NOTE TO READER

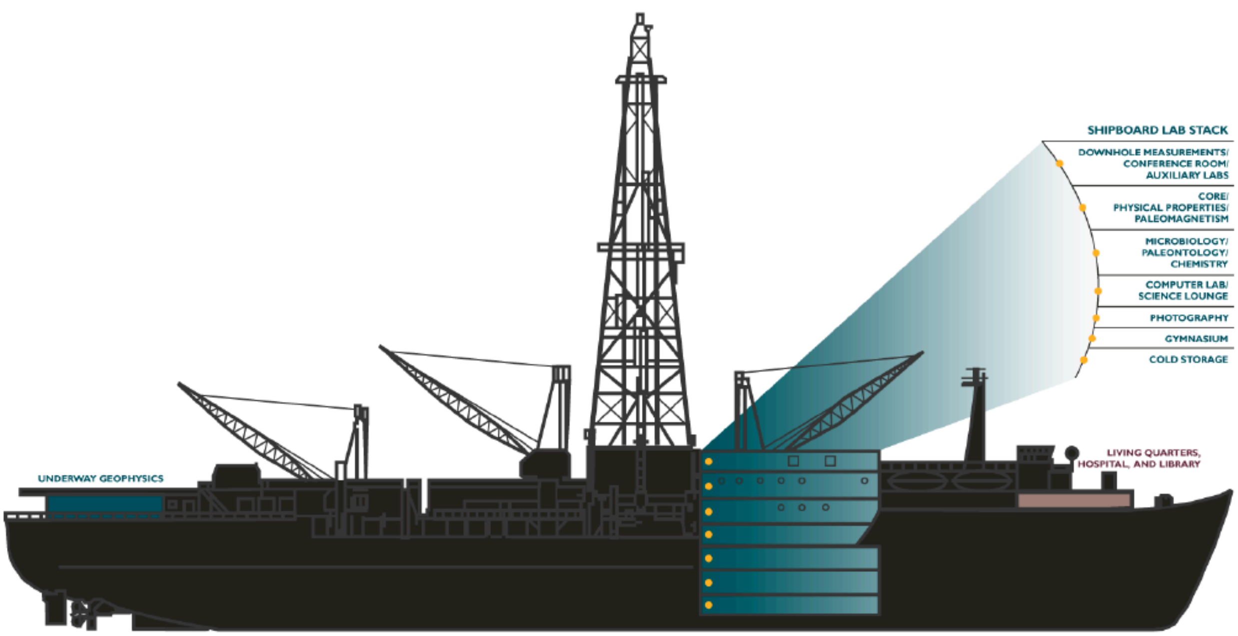
This document was published in June 2002. For most current practices or additional information, contact ODP representatives in JOIDES, JOI, TAMU, or LDEO.

Additionally, page numbers listed in the Table of Contents and throughout this document are not accurate. They make reference to the format used in the 2002 document.

LABORATORY SAFETY AND HAZARD COMMUNICATION COMPLIANCE MANUAL

For research facilities aboard *R/V JOIDES RESOLUTION* that are operated by the Ocean Drilling Program/Texas A&M University

Texas A&M University



Publication Date: June 2002

TABLE OF CONTENT

INTRODUCTION

This manual is intended to provide guidance to the *R/V Joides Resolution* staff in complying with the Texas A&M University Hazard Communication Program (section 1). Additionally, the basics of laboratory safety and management of hazardous chemicals are discussed in section 2 to 4.

It is NOT the purpose of this document to be comprehensive marine safety manual covering all shipboard activities, but to supplement the existing Safety Management System documents provided and maintained by the ship's owner.

The study of this manual should be supplemented by the reading of the Introduction to Texas A&M University Safety Management Policies Manual.

MAINTENANCE OF THIS MANUAL

This manual will be reviewed, updated, and republished (as needed) annually each June by the Supervisor of Technical Support. The policies stated in this manual will supercede all other polices as of its publication and revision dates.

OTHER ODP SAFETY DOCUMENTS

Specific safety-related topics are addressed in the following ODP documents. These documents are available from ODP/TAMU and on the *JOIDES Resolution*. This list will be updated periodically, as appropriate.

- ***Introduction to Ocean Drilling Program's Safety Management Policies*** provides general guidance for scientific and technical staff on board *JOIDES Resolution* in complying with the Texas A&M University Hazard Communication Program. It also covers the basics of shipboard and laboratory safety and management of hazardous chemicals.

- ***Hydrogen Sulfide Drilling Contingency Plan*** provides guidance in recognizing, preparing for and mitigating potentially dangerous hydrogen sulphide (H_2S) situations during drilling and coring operations.

- ***Introduction to Shipboard Organic Gechemistry on the JOIDES Resolution*** provides guidance on hydrocarbon monitoring and safety

- ***Site/Safety Panel Guidelines and Safety Manual*** addresses fundamental issues of site selection and operational procedures to minimize drilling hazards and risks of accident or pollution.

- ***Ocean Drilling Program Crisis Management Plan*** describes priorities and procedures to be followed in responding to a major, life threatening, operations damaging incident.

Section 1: WORKPLACE HAZARD COMMUNICATION IMPLEMENTATION PLAN

According to the TAMU HAZCom Program, each workplace (*R/V Joides Resolution*) must have a written plan that describes how TAMU HazCom is implemented in the workplace. To assure compliance with the TAMU HazCom, the following documentation must be available:

- Copy of the most current version of the TAMU HazCom Program (see Attachment 4 in the Introduction to Texas A&M University Safety Management Policies Manual).
- Workplace Implementation Plan.
- Work Area Implementation Plans.
- Records of training.

A copy of the Workplace Implementation Plan of the *R/V Joides Resolution* is presented in Attachment 1. This plan lists the:

- Positions responsible for complying with the annual Workplace Chemical Inventory (WPCI) and location of where the WPCI is filed.
- Location of Material Safety Data Sheets (MSDS).
- Location of “Notice to Employees” postings.
- Location of employee training records.
- Positions responsible for assuming compliance with training requirements.

Such a list should also be compiled and kept in each different laboratory on the ship to form the individual Work Area Implementation Plans.

1. WORKPLACE AND WORK AREA CHEMICAL INVENTORIES

The TAMU HAZCom program requires that each workplace compiles and maintains an annual WPCI and work area inventories (WACI). The annual WPCI requirements generally apply to quantities of 50 gallons or 500 pounds. The quantities of chemical carried on board the *R/V Joides Resolution* do not reach this quota, thus the "Research Laboratory Exemption" listed in the TAMU HAZCom Program (see Attachment 4 in the Introduction to Texas A&M University Safety Management Policies Manual) applies to the ship. All work areas are also exempt from maintaining a WACI for hazardous material used in the routine laboratory operations.

Should non-exempt hazardous materials be brought aboard the *R/V Joides Resolution* or the amount stored exceed the Threshold Planning Quantities (TQP) for extremely hazardous materials (See Appendix I) it will be the Lab Officer responsibility:

- To insure that all non-exempt materials are listed in a WACI. A work area chemical inventory should contain the following elements: chemical name, Chemical Abstract Service (CAS) number, maximum on hand, storage location and the name of the user. Electronic inventory systems may be used, and should be readily accessible to anyone needing that information.

- To advise the Supervisor of Technical Support to update the shore copy and notify TAMU’s

Environmental Health and Safety Department in accordance to the regulation of the TAMU Hazard Communication Program.

Extremely hazardous materials include those that are:

- Extremely toxic
- Highly reactive, unstable or explosive
- Known human carcinogens
- Some flammable liquids (Class A)
- Reproductive toxins
- Infectious agents ($\geq$ BL-3)
- Sensitizers and/or allergens
- Any material, which because of quantity present, use or other conditions, may be particularly hazardous.

NOTE: *Do not confuse the ODP Hazardous Material Inventory with the Work Area Chemical Inventory. The ODP Hazardous Material Inventory lists all hazardous material, regardless of amount, that has been approved for use on the R/V Joides Resolution. Note, this same inventory will be used to identify materials that need to be reported on the WACI.*

2. LOCATION AND ACCESS TO HAZARD AND SAFETY INFORMATION

The TAMU HAZCom program requires that a workplace maintains a file of current MSDS and ensures proper labeling of chemicals to conform to the MSDS identification. Onboard the *R/V Joides Resolution*, the MSDS are available electronically via the shipboard computer network and in paper form in each designated each work areas.

2.1. Location of MSDS

MSDS Electronic Database: An MSDS electronic database is available on the Assistant Lab Officer's PC. To access the electronic MSDS database you must the launch the ChemExpress application. For instruction on how to use the MSDS Electronic Database, see either the Lab Officers or the Assistant Lab Officer.

Also, MSDS and other information on hazardous materials can be accessed from the Environmental Health and Safety Department (845-2132) and through the EHSD Homepage at http://EHSD-online.tamu.edu. Click on "MSDS" and follow the instructions.

You can access to MSDS, after hours, through the EHSD Homepage or by calling TAMU Telecommunications Center (845-4311), ask for assistance from EHSD. ***Note, to access the EHSD database from the R/V Joides Resolution, special arrangements must be made by both the shore and shipboard System Managers. This make can take several days to setup.***

Location of Work Area MSDS Files: The MSDS Files (three-ring binders) are posted in each of the following work areas (see Attachment 2 for diagrams of the laboratory work areas):

- Thin Section Lab.
- Downhole Measurement Lab.
- Core Lab.
- Chemistry Lab.
- Microbiology Lab & ICP Prep. Room.
- Paleontology Lab.
- Main Deck Spaces.
- Photo Lab.
- ET Shop.
- Mezzanine Storage.
- Lower 'Tween Deck Spaces.
- Hold Deck Spaces.
- Underway Geophysical Lab (includes Fantail).
- Subsea Shop.
- Special Research Vans (when onboard).

Location of Department MSDS Files: A master of all MSDS is filed and kept in the Lab Officer's Office.

2.2. Hazard Warning Signs

Warning signs (e.g. radioactivity hazards, biological hazards, fire hazards, and laser operations) are appropriately posted in laboratory areas with special or unusual hazards. Other signs are posted to show the locations of safety showers, eyewash stations, exits, and fire extinguishers. Hazardous waste containers must be properly labeled.

Location of Hazard Warning Signage:
The locations of hazard warning signs are noted on the work area diagrams (Attachment 2).

Location of Emergency Information and Evacuation Plan:
In regards to the ODP research facilities, emergency information and evacuation plans are kept in the office of Technical Support. All other documents regarding other types of ship emergencies, the evacuation of other ship spaces, and the abandonment of the ship are located on the ship's Bridge.

Postings for Exits and Emergency Equipment:
The locations of exits and emergency equipment are noted on the work area diagrams.

Warning Signs Posted at Areas or Equipment where Unusual Hazards Exist:
The locations of areas or equipment where special or unusual hazards exist are noted on the work area diagrams (see Attachment 2).

Posting of Areas where Food/beverage Preparation, Consumption and Storage are not Permitted:
The locations of were food and/or beverage **MAY NOT** prepared, consumed or stored is noted on the

work area diagrams (see Attachment 2).

Other Signage:
All other signage is noted on the work area diagrams or is documents in the *R/V Joides Resolution*'s safety manuals. (See ship's Master)

2.3. Labeling Hazardous Chemicals

Each primary container (as received from the supplier) must be fully labeled with the National Fire Protection Agency (NFPA) labels provide by the Lab Officer. The label must include the following:

- Name and address of the manufacturer
- Identity of the contents (Must be the same as appears on the MSDS)
- Physical and health hazards, including target organs.
- Missing or illegible labels must be replaced.

Complete labeling of each secondary container in research laboratories is not required. However, the contents of secondary containers must also be marked using the NFPA label system so that they are readily identifiable by persons not associated with the lab (e.g., emergency or spill responders).

3. LOCATION OF PERSONNEL TRAINING RECORDS

TAMU HAZCom requires a workplace to ensure that all employees (all member of the science party) have received proper training before working with or in an area containing hazardous chemicals and to maintain a record of the training. At ODP, the personnel training records are kept in the offices of the Ocean Drilling Program's Supervisor of Human Resource. A secondary copy is kept aboard the *R/V Joides Resolution* in the Lab Officer's office. All training records are maintained for at least five years.

In accordance with TAMU HAZCom, members of the science party must be provided three levels of training: General, Work Area Specific, and Chemical Specific. Forms to document all three types of training are included in Attachment 4.

Members of the science party must be provided training before potential exposure to hazardous chemicals and when a new hazard, or significantly increased hazard is introduced into the work area!

