
WRW ROOF


PRC 7 – WIND TUNNEL
FIRE EXTINGUISHER
FIRST AID KIT
8 NOT ACCESSIBLE
9
1A
1B
10
4
5
6
7
2
3A
3B

INDEX