- **General Training** requirement can be satisfied by completion of:

  a. The EHSD Introduction to Laboratory Safety Training Course
  b. The EHSD HazCom General Training Course
  c. As provided by the Lab Officer
  d. Visiting scientists, observers, and consultants can sign a letter (Attachment 5) which states that they have already received equivalent training from their institution or employer.

There is no requirement to repeat General Training.

- **Work Area Specific Training** requirement can be satisfied by providing Information on hazardous chemicals known to be present in the employees work area and to which the employees may be exposed, including:

    a. Location within the work area
    b. Specific hazards, including acute and chronic effects
    c. Safe handling procedures
    d. Location of MSDS
    e. How to obtain and use appropriate personal protective equipment
    f. First aid treatment to be used with respect to the hazardous chemicals
    g. Instructions on spill cleanup procedures
    h. Proper disposal of hazardous chemical specific to that work area
    i. How to properly use and shut down hazardous equipment (i.e. high pressure systems, powered radiation sources, lifting equipment, etc.)

- **Chemical Specific Training** can be accomplished by reading section 4 of this manual, all applicable Material Safety Data Sheets and understanding the information provided. Chemical specific training is only required for personnel working directly with the materials that have acute or chronic toxicity, including biohazards, and radioactive materials.

- **Record Keeping:**
    a. Training records and waivers must be kept for 5 years
    b. Workplace inventory records are maintained by EHSD
    c. Certification of completion of required training should be reported as required within the Workplace

Section 2: INTRODUCTION TO LABORATORY SAFETY

It is essential for everyone involved in laboratory operations to be safety minded. Safety awareness must be a part of every person's habits and each must accept responsibility for conducting all work in accordance with good safety practices. Good safety practices include adherence to the principles of laboratory safety, exercising due diligence and prudence in the laboratory, and avoiding actions that increase risk to themselves and others. Each person must be prepared, in advance, for possible accidents by knowing what emergency equipment is available and how it is to be used. Every laboratory worker has a basic responsibility to himself and colleagues to plan and execute laboratory operations in a safe manner in accordance to the policy set forth in this manual, other ODP safety documents, and the *R/V Joides Resolution* Safety Management System.

Ultimately, as the laboratory supervisor, the **Lab Officer has overall safety responsibility and authority** for ensuring that: (a) employees are properly trained and follow safety rules; (b) adequate emergency equipment (in proper working order) is available; (c) emergency equipment is provided and personnel are trained in its use; (d) information on special or unusual hazards in non-routine work is provided.

The Lab Officer has the authority to stop any laboratory activity that does not meet the safety requirements set forth in this manual.

1. PRINCIPLES OF LABORATORY SAFETY

Every person working in this laboratory is expected to:

- Know and follow the safety rules and procedures that apply to the work being done. Be aware of the potential hazards (physical, chemical, biological) and institute appropriate safety precautions before beginning any new operation.
- Know the location of and proper use of emergency equipment, emergency procedures, and how to obtain additional help in an emergency.
- Know the types of personal protective equipment available. Use the appropriate personal protective equipment.
- Be alert to unsafe conditions and actions and advise the supervisor for prompt correction.
- Do not store or consume food or beverages or apply cosmetics in areas where hazardous chemicals are being used or stored.
- Handle and dispose of laboratory waste in accordance with the TAMU and the *R/V Joides Resolution* waste disposal procedures.
- Use traps or scrubbing devices to prevent the escape of hazardous substances.
- Be certain that all chemicals are correctly and clearly labeled. Post warning signs when unusual hazards (i.e., radiation, laser operations, flammable materials, biological hazards) or other special conditions exist.
- Do not distract or startle any other worker. Practical jokes or horseplay will not be tolerated at any time.
- Properly store and segregate hazardous materials.
- Use equipment only for its designed purpose.

- Position and clamp reaction apparatus appropriately to permit manipulation without the need to move the apparatus until the entire reaction or procedure is completed. Combine reagents in appropriate order, and avoid adding solids to hot liquid.
  - Avoid working alone when using hazardous chemicals or procedures.
  - Think, act, and encourage safety until it becomes a habit.

2. STRATEGIES FOR MINIMIZING EXPOSURE TO HAZARDOUS MATERIALS

2.1 Engineering Controls

Engineering controls reduce personnel exposure by modifying the source or reducing the quantity of contaminants released into the work environment. Engineering controls can be very effective and are the preferred method for reducing personnel exposures. The most common engineering controls used aboard the *R/V Joides Resolution* are general-area ventilation systems (HVAC), chemical fume hoods and biological safety cabinets.

General laboratory ventilation is designed to replace exhausted air and provide the temperature, humidity and air quality required for the laboratory procedures without creating drafts at exhaust hoods. Airflow should be from areas of low hazard through areas of higher hazard. Air that is exhausted from laboratories should not be returned to any air intake.

The fume hood(s) provide an average of 100-125 linear feet per minute (fpm) of airflow at the hood face with no part less than 70 fpm. The following rules should be followed when using hoods:

- Volatile toxic or flammable chemicals work should be conducted in a fume hood that is exhausted to the outside *(Activated charcoal filtered units are not acceptable substitutes for direct exhaust hoods)*.
- Hood sash or sliding windows should be kept fully closed except as necessary for manipulation of equipment or other operations.

Biological Safety Cabinets (BCS), are designed, when fitted with HEPA filters to remove particulates from the air. A BSC, does not provide protection from chemical vapors unless vented to the outside and exhausted air is not returned into the room.

Other engineering controls such as local exhausts and glove boxes may be used for special ventilation purposes. Contact the Lab Officer for additional information if special ventilation or other engineering controls are needed.

TAMU and ship's owner share responsibility for evaluation and maintenance of engineering controls aboard the *R/V Joides Resolution*. TAMU's EHSD evaluates chemical fume hoods and local exhausts annually or as necessary, for proper operation and airflow. Sash level stickers indicating the maximum sash operating height and the evaluation date are placed on the fume hood when it is surveyed. As a rule:

- EHSD, ODP and the ship owner's approval are required prior to installation, relocation or modification of any laboratory local exhaust ventilation equipment or component.

- If fume hoods have alarms to indicate hood failure, alarms are tested, at least annually, by EHSD and should be checked periodically by lab personnel.
- BCS must be certified annually through a contract coordinated by EHSD.

If there is reason to believe that any engineering control (e.g., fume hood, BSC, glove box, local exhaust) or alarm is not functioning properly, contact the Lab Officer (dial 114) or the Engine Control Room (ECR dial 113) immediately. Other emergency numbers are listed in Appendix II.

2.2. Administrative Controls

Administrative controls include establishing and enforcing safety rules and standard operating procedures; protocol review; and reducing potential personnel exposure by substitution of a less hazardous material, rotation of personnel, and work schedule modification. The Laboratory Safety Rules and Procedures in Section 3 are intended to enhance the safety and health of laboratory employees.

Section 3: LABORATORY SAFETY RULES AND PROCEDURES

It is impossible to design a set of laboratory safety rules that address all potential hazards and occurrences. However, accidents and injuries can be avoided by using good judgment and by following general safety guidelines and prudent practices, which are applicable to any laboratory situation. The procedures and requirements described below are to be used to improve laboratory safety, avoid accidental release of hazardous chemicals and to minimize the risk of personnel exposure.

Additional information on laboratory safety, chemical safety, etc. is available in the TAMU Safety Manual section of the EHSD Homepage or by contacting EHSD.
Note: to access the EHSD database from the R/V Joides Resolution, special arrangements must be made by both the shore and shipboard System Managers. This make can take several days to setup.

1. SAFE LABORATORY PRACTICES

All persons working in a laboratory aboard the *R/V Joides Resolution* are expected to exercise due care, good judgment and follow prudent practices including:

- Treat all chemicals as if they were hazardous.
- Minimize exposure to any chemical.
- Avoid repeated exposure to any chemical.
- Never underestimate the potential hazard of any chemical or combination of chemicals.
- Assume that a mixture or reaction product is more hazardous than any component or reactant.
- Be alert to, and immediately report, any unsafe conditions or activities to your supervisor.

Each member of the science party should remember that injuries can occur as well outside the laboratory or other work area. It is important that safety be practiced in offices, stairways, corridors, and other places. Safety is largely a matter of common sense, but a constant safety awareness of everyday hazards is vital.

The following paragraphs highlight some safe laboratory practices that should be followed by all members of the science party.

1.1. Chemical Hygiene

- Mouth pipeting should be prohibited; a pipet bulb or an aspirator should be used.
- Potentially exposed skin surface should be washed frequently, and before leaving the laboratory area. (Do not use solvents for washing the skin. They remove the natural protective oils from the skin and can cause irritation and inflammation, and may facilitate absorption of a toxic chemical.)
- Long hair and loose clothing should be confined when in the laboratory.
- Exposure to gases, vapors, and aerosols should be avoided.
- Shorts and open toed shoes should not be worn in the lab where reactive, corrosive, or toxic materials are being used unless covered by protective clothing.

1.2. Food and Drinks in the Laboratory

Contamination of food and drink are potential routes for oral exposure to toxic substances.

- Food and beverages may be stored, handled, and consumed ONLY in an area that is designated to be free of potentially toxic substances.
- Laboratory chemicals (e.g., NaCl, sugar), glassware or equipment should not be used for storage, preparation, or use of materials intended for human consumption.
- Food, drinks, tobacco products, cosmetics should not be brought or used in laboratories, or other areas where radioactive, or hazardous biological or chemical materials are present.
- Consumable items should not be stored in laboratories (including refrigerators within laboratories).
- Rooms that are adjacent, but separated by floor to ceiling walls, and where hazardous substances are not present, may be used for these activities at the discretion of the supervisor responsible for the area(s).
- Laboratory ice should not be used for human consumption.

Location where storage, preparation and consumption of food, drinks etc ARE NOT permitted are indicated in the Laboratory Diagrams (Attachment 2).

1.3. Personal Protective Equipment

Laboratory employees must be furnished appropriate personal protective equipment (PPE) if potential exposure cannot be effectively controlled by engineering and administrative controls. PPE is required as follows:

- Appropriate eye protection MUST ALWAYS be worn anytime there is a risk of injury from chemical contact or airborne dust, particle or penetrating objects. Additional eye and face protection should be worn, as needed (e.g., radiation, laser). Contact lens may be worn in the lab. However, contact lens and normal corrective glasses cannot be a substitute for wearing other personal eye protective equipment.
- Protective apparel, including face shields, gloves, and other special clothing or footwear must be worn as needed.
    - Potentially contaminated protective clothing should not be worn outside the lab area. Lab coats should be cleaned regularly (special washing may be required) and not washed with regular clothing.
    - Contaminated disposable clothing should be treated as hazardous waste.
- Equipment for protection of the respiratory system, skin and clothing must be provided and should be worn as appropriate. Assurance of proper fit is required whenever the use of respiratory protective equipment is necessary.

Appropriate PPE can be determined by consulting the MSDS or by requesting assistance from the Lab Officer.

1.4. Working Alone and Unattended Operation

is imprudent practice to work alone in a laboratory. Arrangements should be made between individuals working in other areas of the ship to cross check periodically. Hazardous procedures, should never be undertaken when working alone in the laboratory.

Under unusual conditions, special rules may be necessary. The Lab Officer will determine whether the work requires special safety precautions such as having two persons in the same room during a particular operation.

When it is necessary to carry out laboratory operations continuously or overnight and leave them unattended, it is essential to plan for interruptions in utility services such as electricity, water, coolant, etc. These operations must be designed to be safe, and plans should be made to minimize hazards in case of failure. Wherever possible, routine inspection of the operation should be done and, in all cases, the laboratory lights should be left **ON** and an appropriate sign should be placed on the door to indicate that the operation is unattended.

1.5. Housekeeping in the Laboratory

There is a definite relationship between safety performance and orderliness in the laboratory. Therefore, all lab personnel will be individually and collectively responsible for maintaining the work area in a clean and orderly fashion by following these recommendations:

- Keep work areas clean and free from obstructions. Hallways, corridors, aisles and exit routes must ALWAYS be kept clear and free of obstructions.
  - Do not allow emergency equipment, electrical panels, and such to be blocked.
  - Do not use hallways or stairways for storage.
- Clean the work area following the completion of any operation or at the end of each day.
- Clean and dispose of spilled chemical and cleanup waste promptly and properly.
- Dispose of unneeded chemicals, empty containers, etc. Do not allow unneeded items to accumulate and create clutter.
- Clean floors regularly. Accumulated dust, chromatography adsorbents, and other powdered chemicals and materials may pose respiratory hazards.
- Store equipment and chemicals properly to minimize clutter.

1.6. Proper Usage and Maintenance of Equipment

Proper equipment usage and good maintenance is important for safe, efficient operations. Equipment should be inspected and maintained regularly. The risk and the consequences of failure should determine servicing schedules. Follow the recommendations below:

Do Not Attempt To Use Equipment That Been Marked OUT-OF-ORDER!

- Use equipment only as it was intended. Follow the manufacturer's instruction manual closely.
- Do not deactivate or defeat safety devices.
- Equip all mechanical equipment with guards that prevent access to electrical connections or moving parts (such as the belts and pulleys of a vacuum pump).
- Inspect equipment before use to ensure that the guards are in place and functioning.

- Use safety shielding for any operation having the potential for implosion or explosion such as:
  - b When a reaction is attempted for the first time (small quantities of reactants should be used to minimize hazards).
  - c Whenever a familiar reaction is carried out on a larger than usual scale (e.g., 5-10 times more material).
  - d Whenever operations are carried out under non-ambient conditions. Locate shields such that all personnel in the area are protected from the hazard.

In case of equipment malfunctions or unsafe conditions, the supervisor of the equipment should be contacted. In case of utility or ship's equipment failure, the Engine Control Room (dial 113) should be contacted promptly. For information or assistance regarding fume hood or local exhaust operation or testing, the Lab Officer (or EHSD) should be contacted.

1.7. Prior Approval For Non-Routine

Prior to engaging in a laboratory task that is non-routine, employees must obtain prior approval to proceed from the Lab Officer or his or her designee whenever:

- A new laboratory procedure or test is initiated.
- It is likely that toxic concentrations could be reached or other hazardous situations could arise.
- There is a change in a procedure or test, even if it is very similar to prior practices. Change in a procedure or test means:
  - a A 10% or greater increase or decrease in the amount of one or more hazardous chemicals (including catalysts) used
  - b A substitution or deletion of any of the chemicals in a procedure.
  - c Any significant change in the system or in other conditions under which the procedure is to be conducted.
- There is a failure of any of the equipment used in the process, especially of safeguards such as fume hoods or clamped apparatus.
- There have been previous unexpected results or potential or near accidents
- Members of the laboratory staff become ill, suspect that they or others have been exposed, or otherwise suspect a failure of any safeguards.

1.8. Fire Prevention in the Laboratory

Observe the following rules when using flammable materials in laboratory operations:

- NEVER use an open flame to heat a flammable liquid or for vacuum distillation.
- Use an open flame only when necessary and extinguish it when it is no longer actually needed.
- Do not light a flame unless all flammable substances are removed from the immediate area. Be sure that containers of flammable materials in the area are tightly closed.
- Notify other occupants of the laboratory before lighting a flame.
- Store flammable materials properly. Separate flammable chemicals from oxidizers.
- Use only non-sparking electrical equipment when volatile flammable materials may be present.
- Minimize quantities of flammable solvents in the lab. (See Table 1: Recommended Maximum Quantities of Flammable Liquids in Research Laboratories)

2. SOME SPECIFIC SAFETY CONCERNS

2.1.Laboratory Glassware

Accidents involving glassware are a leading cause of laboratory injuries. To prevent accidents, follow these recommendations:

- Use care in handling and storage procedures to avoid damaging glassware. Damaged items should be discarded or repaired.
- Use appropriate hand-protection when inserting glass tubing into rubber stoppers or corks, or when placing rubber tubing on glass hose connections. Tubing should be fire polished or rounded and lubricated. Hold hands close together to limit movement of glass should fracture occur. Use plastic or metal connectors (instead of glass connectors) when possible.
- Handle vacuum-jacketed glass apparatus with extreme care to prevent implosions. Tape or shield equipment such as Dewar flasks.
- Use heavy-walled, silica glassware (Pyrex, Kimax, etc.) for work involving non-ambient pressure or temperature work.
- Use hand protection when picking up broken glass. (Use a brush to sweep small pieces into a dustpan.)
- Seek instruction in the use of glass equipment designed for specialized tasks. (For example, separatory funnels containing volatile solvents can develop considerable pressure during use.)

2.2. Vacuum Systems

Glass vacuum systems pose severe implosion hazards. Follow these guidelines and requirements for safety:

- Ensure that pumps have belt guards in place during operation.
- Ensure that service cords and switches are free from defects.
- Always use a trap on vacuum lines to prevent vapors from being drawn into the vacuum pump, building vacuum line, or water drain.
- Replace and properly dispose of vacuum pump oil that is contaminated with condensate. Used pump oil must be disposed as hazardous waste.
- Place a pan under pumps to catch oil drips.
- Do not operate pumps near containers of flammable chemicals.
- Do not place pumps in an enclosed, unventilated cabinet.

IMPORTANT: **All glass vacuum equipment is subject to possible implosion. Conduct all vacuum operations with a table shield or in a fume hood. Do not underestimate the pressure differential across the walls of glassware that can created by a water aspirator.**

The glassware used with vacuum operations must meet the following requirements:

- Only heavy-walled round-bottomed glassware should be used for vacuum operations. The only exception to this rule is specifically designed for vacuum operations, such as an Erlenmeyer filtration flask.

- Wrap exposed glass with tape to prevent flying glass if an implosion occurs.
- Carefully inspect vacuum glassware before and after each use. Discard any glass that is chipped, scratched, broken, or stressed.

When possible, use molded plastic desiccators with high tensile strength or a perforated metal desiccator guard for glass desiccators.

2.3. Cold Traps and Cryogenic Hazards

A cold trap is a condensing device to prevent liquid contamination in a vacuum line. Guidelines for safely using a cold trap include:

- Locate the cold trap between the system and vacuum pump.
- Ensure that the cold trap is of sufficient size and cold enough to condense vapors present in the system.
- Check frequently for blockages in the cold trap.
- Use iso-propanol/dry ice or ethanol/dry ice instead of acetone/dry ice to create a cold trap. Iso-propanol and ethanol are less expensive, less toxic, and less prone to foam.
- Do not use dry ice or liquefied gas refrigerant bath as a closed system. These can create dangerous uncontrolled high pressures.
- Extreme cold is the primary hazard of cryogenic materials (e.g., liquid oxygen, liquid nitrogen, dry ice). Cryogens and the surfaces they cool can cause severe burns if allowed to contact the skin. Use gloves and a face shield if needed when preparing or using some cold baths.
- Do not use cryogens to cool a flammable mixture in the presence of air. Oxygen (from the air) can condense on the surface of the container resulting in an explosion hazard.
- Use appropriate dry gloves when handling dry ice.
- Avoid excess frothing by adding dry ice slowly to the liquid portion of the cooling bath.
- Do not breathe vapors or lower your head into a dry ice chest: carbon dioxide is heavier than air, and suffocation can result.

2.4. Pressurized Systems

To avoid accident with pressurized systems:

- Make sure that the pressurized apparatus should have an appropriate relief device.
- Do not carry out a reaction in, or apply heat to, a closed system unless it is designed and tested to withstand pressure.
- Use an inert gas ebulator system to avoid bubbling or pressure buildup for reactions that cannot be opened directly to the air.

3. MANAGEMENT OF HAZARDOUS MATERIALS

3.1. Hazardous Material Delivery

Before any hazardous material is allowed onboard the *R/V Joides Resolution* the Lab Officer will determine that the material can be used safely onboard by “checking-off” and signing the Hazardous Material Usage Approval form (Attachment 6) and then getting the Captain’s approval and signature on the same form. The material’s name and hazard information will be entered into the ODP Hazardous Material Database and copy the approval form will be kept in the Lab Officer’s office.

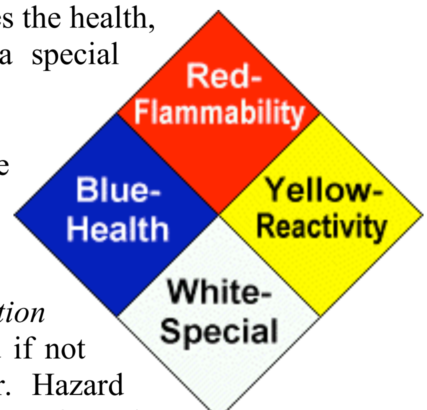
3.2. Chemical Labeling and ODP Policy

The TAMU HazCom program requires that containers of hazardous chemicals should be properly labeled. It distinguishes between two types of containers:

- Primary Containers: which are those received from the supplier. Labels on primary containers must not be defaced or removed and must include the following information:
  - Identify of the material as it appears on the MSDS
  - Health and physical hazards including the target organ
  - Manufacture’s name and address
  - NFPA hazard label used for ODP policy (see below)
- Secondary Containers: which are any containers to which chemicals have been transferred to from a Primary container or any container that is used to mix chemicals in (lab glassware).
  - All secondary containers must be labeled with the contents name
  - If the container’s volume is 500ml or greater then the NFPA label must used, as well (ODP policy)

ALWAYS LABEL WATER BOTTLES!!

ODP has adopted the National Fire Protection Association (NFPA) chemical hazard labeling system for all primary chemicals containers (the original container provided by the vendor) and secondary containers with volumes greater than 500 ml. The NFPA system indicates the health, flammability and reactivity hazards of the chemicals. In addition, a special precaution symbol may be used where necessary.



The NFPA hazard labeling system was chosen by ODP because it simple and easily understood by non-English speaking personnel on the emergency response team.

As a rule, when chemicals are unpacked onboard the *R/V Joides Resolution* they must be inspected for damage and a NFPA label must be applied if not provided by the vendor. Blank labels are available from the Lab Officer. Hazard rating information for various chemicals can be gotten from Attachment 7 or from the MSDS. *When replacing existing labels with the NFPA label try to apply the label in such a way as to NOT cover the original label.*

Many chemicals shipped from U.S. vendors can also labeled with the Hazardous Materials Identification System (HMIS) hazard labels. At first glance, the HMIS and NFPA labeling systems appear quite similar. Both have four sections colored blue, red, yellow and white. HMIS uses colored bars, while NFPA uses colored diamonds. HMIS attempts to convey full health warning information to all

employees while NFPA is meant primarily for fire fighters and other emergency responders. HMIS labels will be replaced with NFPA labels as chemicals arrive on board for consistency.

3.3. Chemical Storage

Aboard the *R/V Joides Resolution*, the chemicals are stored by hazard class. The following color scheme should be used for storing and separating hazardous materials:

Storage Color Code	Hazard Type
Gray	Moderate hazard
White	Corrosive
Yellow	Oxidizer
Red	Flammable
Blue	Keep away from food
	Irritant
	Toxic
Black	Carcinogen-Biohazards
	Mutagen-Biohazards
	Highly Toxic
	Radioactive
	Hydrofluoric Acid

The following rules should be applied when storing Chemicals:

- Any cabinets, drawer, refrigerators, etc that is used to store chemicals, of any amount, must be marked on the outside with:

1. Storage Color Code, such as -> OXIDIZER
2. NFPA Hazard showing the maximum rating of all the contents
3. Printed listed of the chemical names and maximum quantity that can be store in this cabinet. **Note: it is the responsibility of the marine specialists assigned to that lab to make sure that chemical storage units only have the chemicals and quantities indicated on the list or update the list to reflect the change.**

- Also make sure to:

    1. Store flammable solvents and strong acids or bases separately and in appropriate cabinets. **Flammable materials must not be stored in refrigerated equipment, unless the refrigerator is specifically designed for that purpose.**
    2. Secure compressed gas cylinders (strap, chain or cylinder stand).
    3. All stored chemicals must be in appropriate containers, tightly sealed, properly labeled, and in good condition.

- **Materials that fall in to the "BLACK" storage category must be kept under in locked**

storage at all times.

To maintain adequate separation of incompatible chemicals and their storage units. the International Air Transport Association (IATA) Class/Division values (when available) and the segregation table (below) can be used as a guide to determine what materials can be stored together. When in doubt always refer to the MSDS.

Hazard Label	1 excl. 1.4S	1.4S	2	3	4.2	4.3	5.1	5.2	8
1 excl. 1.4S	-	X	X	X	X	X	X	X	X
1.4S	X	-	-	-	-	-	-	-	-
2	X	-	-	-	-	-	-	-	-
3	X	-	-	-	-	-	X	-	-
4.2	X	-	-	-	-	-	X	-	-
4.3	X	-	-	-	-	-	-	-	-
5.1	X	-	-	X	X	-	-	-	X
5.2	X	-	-	-	-	-	-	-	-
8	X	-	-	-	-	X	-	-	-

X indicates that materials with these classes/divisions must NOT be stored together!

For more details on the storage of hazardous materials see Section 4 of this manual: Working With Hazardous Materials.

<u>3.4. Proper Usage of Chemicals in Fume Hoods</u>

For all operations that might result in release of flammable, toxic or malodorous chemical vapors or dust, a hood or other local ventilation device must be used when working with any air-borne substance with a permissible concentration in air of less than 50 ppm. To safely use hazardous chemicals in a hood:

- Confirm adequate hood performance before use.
- Keep the fume hood sash or sliding windows closed at all times except when necessary for manipulations within the hood.
- Minimize storage of materials in the hood.
- Do not use a fume hood for long-term storage of chemicals or equipment
- Do not allow blockage of vents or disruption of airflow.
- Leave the hood "ON" if volatile or toxic substances are stored (in the hood or ventilated cabinet below) or if needed to assure adequate general laboratory ventilation.
- Place equipment and other materials at least six inches behind the sash to assure proper airflow and to reduce the escape of chemical vapors into the lab.
- Raise large equipment ~1.5 inches off the work surface to allow air to flow underneath.
- Do not allow loose papers, paper towels, or tissues (e.g., Kimwipes®) to be drawn into the exhaust duct.
- Do not place objects in front of a fume hood (such as refrigerators or lab coats hanging on the manual controls) that might interfere with airflow.
- See "Strategies for Minimizing Exposure to Hazardous Chemicals; See Table 4 "Health Hazard Rating: Acute Toxicity
- DO NOT install, remove, relocate or modify any hood or exhaust system without prior approval

of the Lab Officer, ship's owner, and EHSD.

3.5. Hazardous Waste

Hazardous waste include materials that can be classified as ignitable, reactive, corrosive, toxic, universal waste and waste not excluded from regulations. The materials cannot be disposed of the sanitary sewer or trash. The TAMU Hazardous Waste Disposal Program described in Appendix III provides guidelines on disposing hazardous waste. Most of its information should be used as a guide only, unless, the material is being shipped back to TAMU for disposal.

When a procedure will generate a hazardous waste, the operator should follow the following recommendations:

- Find appropriate containers to store hazardous material.
- Find an appropriate storage location onboard.
- Containers used for collection of hazardous waste must be in good condition, must not leak, and must remain closed except when waste is added. Containers and contents must be compatible. Do not overfill hazardous waste containers (Allow at least 10% headspace for liquid expansion).
- Containers should be triple rinsed, the labels defaced and the lids removed before disposing of empty containers.
- Check with the Lab Officer if the material can be disposed of in the next port-of-call or that arrangements can be made to keep the material onboard until the ship arrives at a port where the material can be dispose.
- The Lab Officer must in turn notify the ODP Marine Logistic Coordinator as soon as possible of the need to dispose of hazardous waste and provide the chemical makeup of the material and quantity to be disposed.
- The ODP Marine Logistic Coordinator will provide the Lab Officer with the necessary instructions on how to package and label the waste according to the laws and regulations of the port-of-call.

Note: On board the *R/V Joides Resolution* there are special "Acid" drains for corrosive liquids in the Chemistry and Paleontology Laboratories. See either the Chemistry technician or Lab Officers for drain locations.

3.6. Spills and Location of Clean-up Kits

Every lab should have immediate access to equipment and supplies to cleanup spills of the largest container of every type of hazardous material in the work area. For detailed instructions on how to use acid, base, and flammable clean-up kits, refer to Attachment 8. In the event of a small, contained spill* and/or until assistance from the ship board emergency response team is obtained, follow these steps:

- If the liquid has spilled on a person, immediately get to a safety shower and wash off the chemical. The showers are located on each landing as well as the Chemistry Lab and in the hall near the Paleo Lab on the Focsle Deck; at the Photo Table on the Bridge Deck. Remove clothing if necessary and notify the ship's Physician.
- If the substance is dry and/or nonvolatile, shut off hoods, close windows and doors, and vacate rooms. Label door with appropriate warning. Allow the aerosol to settle for about 30 minutes

before reentering room.

- If the substance is volatile, leave ventilation on and vacate room. Be sure the immediate area is clear of personnel. Close the door and post warning.
- Notify the laboratory the Lab Officer or Assistant Lab Officer.
- Assemble materials necessary for decontamination and don appropriate protective clothing, i.e., disposable lab coat, gloves and splash goggles. If respiratory protection is needed, seek assistance from supervisor.
  - For a liquid carcinogen or other hazardous chemical spill, wipe up the spill with absorbent material. Wash down all surfaces with the decontaminating solution appropriate to the nature of the material.

  - For a dry chemical or biological spill, wash down all surfaces with an appropriate solvent to neutralize or deactivate and remove the substance.
  - Place all contaminated materials in impermeable containers and seal. Properly remove and bag protective clothing and follow appropriate disposal procedures.
  - Wash the area with soap and water to ensure that all of the neutralizing materials have been cleaned up.
  - Ventilate area thoroughly before allowing general use.

In case of emergency, the Self Contained Breathing Apparatus (SCBA) are located near the main Deck copier, in the Core Entry area next to the Core Rack, and in the Tool Pusher's Office. The clean-up Suits are located in the locker in the Lab Officer's office. The clean-up kits are located at the bottom of the stairs on the Hold Deck in the Lab Stack.

**A small contained spill of hazardous material is one that can be managed by a single person who, when wearing proper PPE, will not encounter excessive exposure, other hazardous condition (e.g. fire, explosion) or release of highly odoriferous or noxious materials. Any other spill is a "large spill" requiring activation of the Shipboard Emergency response team, contact the Lab Officer or Assistant Lab Officer.*

4. REGULATED OR RESTRICTED ACCESS AREAS OR PROCEDURES

All unlocked research spaces aboard the *R/V Joides Resolution* are open to all members of the science party. To gain access to locked areas, contact to the Lab Officer or Assistant Lab Officer. Also, the Lab Officer must approve any procedure that is not documented in the Shipboard Handbook or Laboratory Technical Note.

5. REPORTING ACCIDENTS AND HAZARDOUS CONDITIONS

Emergency telephone numbers to be called in the event of fire, accident, water or gas leak, or hazardous chemical spill should be posted prominently in each laboratory. Notify these persons immediately in the event of an accident or emergency.

ALL accidents, near accidents and hazardous conditions should be promptly reported to the Lab Officer. First Report of Injury Forms shall be completed and filed as required for all "Reportable Injuries."

Section 4: WORKING WITH HAZARDOUS MATERIALS

Hazardous materials include chemicals that are classified into four main categories: corrosive, flammable, reactive and toxic. This section defines each type of hazardous chemicals and provide guidelines on how to use and store them; what health risks are associated with each type; what first aid should be administer; and what PEE to use when working with them.

1. CORROSIVE CHEMICALS

Corrosive chemicals (solids, liquids and gases) destroy living tissue by chemical action at the site of contact. Direct contact with corrosive chemicals, especially inorganic alkali hydroxides, can severely damage living tissue. All hydrogen halides are serious respiratory irritants and also cause severe burns. Hydrofluoric acid (even at low concentrations) is particularly dangerous. Corrosives are the most common health hazards encountered in the laboratory environment.

1.1 General Characteristics

- Corrosives can cause visible destruction or irreversible alterations at the site of contact. Extent of tissue damage, for each agent, is directly related to concentration and length of exposure at the site of contact. Inhalation of the vapor or mist can cause severe bronchial irritation. Corrosives are particularly damaging to the skin and eyes.
- Inorganic acids and bases are common laboratory corrosives. Other materials (oxidizing, reducing, and dehydrating agents) can be severely corrosive to living tissue.
- Sulfuric acid is a very strong dehydrating agent and nitric acid is a strong oxidizing agent. Dehydrating agents can cause severe burns to the eyes due to their affinity for water. Many oxidizing agents are also corrosive.
- Some chemicals that are non-corrosive when dry can be corrosive when wet (e.g. when in contact with moist skin or mucus membranes). Lithium chloride, halogen fluorides, and allyl-iodide are examples.

1.2. Examples of Corrosives

Sulfuric acid	Bromine
Hydrochloric acid	Ammonium hydroxide
Hydrofluoric acid	Fluorine
Nitric Acid	Phenol
Inorganic hydroxides	Acetic acid
Phosphoric acid	Chlorine

Note: These are some of the corrosive chemicals most frequently used on the *R/V Joides Resolution*

1.3. Use and Storage of Corrosives

For proper usage and storage of corrosive chemicals, follow these recommendations:

- Do not work with corrosive chemicals unless an emergency shower and continuous flow eyewash are available.

- Always store acids separately from bases. Many acids are also strong oxidizers, therefore should be isolated from flammables.
- Store corrosives in a wooden or corrosion-resistant cabinet.
- Store on a low shelf or cabinet; never above eye level.
- Corrosives should be stored in plastic-coated containers.
- Containers of corrosive chemicals should be placed in a secondary container (e.g. tray or bucket to contain any leakage).
- When diluting acid with water, add acid to water, never add water to acid.

Aboard the *R/V Joides Resolution* the following color scheme is used for storing and separating hazardous materials:

Storage Color Code	Hazard Type
Gray	Moderate hazard
White	Corrosive
Yellow	Oxidizer
Red	Flammable
Blue	Keep away from food
	Irritant
	Toxic
Black	Carcinogen-Biohazards
	Mutagen-Biohazards
	Highly Toxic
	Radioactive
	Hydrofluoric Acid

1.4. Use and Storage of Hydrofluoric Acid

Hydrofluoric acid (HF) is extremely hazardous and can cause severe burns. Initial skin contact with hydrofluoric acid may not produce any symptoms. Inhalation of anhydrous hydrogen fluoride can be fatal.

ODP should be notified in advance of anticipated hydrofluoric acid use on a leg and its use requires special permission from the Lab Officer.

Also, hydrofluoric acid will not be used on the *JOIDES Resolution* unless burn treatment medical supplies and acid spill clean up chemicals are available in sufficient quantities. ODP will coordinate with the ship's Medical Officer to ensure medical supplies are available.

Following is a set of rules that need to be strictly enforced when using HF:

- Only persons fully trained on its hazards and safe handling procedures should use hydrofluoric acid.

- Hydrofluoric acid is stored **ONLY** in the Paleontology Lab in the ventilated cabinet under the "in-board" fume hood (the smaller of the two fume hoods in this lab).
- The hydrofluoric acid cabinet will be kept locked **at all times.**
- Hydrofluoric acid will not be used when ship motion limits normal handling.
- **Only 500 ml** of hydrofluoric acid will be allowed outside the hydrofluoric acid cabinet at any time.
- In the event of a failure of the normal operation of the HF fume hood ventilation system, all HF containers will be immediately capped and the hood sash will be closed.
- Before using hydrofluoric acid the user (along with the Lab Officer) must:
  - Place a sign on the fume hood that says: "HYDROFLUORIC ACID ONLY".
  - Insure that the fume hood is functioning properly.
  - Insure that the hydrofluoric acid spill kit is in the lab.
  - Insure that the cream for treatment of hydrofluoric acid exposure is in the lab.
- Samples should be processed in groups (10-20 samples) to minimize safety risks. The scientist using hydrofluoric acid will wear safety gloves, apron, and a full-face shield.
- Used hydrofluoric acid will be stored in clearly labeled plastic containers. HF should never be stored in a glass container. Polyethylene is the preferred plastic due to its unusual resistance to HF. When a container (20 liter) contains 7 liters of used acid, the Lab Officer/or delegate will neutralize the used acid to a 1% concentration by adding it (with stirring) to cold water and aqueous sodium hydroxide.
- If direct contact with hydrofluoric acid is suspected, contaminated clothing must be removed immediately, the area must be washed with water for at least 15 minutes, and immediate medical attention must be sought.
- If hydrogen fluoride vapors are inhaled, the victim must be immediately moved to an uncontaminated atmosphere (if safe to do so), kept warm, and provided prompt medical attention.
- In case of spill outside the fume hood:
  - Notify all personnel working on the Fo'c'sle deck to evacuate the area
  - After evacuating the Fo'c'sle deck, contact either the Bridge (126) or the Lab Officer (114).

1.5. Health Hazards Associated with Corrosives

- Acute Health Effects:
  - Inhalation - irritation of mucous membranes, difficulty in breathing, uncontrolled coughing, and pulmonary edema.
  - Ingestion - irritation and burning sensation of lips, mouth, and throat; pain in swallowing; swelling of the throat; painful abdominal cramps; vomiting; shock; risk of perforation of the stomach.
  - Skin Contact - burning, redness and swelling, painful blisters, profound damage to tissues. Alkalis may feel slippery or soapy.
  - Eye Contact - stinging, watering of eyes, swelling of eyelids, intense pain, ulceration of eyes, loss of eyes or vision.
- Chronic Health Effects:
  Symptoms of chronic exposure vary greatly between corrosive chemicals. For example, the chronic effect of hydrochloric acid is damage to the teeth; the chronic effects of hydrofluoric acid are decreased bone density, fluorosis, and anemia; the chronic effects of sodium hydroxide

are unknown.

1.6. First Aid

- Inhalation - remove person from source of contamination if safe to do so. Get medical attention. Keep the victim warm and quiet and do not leave unattended.
- Ingestion - remove person from source of contamination. Get medical attention and inform emergency responders of the name of the chemical swallowed.
- Skin Contact - remove person from source of contamination and take immediately to an emergency shower or source of fresh, running water. Remove clothing and jewelry from affected areas immediately. Flush the affected area with fresh running water for a minimum of 15 minutes. Get medical attention.
- Eye Contact - remove the victim from the source of contamination. Immediately rinse the eyes with water for a minimum of 15 minutes. Have the person look up and down and from side to side. Get medical attention. Do not let the person rub their eyes

1.7. Personal Protective Equipment

Neoprene and nitrile gloves are effective against most acids and bases. Polyvinyl chloride (PVC) is also effective for most acids. A rubber coated apron and goggles should also be worn. If splashing is likely to occur, wear a face shield over the goggles. Always use corrosives in a chemical fume hood. Contact the Lab Officer for assistance in selection of appropriate PPE.

2. FLAMMABLE CHEMICALS

Flammable liquids are the most common chemicals (often in large volumes) found in a laboratory. The primary hazard associated with flammable liquids is their ability to readily ignite and burn. It is the vapor of a flammable liquid, not the liquid itself that ignites and causes a fire.

2.1. Definitions

- VAPOR PRESSURE: The rate at which a liquid vaporizes is related to its *vapor pressure*. Liquids with high vapor pressures are more volatile than those of lower vapor pressure. The vapor pressure (and the rate of vaporization) of a liquid increases rapidly as its temperature is raised or as atmospheric pressure decreases.
- FLASH POINT: The lowest temperature at which a liquid gives off vapor at such a rate as to form an air-vapor mixture that will ignite, but will not sustain ignition. The flashpoint of several solvents is significantly lower than room temperature.
- LIMITS OF FLAMMABILTY OR EXPLOSIVITY: The limits of flammability or explosivity define the range of fuel-air mixtures that will sustain combustion. The lower limit of this range is called the *Lower Explosive Limit* or LEL, and the higher limit of this range is called the *Upper Explosive Limit* or UEL. Materials with very broad flammability ranges (e.g., acetylene, LEL = 3%, UEL = 65%) are particularly hazardous because almost any fuel-air combination may form an explosive atmosphere. The vapors produced by evaporation of a very small volume (1-2 ml) of a flammable solvent in a confined space (e.g., refrigerator) can be well above the LEL.
- VAPOR DENSITY: The vapor density of a flammable material is the density (mass to volume

ratio) of the corresponding vapor relative to air under specific temperature and pressure conditions. A flammable vapors with vapor density greater than one (i.e. "heavier" than air) is hazardous because they will accumulate at floor level and flow in a liquid-like manner. This action can create a potential fire or explosion hazard if it reaches an ignition source.
Factors that determine flammability of several common laboratory solvents are shown in Table 2.

2.2. Examples of Flammables

Acetone	Ethyl Alcohol
Benzene	Methyl Alcohol
Hexane	Toluene
Isopropyl Alcohol	Xylene

Note: These are some of the corrosive chemicals most frequently used on the *R/V Joides Resolution*

2.3. Use and Storage of Flammable Solvents

For proper usage and storage of flammable solvents, follow these recommendations

- Minimize the amount of flammable liquids kept in the lab. (See Table 2, Recommended Maximum Quantities of Flammable Liquids Within a Research Laboratory).
- Store flammable liquids in fire resistant storage cabinets designed for flammables, or inside storage rooms.
- Never store flammable chemicals in a standard household refrigerator. Flammables can only be stored cold in a "lab safe" or explosion-proof refrigerator.
- Do not leave flammable solvents on the counter or on open shelves.
- Dispensing and receiving containers must be bonded together (to prevent sparks from static electricity) before transfer for pouring.
- A grounding strap must be used when transferring flammable liquids to or from containers greater than 1 liter. Static electricity can buildup on ALL types of containers (glass, plastic, and metal) during the transfer.
- Use flammables only in areas free of ignition sources.
- Never heat flammables with an open flame. Instead, use steam baths, water baths, oil baths, hot air baths, sand baths or heating mantles.

Note: None of the research facilities aboard the *R/V Joides Resolution* are protected by a sprinkler system. The User Room, System Manger's Office, and the Computer Machine Room are protected by a Halon system.

It is my suggestion to add here subsections on health hazards (fire and explosion are only one hazard, solvents should not be touched, breathed etc), first aid, and PEE like it was well done for the corrosives. Keep it general and it can be extracted from the MSDS or hazardous handbook.

3. HIGHLY REACTIVE CHEMICALS

"Reactive" applies to a broad category of chemicals, including potent oxidizing or reducing agents, unstable chemicals and substances capable of exploding, decomposing and/or reacting violently in the presence of water, oxygen, static or light. They may react to produce toxic or explosive gases. Reactive chemicals exhibit moderate to extremely rapid reaction rates and include materials capable of rapid release of energy by themselves (self-reaction, or polymerization), and/or rates or reaction that may be increased by heat, pressure or by contact with incompatible substances.

3.1. Different Classes of Reactive Chemicals

Reactive chemicals are broadly classified into two groups: those that may explode, and those that will not. The reactivity potential of similar chemicals within the same chemical class (e.g., alkali metals) varies considerably and may also unpredictable because of aging or contamination.

Reactive chemicals may be further subdivided and placed into six classes based upon their chemical behavior.

3.1.1. Class I

Chemicals of this class are normally unstable and readily undergo violent change without detonating. This class includes:

- Reducing Agents - Chemical reducing agents react strongly with oxidizers.

  Examples of common reducing agents and groups are:

Hydrogen	Hydrides	Carbides
Sulfides	Hydrazine	Arsines
Stibine	Phosphine	Silanes
Organic lithium compounds		Borane
Phosphorus (red, white, yellow)		Metallic acetylides
Hypophosphides		

- Pyrophorics – can spontaneously ignite in presence of air or water (e.g., metal alkyls, phosphorus and finely divided metal powders such as magnesium, aluminum, and zinc).--------To avoid ignition, *prevent contact with air or water and use and store them in inert environments.*
- Polymerizables - spontaneously polymerize in contact with air (e.g.,divinyl benzene*).* --------To avoid polymerization*, keep cool and avoid direct sunlight and contact with water.*
  Oxidizers – these chemicals react violently in contact with organic materials or strong reducing agents. Chemical oxidizing agents present fire and explosion hazards on contact with combustible materials. Depending on the class, an oxidizing material may increase the burning rate of combustibles with which it comes in contact; cause the spontaneous ignition of combustibles with which it comes in contact; or undergo an explosive reaction when exposed to heat, shock, or friction. Most oxidizers are also

corrosive. --To avoid violent reactions, *minimize the amounts for procedure, do not keep excessive amounts of material in the vicinity of process and store properly, away from organic materials, flammable materials and reducing agents.*

Examples of common oxidizers used on board the *R/V Joides Resolution* include:

Oxygen, oxides, dioxides, peroxides
Sulfates, persulfates
Nitrates, nitrites
Bromine, chlorine
Hypochlorites
Chromates, dichromates
Permanganates
Perchloric, chromic and fuming nitric acids

- Peroxides – Peroxides are one of the most hazardous oxidizer found in laboratories as they are very unstable. Some chemicals called peroxide-forming materials are chemicals that react with oxygen (including air), heat and light to form peroxides. The tendency to form peroxides by most of these materials is greatly increased by evaporation or distillation. Many peroxides formed from materials used in laboratories are more shock sensitive than TNT. Just the friction from unscrewing the cap of a container of ether that has peroxides in it can provide enough energy to cause a severe explosion. For example, organic peroxides are extremely sensitive to shock, sparks, heat, friction, impact, and light.

Peroxide-forming materials are NOT allowed on the *R/V Joides Resolution!*

Table 3 lists a few peroxide-forming compounds that can form explosive levels of peroxide without concentration. These compounds can be divided into three hazard categories:

- Compounds forming peroxides that can spontaneously decompose during storage. Maximum storage time = 3 months.
- Compounds forming peroxides that require the addition of a certain amount of energy (distillation, shock) to explosively decompose. Maximum storage time = 12 months.
- Compounds that have the potential to form peroxide polymers, a highly dangerous form of peroxide, which precipitate from solution easily and are extremely heat and shock-sensitive. Maximum storage time = 12 months.

Note: Storage times are based on time after opening container.

For help in determine the presence of peroxides, refer Kelly (19??) and Swern (19??).

To avoid problems with peroxides, all peroxidizable chemicals should be dated upon receipt and upon opening (2 dates). Do not open any container that has obvious crystal formation around lid. Other precautions are similar to those used for flammables.

3.1.2. Class II

Chemicals of this class are unstable and are highly reactive in the presence of water, they include:

- Chemicals that react exothermically in contact with water; some decompose in moist air and violently decompose in water. Examples of these chemicals are: sulfuric acid, chlorosulfonic acid, oleum, phosphorous trioxide and pentoxide, acetyl halides, phosphorus halides, titanium tetrachloride, glyoxal.
- Chemicals that decompose violently in water with evolution of heat and flammable gases, which may ignite if exposed to ignition source. Evolution of heat with water may be sufficient to cause auto-ignition (and explosion). Examples of these chemicals are: alkaline metals, alkaline earth metals, alkaline metal hydrides, and alkaline metal nitrides.
- Chemicals that, in the presence of water, generate toxic gases, vapors or fumes in quantity sufficient to present a danger to human health or the environment. Examples of these chemicals include: alkaline metal phosphides, phosphorus halides, aluminum phosphide, toluene diisocyanate.

  To handle these class II chemicals safely, use precautions similar to corrosives:

  - Keep away from moisture.
  - Use protective acid resistant rubber or plastic clothing with gloves and face shield.
  - Handle materials in fume hood since fuming in moist air can result in exposure to corrosive and/or toxic gases or flammable gases.
  - In case of fire, use dry sand to smother flames (use of water as a fire extinguisher may aggravate fire).

These chemicals must be opened or used only inside a properly operating fume hood. Containers must be tightly sealed and away from moisture.

3.1.3. Class III

Compounds that produce hydrogen cyanide or hydrogen sulfide gases on contact with acids or with materials that form acids in the presence of moisture or wate. Examples of this class of chemicals include inorganic cyanides or sulfides.

Isolate these chemicals from acids, oxidizers and moisture. Use only with adequate ventilation and respiratory protection.

3.1.4. Class IV

Chemicals that detonate or explode if heated under confinement. Detonation or explosion can occur if heated above ambient temperature or if exposed to an initiating source such as shock, mechanical shock, spark or flame, or a catalyst, which accelerates decomposition.

Examples of Class IV chemicals are:

lead amide	ammonium picrate
sodium amide	ammonium tetrachromate
thallous nitride	metal periodates
metal azides	organic perchlorates
brominated organic compounds	isoamyl nitrite
benzene diazonium salts	ammonium nitrate or chlorate

Chemicals in this class may also be flammable, corrosive (acidic), water reactive or light sensitive.

Protect containers from physical damage, heat and isolate from incompatible chemicals. Users must be thoroughly familiar with the hazardous properties of the materials prior to use.

3.1.5. Class V

Chemicals in this class can detonate, undergo explosive decomposition, or react at ambient temperature and pressure without any external initiating source. Examples of this class of chemicals are: ammonium chlorate, organic azides, metal azides, benzoyl peroxide, and peroxidized ethers).

Class V materials are NOT allowed on the *R/V Joides Resolution!*

Only knowledgeable and trained individuals should handle these compounds. Inspect and evaluate containers and chemicals periodically for evidence of deterioration. Minimize quantity in stock and dispose of excess frequently. Check the MSDS for information on incompatibles for storage and chemical properties of materials handled. Use appropriate personal protective equipment.

3.1.6. Class VI

Chemicals in this class include forbidden explosives as defined in 49 CFR 173.51, or a Class A explosive as defined in 49 CFR 173.53 or a Class B explosive as defined in 49 CFR 173.88. Forbidden explosives are capable of detonation or explosive decomposition under ambient conditions and are considered too dangerous for transportation.

Examples of Class VI explosives include:

-	Class A Explosives	Class B Explosives
diethylene glycol dinitrate	Trinitrotoluene	stabilized nitrocellulose
unstabilized nitroglycerine	Mercury fulminate	stabilized nitroglycerin
nitrocellulose	Diazodinitrophenol lead	
	2, 4-dinitroresorcinate	

The presence of these materials is not permitted on the TAMU campus or in TAMU facilities without prior written approval from EHSD.

Class VI materials are NOT allowed on the *R/V Joides Resolution!*

It is my suggestion to add here subsections on health hazards first aid, and PEE like it was well done for the corrosives. Keep it general and it can be extracted from the MSDS or hazardous handbook.

4. TOXIC CHEMICALS

Toxic chemicals are those that harm tissue (e.g., skin, eye), an organ (e.g., liver, kidney), a system (e.g., respiratory, nervous) by disruption of a biochemical process (e.g., transport, excretion), or by disturbing an enzyme system or other function at a site *remote from the site of contact*. The inherent toxicity of a substance is a function of it's molecular structure and physical state.

4.1. Definition of Acute and Chronic Toxicity

"Dose-Response" or "the Dose Makes the Poison" is a basic principle of Toxicology. In other words, there are conditions or circumstances in which exposure to any substance can be harmful, and there are conditions that exposure to the same substance is harmless. Those factors include conditions of exposure (dose, time), route of exposure (inhalation, dermal) and the subject (gender, reproductive status, prior exposure, age, health, nutrition, and life style factors).

The most important of those factors is the dose-time relationship, which is the basis for distinguishing between "acute" and "chronic" toxicity.

Acute toxicity refers to the capacity of a substance to inflict biological damage as result (usually) of a single exposure to a sudden, relatively large exposure. In most cases, acute exposure results in an immediate, emergency situation. Hydrogen cyanide is an example of a potent acute toxin.

Chronic toxicity refers to the capacity of a substance to inflict biological damage as a result of repeated, relatively low exposure over an extended period of time where response is not immediate. Chemically-induced carcinoma is an example of chronic toxicity.

The response to chemical exposure can range from mild and reversible (headache from inhaling solvent vapors that disappears when the victim gets fresh air) to severe and irreversible (liver, kidney or neurological damage from excessive inhalation of chlorinated solvents). The toxic response depends on the severity of exposures. Greater exposure and repeated exposure generally lead to more severe effects. Toxic agents can cause local effects, systemic toxic effects, or both.

4.2. Chemicals With High Acute, Or Unknown Toxicity (Procedure A)

4.2.1.General Precautions

To minimize exposure to highly toxic substances (see Table 4 for Health Hazard Ratings for Acute Toxity):

- Use and store acute toxins only in areas of restricted access. Post appropriate warning signs. Keep doors closed when occupied and locked when unattended.

Chemicals with acute toxicity will be kept in a locked storage aboard the *R/V Joides Resolution* at ALL TIMES!

- Conduct work only in a chemical fume hood (with a face velocity of at least 100 linear feet per minute) or other containment device for procedures, which may result in the generation of hazardous aerosols or vapors. Use appropriate trap(s) to prevent release of vapors into the hood exhaust.
- Protect against dermal exposure by using gloves and long sleeves (and other protective apparel as appropriate). Be sure that the personal protective equipment is appropriate to provide necessary protection. Wash hands and arms frequently and immediately after working with these materials.
- Avoid working alone. At least two persons should be present at all times if the compound used is highly toxic or of unknown toxicity.
- Prevent spills and accidents, but if they should happen:
  - Store breakable containers in chemically resistant trays. Conduct procedures and mount apparatus above containment trays or cover work and storage surfaces with removable, adsorbent, plastic backed paper.
  - If a major spill occurs outside the hood, evacuate the area immediately. Assure that cleanup personnel wear suitable protective apparel and equipment. Notify your supervisor immediately.
- Control Hazardous waste by:
  - Thoroughly decontaminating contaminated clothing or shoes or disposing of them as hazardous waste. Use chemical decontamination only if practical and safe.
  - Storing highly toxic contaminated waste in closed, suitably labeled, impervious containers,
  - Disposing of waste properly (see Appendix III)
- Maintain inventory, use and disposal records (including quantity, concentration used and workers involved). Us*e the ODP Hazardous Material Inventory database*.

4.2.2 Airborne Chemicals

When working with airborne chemicals (i.e. volatile chemicals with a maximum recommended concentration in air of less than 50 ppm) follow these precautions:

- Work only in an operating fume hood, glove box vacuum system, or similar device. The device must be equipped with appropriate traps and/or scrubbers.

DO NOT work with these chemicals unless appropriate containment equipment is available.

- If a recommended exposure level in air is not available for that substance for animals or humans, consider median inhalation lethal concentration information, (LC50). Any procedures involving materials with an LC50 less 200 ppm or 2000 mg/m3 (continuous exposure for one hour or less) must be conducted in an operating fume hood, glove box, vacuum system, or similar equipment. If appropriate containment equipment is not available, no work should be performed using that material.
- Personal Protective Equipment should be always be used with volatile chemicals. Protective eyewear and a lab coat should be worn with nitrile and neoprene gloves.

Acetone made be used for the gluing of end caps liner divider ONLY on the Core Receiving platform.

4.2.3. Chemical Allergens and Sensitizers

A chemical allergy is an adverse reaction by the immune system sensitized resulting from previous exposure to that chemical or a structurally similar chemical. Once sensitization occurs, allergic reactions can result from exposure to extremely low doses of the chemical. Allergic reactions can be immediate or delayed. Anaphylactic shock is a very severe, immediate and life-threatening reaction that must be treated as a medical emergency. A wide variety of chemical and biological substances can illicit symptoms of dermal and respiratory hypersensitivity.

Examples of chemicals that can cause an allergic reaction include diazomethane, chromium, nickel, bichromates, formaldehyde, isocyanates, and certain phenolics.

To prevent dermal and respiratory exposures and avoid allergic reactions, always use a fume hood and appropriate personal protective equipment.

4.3. Chemicals With High Chronic Toxicity (Procedure B)

Examples of chemicals with high chronic toxicity are known human carcinogens (especially those with high vapor pressure), substances with high carcinogenic potency in animals, reproductive toxins and substances that cause other delayed effects.

In addition to all the **"General Precautions"** in **Procedure A**, the following supplemental rules (**Procedure B)** must be followed for work with toxicologically significant quantities or concentrations of substances of known or potential high chronic toxicity:

- All transfers and work with highly toxic substances should be conducted in an area of a lab designated for use of highly toxic substances (e.g. controlled or restricted-access area, restricted access hood or glove box, etc.). All persons with access must be aware of the substances being used and precautions necessary to prevent exposure. The controlled area should be conspicuously marked with warning and restricted access signs.
- All work should be conducted in a pressurized glove box. The ventilation rate for a negative pressure glove box should be at least two-volume changes per hour and minimum pressure of at least 0.5 inches of water. Positive pressure glove boxes should be thoroughly checked for leaks before each use. In either case, the exhaust should be trapped or filtered through a HEPA filter and exhausted through a fume hood.
- Containers of chemicals with high chronic toxicity should be stored only in a ventilated, limited access area in appropriately labeled, unbreakable, chemically resistant, secondary containers.
- Containers of contaminated waste (including washings) should be transferred from the controlled area in an appropriate secondary container under the supervision of authorized personnel.
- Equipment and surfaces should be protected from contamination:
  - Vacuum pumps must be protected against significant contamination by scrubbers or HEPA filters (if appropriate) and vented into the chemical fume hood.
  - Contaminated vacuum pumps or other equipment including glassware must be decontaminated before removing them from the controlled area or properly disposed as hazardous waste.
  - Any contaminated space, including the "controlled area" must be decontaminated promptly, and prior to resumption of normal work.
  - Protective apparel must be removed and placed in an appropriate, labeled container. Do not wear potentially contaminated apparel outside the controlled area. Wash hands, forearms, face, and any other exposed skin thoroughly before leaving the work area.
  - Clean floors with a wet mop or a vacuum cleaner equipped with a HEPA filter. Do not dry-sweep.
- A written plan for use and disposal of these materials must be designed and have the signed approval of the laboratory supervisor. In writing this plan, factors such as volatility, concentration, complexity of manipulations, worker experience and qualifications, etc. should be considered in determining risk of significant exposure or release. The plan should also include contingency plans, equipment, and materials to minimize exposures of personnel and property in case of accident or spills.

- A qualified physician should be consulted concerning the need for regular medical surveillance if employees are using toxicologically significant quantities of a chronic toxicant. See Medical Consultations and Examinations, below.

4.4. Reproductive Toxins

Reproductive toxins are substances that have adverse effects on human reproduction including fertility, gestation, lactation, and general reproductive function. Developmental toxins are those that act during pregnancy to cause adverse effects on the embryo or fetus. These substances can be embryotoxic (lethality i.e., death of the fertilized egg, the embryo, or the fetus), teratogenic (malformations), retarded growth and postnatal functional deficiencies.

Examples of reproductive toxins include organomercurials, inorganic heavy metal compounds, and formamide

Relatively little is known about the effects of occupational chemical exposure on human reproductive function. Therefore, it is prudent for all workers (regardless of gender or reproductive status) to minimize chemical exposure by following these recommendations:

- Nursing mothers should minimize exposure to lipophilic chemicals.
- Workers with reproductive potential should handle volatile reproductive toxins only in a hood with confirmed performance, using appropriate protective apparel to minimize dermal and respiratory exposure.
- The use of known reproductive toxins should be reviewed and evaluated at least annually or whenever a procedural change is made.
- These chemicals shall be properly labeled and stored in an adequately ventilated area inside an unbreakable secondary container.
- Supervisors shall be notified of all incidents of exposure or spills.
- Employees should consult with their physician regarding specific questions about reproductive risk.

5. CHEMICALS PRODUCED IN THE LABORATORY

Any hazardous material produced aboard the *R/V Joides Resolution* must approved by the Lab Officer and the Ship's Captain. Also, the hazardous material must entered into the ODP Hazardous Material Inventory.

- If the chemical composition is known and the chemical is produced exclusively for the laboratory of origin, the Lab Officer will determine if it is hazardous.
- If the material is hazardous, the Lab Officer will provide and document training (e.g., toxicological properties, safe handling procedures).
- If the chemical produced is a by-product with an unknown composition, the supervisor shall assume that the substance is a hazardous chemical and shall implement all procedures in this Laboratory Safety Manual.
- If the product is sold to a user outside the lab, the supervisor may be required to comply with the Texas Hazard Communication Act, including preparation of MSDS and labeling.

6. MEDICAL CONSULTATIONS AND EXAMINATIONS

Health assessments prior to work assignment and periodic medical surveillance may be required under certain circumstances. Your Department or College may have an occupational health program designed to evaluate certain high-risk situations involving chemical or biological agents. If such a program is unavailable, the employee should consult with their personal physician.

7. CHEMICAL MONITORING OF THE WORKPLACE

EHSD can assist in both the assessment and monitoring of employees' exposures to chemical agents. Personal monitoring is used to determine if safe levels of exposure are being maintained in the work area to protect employee health. Contact EHSD for an evaluation or to arrange for monitoring.

Section 5: REFERENCES

Bretherick, L., 1995, Handbook of Reactive Chemical Hazards, 5th Ed., Butterworth-Heinemann, Oxford, England, (Evans Library: T55.3.H3 B73 1995).

Gershey, E. L., Party, E., Wilkerson, A., 1991, Laboratory Safety in Practice, Van Nostrand Reinhold, New York.

Kelly, R. J., 1996, Review of Safety Guidelines for Peroxidizable Organic Compounds, *Chemical Health and Safety.*

Mahn, W. J., 1989, Academic Laboratory Chemical Hazards Handbook, Van Nostrand Reinhold, New York.

Mahn, W. J., 1990, Fundamentals of Laboratory Safety, Physical Hazards in the Academic Laboratory, Van Nostrand Reinhold, New York.

Pepitone, D.A., 1984, Safe Storage of Laboratory Chemicals, Ed., John Wiley & Sons, New York.

Prudent Practices in the Laboratory, 1995, Handling and Disposal of Chemicals, National Research Council, National Academy Press, Washington, D.C.

Steere, N. V., 1970, Handbook of Laboratory Safety, Chemical Rubber Company, Cleveland, OH.

Swern, D., 19?? Organic Peroxides, (Three Volumes) Ed., Wiley-Interscience, New York.

Texas A&M University Safety Manual, (http://ehsd-online.tamu.edu).

Section 6: TABLES

TABLE 1: RECOMMENDED MAXIMUM QUANTITY[1] OF FLAMMABLE LIQUIDS WITHIN A NON-SPRINKLERED[2] RESEARCH LABORATORY

	FLAMMABLE LIQUID CATEGORY				
CONTAINER TYPE	4	3	2	1	0
Glass	1 L	2 L	4 L	4 L	20 L
Metal	4 L	4 L	4 L	4 L	20 L
Approved Plastic	4 L	4 L	4 L	4 L	20 L
Safety Can	8 L	8 L	8 L	8 L	20 L
Metal Drum	N/A[3]	N/A	N/A	N/A	120 L

[1]Quantities based upon proper storage within a Flammable Solvents Storage Cabinet

[2]Most TAMU research laboratories are **WITHOUT** ceiling sprinkler systems

[3]N/A = Not allowed

Limit the total combined volume of Class 4 + 3 flammable liquids within a laboratory to 10 L.

TABLE 2: PROPERTIES OF VOLATILE LABORATORY CHEMICALS

Chemical	Flash Point [1]	Boiling Point [1]	Ignition Temp [1]	Flammable Limit (% by vol. in air)		NFPA Fire and Hazard Category[2]
				Lower	Upper	
Acetaldehyde	-38	21.1	175	4.0	60	4
Acetic acid (glacial)	39	118	463	4.0	20	2
Acetone	-17.8	56.7	465	2.6	12.8	3
Acetonitrile	6	83	524	3	16	3
Benzene	-11.1	80	540	1.3	7.1	3
Carbon disulfide	-30	46	80	1.3	50	3
Cyclohexane	-20	82	245	1.3	8.0	3
Diethylamine	-23	57	312	1.8	10	3
Diethyl ether	-45	35	160	1.9	36	4
Dimethyl sulfoxide	95	189	215	2.6	42	1
Ethyl alcohol In water 95% 80% 60% 40%	13 17 20 22 26	78.3	365	3.3	19	3
n-Heptane	-3.9	98.3	215	1.1	6.7	3
n-Hexane	-21.7	68.9	225	1.1	7.5	3
Isopropyl Alcohol	11.7	82.8	399	2.0	12	3
Methyl alcohol	11.1	64.9	385	6.7	36	3
Methylethyl ketone	-6.1	80.0	516	1.8	10	3
Pentane	-40.0	36.1	260	1.5	7.8	4
Styrene	32.2	146	490	1.1	6.1	3
Tetrahydrofuran	-14	66	321	2	12	3
Toluene	4.4	111	480	1.2	7.1	3
p-Xylene	27.2	138	530	1.1	7.0	3

[1](^{O}C)
[2]National Fire Protection Association (NFPA 704)

[2]NFPA HAZARD CATEGORY

Fire Hazard (Flash points)	Reactivity	Health Hazard (Acute)
4 = Extremely flammable(<23 C)	4 = Unstable, may detonate	4 = Extreme hazard
3 = Highly flammable (23-39C)	3 = May detonate if initiated	3 = High hazard
2 = Flammable (39-93C)	2 = Violent chemical change at high T or P	2 = Moderate hazard
1 = Combustible (>93C)	1 = Normally stable; May be unstable if heated	1 = Low hazardous
0 = Will not burn	0 = Stable	0 = Normal material

TABLE 3: PEROXIDE FORMING CHEMICALS

a. The chemicals listed below will form explosive levels of peroxides without concentration. Severe peroxide hazard after prolonged storage, especially after exposure to air. All have been responsible for fatalities. *Test for peroxide formation or* ***discard after 3 months.***

(di)isopropyl ether	divinyl acetylene
potassium metal	potassium amide
sodium amide	vinylidene chloride

b. Peroxide hazard on concentration. Test for peroxide formation before distillation or evaporation. Test for peroxide formation or discard after 1 year.

Acetal	Furan
Acetaldehyde	4-Heptanol
Benzyl alcohol	2-Hexanol
Cumene (isopropylbenzene)	Methyl acetylene
Cyclohexanol	3-Methyl-1-butanol
Cyclohexene	Methyl cyclopentane
Cyclopentene	Methyl-isobutyl ketone
Diacetylene (butadiene)	4-Methyl-2-pentanol
Decahydronaphthalene (decalin)	2-Pentanol
Dicyclopentadiene	4-Penten-1-ol
Diethylene glycol dimethyl ether (diglyme)	1-Phenylethanol
Diethyl ether	2-Phenylethanol
Dioxanes	Tetrahydrofuran
Ethylene glycol ether acetates (cellosolves)	Tetrahydronaphthalene
Vinyl ethers	Other secondary alcohols

c. Chemicals, which are a hazard due to, peroxide initiation of autopolymerization. The peroxide forming potential increases for liquids of this group, especially for butadiene, chloroprene and tetrafluoroethylene, such that these materials should be considered as a peroxide hazard. *Test for peroxide formation or discard after 1 year.*

Acrylic acid	Styrene
Acrylonitrile	Tetrafluoroethylene
Butadiene	Vinyl acetate
Chlorobutadiene	Vinyl acetylene
Chlorotrifluoroethylene	Vinyl chloride
Methyl methacrylate	Vinyl pyridine
	Vinyldiene chloride

TABLE 4: HEALTH HAZARD RATING: ACUTE EXPOSURE

Relative Hazard	Ingestion LD_{50} mg/Kg	Inhalation LC_{50} (ppm), 1 hr exposure	Eye Contact (Liquid)	Skin Penetration LD_{50}, ml/Kg	Skin Irritation
4	< 1	< 20	Extremely corrosive	< 0.02	Necrosis – 10% soln.
3	> 1 - 50	> 20 - 200	Corrosive, Irreversible corneal opacity	> 0.02 – 0.2	Necrosis - Undiluted
2	> 50 - .5K	>.2K– 2K	Irritating, reversible corneal opacity ≥ 7 days	> 0.2 – 2.0	Erythema & Slight edema from undiluted
1	>.5K – 5K	> 2K – 10K	Slightly irritating	> 2.0 - 20	Slight erythema - undiluted
0	> 5K	> 10K	Non-irritating	> 20	Non-irritating

0 = relatively non-hazardous; 1=low hazard; 2=moderate hazard; 3=high hazard; 4=extreme hazard

Section 7: APPENDICES

APPENDIX I: EXTREMELY HAZARDOUS SUBSTANCES AND THRESHOLD PLANNING QUANTITIES (TPQ)

CAS #	Chemical Name	TPQ (lbs)
75-86-5	Acetone Cyanohydrin	1,000
1752-30-3	Acetone Thiosemicarbazide	1,000
107-02-8	Acrolein	500
79-06-1	Acrylamide	1,000
107-13-1	Acrylonitrile	1,000
814-68-6	Acryloyl Chloride	100
111-69-3	Adiponitrile	1,000
116-06-3	Aldicarb	100
309-00-2	Aldrin	500
107-18-6	Allyl Alcohol	1,000
107-11-9	Allylamine	500
20859-73-8	Aluminum Phosphide	500
54-62-6	Aminopterin	500
78-53-5	Amiton	500
3734-97-2	Amiton Oxalate	100
7664-41-7	Ammonia	500
300-62-9	Amphetamine	1,000
62-53-3	Aniline	1,000
88-05-1	Aniline, 2,4,6-Trimethyl-	500
7783-70-2	Antimony Pentafluoride	500
1397-94-0	Antimycin A	1,000
86-88-4	ANTU	500
1303-28-2	Arsenic Pentoxide	100
1327-53-3	Arsenous Oxide	100
7784-34-1	Arsenous Trichloride	500
7784-42-1	Arsine	100
2642-71-9	Azinphos-Ethyl	100
86-50-0	Azinphos-Methyl	10
98-87-3	Benzal Chloride	500
98-16-8	Benzeneamine, 3-(Trifluoromethyl)	500
100-14-1	Benzene, 1-(Chloromethyl)-4-Nitro-	500
98-05-5	Benzenearsonic Acid	10
3615-21-2	Benzimidazole, 4,5-Dichloro-2-(Trifluoromethyl)-	500
98-07-7	Benzotrichloride	100
100-44-7	Benzyl Chloride	500
140-29-4	Benzyl Cyanide	500
15271-41-7	Bicyclo[2.2.1]Heptane-2 Carbonitrile, 5-Chloro-6-(((Methylamino)Carbonyl)Oxy) Imino)-, (1s-(1-alpha,2-beta,4-alpha,5-alpha,6E))-	500
534-07-6	Bis(Chloromethyl) Ketone	10
4044-65-9	Bitoscanate	500
10294-34-5	Boron Trichloride	500
7637-07-2	Boron Trifluoride	500
353-42-4	Boron Trifluoride Compound With methyl Ether (1:1)	1,000
28772-56-7	Bromadiolone	100
7726-95-6	Bromine	500
1306-19-0	Cadmium Oxide	100
2223-93-0	Cadmium Stearate	1,000
7778-44-1	Calcium Arsenate	500
8001-35-2	Camphechlor	500
56-25-7	Cantharidin	100
51-83-2	Carbamylcholine chloride	500
26419-73-8	Carbamic Acid, Methyl-,O-(((2,4-Dimethyl-1, 3-Dithiolan-2-yl) Methylene)Amino)-	100
1563-66-2	Carbofuran	10
75-15-0	Carbon Disulfide	10,000
786-19-6	Carbophenothion	500
57-74-9	Chlordane	1,000

470-90-6	Chlorfenvinfos	500
7782-50-5	Chlorine	100
24934-91-6	Chlormephos	500
999-81-5	Chlormequat Chloride	100
79-11-8	Chloroacetic Acid	100
107-07-3	Chloroethane	500
627-11-2	Chloroethyl Chloroformate	1,00
67-66-3	Chloroform	10,000
542-88-1	Chloromethyl Ether	100
107-30-2	Chloromethyl Methyl Ether	100
3691-35-8	Chlorophacinon	100
1982-47-4	Chloroxuron	500
21923-23-9	Chlorthiophos	500
10025-73-7	Chromic Chloride	1
62207-76-5	Cobalt, ((2,2'-(1,2-Ethanediylbis (Nitrilomethylidyne)) Bis(6-Fluorophenolato))(2-)-N,N',O,O')-	100
10210-68-1	Cobalt Carbonyl	10
64-86-8	Colchicine	10
56-72-4	Coumaphos	100
5836-29-3	Coumatetralyl	500
95-48-7	Cresol, o-	1,000
535-89-7	Crimidine	100
4170-30-3	Crotonaldehyde	1,000
123-73-9	Crotonaldehyde, (E)-	1,000
506-68-3	Cyanogen Bromide	500
506-78-5	Cyanogen Iodide	1,000
2636-26-2	Cyanophos	1,000
675-14-9	Cyanuric Fluoride	100
66-81-9	Cycloheximide	100
108-91-8	Cyclohexylamine	10,000
17702-41-9	Decaborane(14)	500
8065-48-3	Demeton	500
919-86-8	Demeton-S-Methyl	500
10311-84-9	Dialifor	100
19287-45-7	Diborane	100
111-44-4	Dichloroethyl ether	10,000
149-74-6	Dichloromethylphenylsilane	1,000
62-73-7	Dichlorvos	1,000
141-66-2	Dicrotophos	100
1464-53-5	Diepoxybutane	500
814-49-3	Diethyl Chlorophosphate	500
71-63-6	Digitoxin	100
2238-07-5	Diglycidyl Ether	1,000
20830-75-5	Digoxin	10
115-26-4	Dimefox	500
60-51-5	Dimethoate	500
2524-03-0	Dimethyl Phosphorochloridothioate	500
77-78-1	Dimethyl sulfate	500
75-78-5	Dimethyldichlorosilane	500
57-14-7	Dimethylhydrazine	1,000
99-98-9	Dimethyl-p-Phenylenediamine	10
644-64-4	Dimetilan	500
534-52-1	Dinitrocresol	10
88-85-7	Dinoseb	100
1420-07-1	Dinoterb	500
78-34-2	Dioxathion	500
82-66-6	Diphacinone	10
152-16-9	Diphosphoramide, Octamethyl-	100
298-04-4	Disulfoton	500
514-73-8	Dithiazanine Iodide	500
541-53-7	Dithiobiuret	100
316-42-7	Emetine, Dihydrochloride	1
115-29-7	Endosulfan	10
2778-04-3	Endothion	500
72-20-8	Endrin	500
106-89-8	Epichlorohydrin	1,000
2104-64-5	EPN	100
50-14-6	Ergocalciferol	1,000
379-79-3	Ergotamine Tartrate	500

1622-32-8	Ethanesulfonyl Chloride, 2-Chloro-	500
10140-87-1	Ethanol, 1,2-Dichloro-, Acetate	1,000
563-12-2	Ethion	1,000
13194-48-4	Ethoprophos	1,000
538-07-8	Ethylbis(2-Chloroethyl)Amine	500
371-62-0	Ethylene Fluorohydrine	10
75-21-8	Ethylene Oxide	1,000
107-15-3	Ethylenediamine	10,000
151-56-4	Ethyleneimine	500
542-90-5	Ethylthiocyanate	10,000
22224-92-6	Fenamiphos	10
115-90-2	Fensulfothion	500
4301-50-2	Fluenetil	100
7782-41-4	Fluorine	500
640-19-7	Fluoroacetamide	100
144-49-0	Fluoroacetic Acid	10
359-06-8	Fluoroacetyl Chloride	10
51-21-8	Fluorouracil	500
944-22-9	Fonofos	500
50-00-0	Formaldehyde	500
107-16-4	Formaldehyde Cyanohydrin	1,000
23422-53-9	Formetanate Hydrochloride	500
2540-82-1	Formothion	100
17702-57-7	Formparanate	100
21548-32-3	Fosthietan	500
3878-19-1	Fuberidazole	100
110-00-9	Furan	500
13450-90-3	Gallium Trichloride	500
77-47-4	Hexachlorocyclopentadiene	100
4835-11-4	Hexamethylenediamine, N,N'-Dibutyl-	500
302-01-2	Hydrazine	1,000
74-90-8	Hydrocyanic Acid	100
7647-01-0	Hydrogen Chloride (gas only)	500
7664-39-3	Hydrogen Fluoride	100
7722-84-1	Hydrogen Peroxide (Conc >52%)	1000
7783-07-5	Hydrogen Selenide	10
7783-06-4	Hydrogen Sulfide	500
123-31-9	Hydroquinone	500
13463-40-6	Iron, Pentacarbonyl-	100
297-78-9	Isobenzan	100
78-82-0	Isobutyronitrile	1,000
102-36-3	Isocyanic Acid, 3,4-Dichlorophenyl Ester	500
465-73-6	Isodrin	100
55-91-4	Isofluorphate	100
4098-71-9	Isophorone Diisocyanate	100
108-23-6	Isopropyl Chloroformate	1,000
119-38-0	Isopropylmethylpyrazolyl Dimethylcarbamate	500
78-97-7	Lactonitrile	1,000
21609-90-5	Leptophos	500
541-25-3	Lewisite	10
58-89-9	Lindane	1,000
7580-67-8	Lithium Hydride	100
109-77-3	Malononitrile	500
12108-13-3	Methylcyclopentadienyl Manganese, Tricarbonyl	100
51-75-2	Mechlorethamine	10
950-10-7	Mephosfolan	500
1600-27-7	Mercuric Acetate	500
7487-94-7	Mercuric Chloride	500
21908-53-2	Mercuric Oxide	500
10476-95-6	Methacrolein Diacetate	1,000
760-93-0	Methacrylic Anhydride	500
126-98-7	Methacrylonitrile	500
920-46-7	Methacryloyl Chloride	100
30674-80-7	Methacryloyloxyethyl Isocyanate	100
10265-92-6	Methamidophos	100

CAS#	Chemical Name	TPQ
558-25-8	Methanesulfonyl Fluoride	1,000
950-37-8	Methidathion	500
2032-65-7	Methiocarb	500
16752-77-5	Methomyl	500
151-38-2	Methoxyethylmercuric Acetate	500
80-63-7	Methyl 2-Chloroacrylate	500
74-83-9	Methyl Bromide	1,000
79-22-1	Methyl Chloroformate	500
60-34-4	Methyl Hydrazine	500
624-83-9	Methyl Isocyanate	500
556-61-6	Methyl Isothiocyanate	500
74-93-1	Methyl Mercaptan	500
3735-23-7	Methyl Phenkapton	500
676-97-1	Methyl Phosphonic Dichloride	100
556-64-9	Methyl Thiocyanate	10,000
78-94-4	Methyl Vinyl Ketone	10
502-39-6	Methylmercuric Dicyanamid	500
75-79-6	Methyltrichlorosilane	500
1129-41-5	Metolcarb	100
7786-34-7	Mevinphos	500
315-18-4	Mexacarbate	500
50-07-7	Mitomycin C	500
6923-22-4	Monocrotophos	10
2763-96-4	Muscimol	500
505-60-2	Mustard Gas	500
13463-39-3	Nickel Carbonyl	1
54-11-5	Nicotine	100
65-30-5	Nicotine Sulfate	100
7697-37-2	Nitric Acid	1,000
10102-43-9	Nitric Oxide	100
98-95-3	Nitrobenzene	10,000
1122-60-7	Nitrocyclohexane	500
10102-44-0	Nitrogen Dioxide	100
62-75-9	Nitrosodimethylamine	1,000
991-42-4	Norbormide	100
0	Organo-rhodium Complex (PMN-82-147)	10
630-60-4	Ouabain	100
23135-22-0	Oxamyl	100
78-71-7	Oxetane, 3,3-Bis(Chloromethyl)-	500
2497-07-6	Oxydisulfoton	500
10028-15-6	Ozone	100
1910-42-5	Paraquat Dichloride	10
2074-50-2	Paraquat Methosulfate	10
56-38-2	Parathion	100
298-00-0	Parathion-Methyl	100
12002-03-8	Paris Green	500
19624-22-7	Pentaborane	500
2570-26-5	Pentadecylamine	100
79-21-0	Peracetic Acid	500
594-42-3	Perchloromethylmercaptan	500
108-95-2	Phenol	500
4418-66-0	Phenol, 2,2'-Thiobis(4-Chloro-6-Methyl)-	100
64-00-6	Phenol, 3-(1-Methylethyl)-Methylcarbamate	500
58-36-6	Phenoxarsine, 10,10'-Oxydi-	500
696-28-6	Phenyl Dichloroarsine	500
59-88-1	Phenylhydrazine Hydrochloride	1,000
62-38-4	Phenylmercury Acetate	500
2097-19-0	Phenylsilatrane	100
103-85-5	Phenylthiourea	100
298-02-2	Phorate	10
4104-14-7	Phosacetim	100
947-02-4	Phosfolan	100

CAS#	Chemical Name	TPQ
75-44-5	Phosgene	10
732-11-6	Phosmet	10
13171-21-6	Phosphamidon	100
7803-51-2	Phosphine	500
2703-13-1	Phosphonothioic Acid,Methyl-, O-Ethyl O- (4-(Methylthio) Phenyl) Ester	500
50782-69-9	Phosphonothioic Acid, Methyl- S-(2-(Bis(1-Methylethyl) Amino) Ethyl)O-Ethyl Ester	100
2665-30-7	Phosphonothioic Acid, Methyl-, O(4-Nitrophenyl) O-Phenyl Ester	500
3254-63-5	Phosphoric Acid, Dimethyl 4-(Methylthio)Phenyl Ester	500
2587-90-8	Phosphorothioic Acid, O,O-Dimethyl-S-(2-Methylthio) Ethyl Ester	500
7723-14-0	Phosphorus	100
10025-87-3	Phosphorus Oxychloride	500
10026-13-8	Phosphorus Pentachloride	500
7719-12-2	Phosphorus Trichloride	1,000
57-47-6	Physostigmine	100
57-64-7	Physostigmine, Salicylate (1:1)	100
124-87-8	Picrotoxin	500
110-89-4	Piperidine	1,000
23505-41-1	Pirimifos-Ethyl	1,000
10124-50-2	Potassium Arsenite	500
151-50-8	Potassium Cyanide	100
506-61-6	Potassium Silver Cyanide	500
2631-37-0	Promecarb	500
106-96-7	Propargyl Bromide	10
57-57-8	Propiolactone, Beta-	500
107-12-0	Propionitrile	500
542-76-7	Propionitrile, 3-Chloro-	1,000
70-69-9	Propiophenone, 4-Amino-	100
109-61-5	Propyl Chloroformate	500
75-56-9	Propylene Oxide	10,000
75-55-8	Propyleneimine	10,000
2275-18-5	Prothoate	100
129-00-0	Pyrene	1,000
140-76-1	Pyridine, 2-Methyl-5-Vinyl-	500
504-24-5	Pyridine, 4-Amino-	500
1124-33-0	Pyridine, 4-Nitro-,I-Oxide	500
53558-25-1	Pyriminil	100
14167-18-1	Salcomine	500
107-44-8	Sarin	10
7783-00-8	Selenious Acid	1,000
7791-23-3	Selenium Oxychloride	500
563-41-7	Semicarbazide Hydrochloride	1,000
3037-72-7	Silane, (4-Aminobutyl) Diethoxymethyl-	1,000
7631-89-2	Sodium Arsenate	1,000
7784-46-5	Sodium Arsenite	500
26628-22-8	Sodium Azide (Na(N(3)))	500
124-65-2	Sodium Cacodylate	100
143-33-9	Sodium Cyanide (Na(CN))	100
62-74-8	Sodium Fluoroacetate	10
13410-01-0	Sodium Selenate	100
10102-18-8	Sodium Selenite	100
10102-20-2	Sodium Tellurite	500
900-95-8	Stannane, Acetoxytriphenyl-	500
57-24-9	Strychnine	100
60-41-3	Strychnine Sulfate	100
3689-24-5	Sulfotep	500
3569-57-1	Sulfoxide, 3-Chloropropyl Octyl	500

CAS#	Chemical Name	TPQ
7446-09-5	Sulfur Dioxide	500
7783-60-0	Sulfur Tetrafluoride	100
7446-11-9	Sulfur Trioxide	100
7664-93-9	Sulfuric Acid	1,000
77-81-6	Tabun	10
7783-80-4	Tellurium Hexafluoride	100
107-49-3	TEPP	100
13071-79-9	Terbufos	100
78-00-2	Tetraethyllead	100
597-64-8	Tetraethyltin	100
75-74-1	Tetramethyllead	100
509-14-8	Tetranitromethane	500
10031-59-1	Thallium Sulfate	100
6533-73-9	Thallous Carbonate	100
7791-12-0	Thallous Chloride	100
2757-18-8	Thallous Malonate	100
7446-18-6	Thallous Sulfate	100
2231-57-4	Thiocarbazide	1,000
39196-18-4	Thiofanox	100
297-97-2	Thionazin	500
108-98-5	Thiophenol	500
79-19-6	Thiosemicarbazide	100
5344-82-1	Thiourea, (2-Chlorophenyl)-	100
614-78-8	Thiourea, (2-Methylphenyl)-	500
7550-45-0	Titanium Tetrachloride	100
584-84-9	Toluene 2,4-Diisocyanate	500
91-08-7	Toluene 2,6-Diisocyanate	100
110-57-6	Trans-1,4-Dichlorobutene	500
1031-47-6	Triamiphos	500
24017-47-8	Triazofos	500
76-02-8	Trichloroacetyl Chloride	500
115-21-9	Trichloroethylsilane	500
327-98-0	Trichloronate	500
98-13-5	Trichlorophenylsilane	500
1558-25-4	Trichloro(Chloromethyl)Silane	100
27137-85-5	Trichloro(Dichlorophenyl) Silane	500
998-30-1	Triethoxysilane	500
75-77-4	Trimethylchlorosilane	1,000
824-11-3	Trimethylolpropane Phosphite	100
1066-45-1	Trimethyltin Chloride	500
639-58-7	Triphenyltin Chloride	500
555-77-1	Tris(2-Chloroethyl)Amine	100
2001-95-8	Valinomycin	1,000
1314-62-1	Vanadium Pentoxide	100
108-05-4	Vinyl Acetate Monomer	1,000
81-81-2	Warfarin	500
129-06-6	Warfarin Sodium	100
28347-13-9	Xylylene Dichloride	100
58270-08-9	Zinc, Dichloro(4,4- Dimethyl-5((((Methylamino)Carbonyl) Oxy) Imino)Pentanenitrile)-, (T-4)-	100
1314-84-7	Zinc Phosphide	500

APPENDIX II: EMERGENCY CONTACT LISTS

EMERGENCY ASSISTANCE CONTACT NUMBERS

ONBOARD THE *R/V JOIDES RESOLUTION*:

In Case of Fire use Emergency Fire Alarms located on each deck.

For Medical Emergency, call the Ship's Hospital at 200.

For all other emergencies, contact the Bridge first at 126.

DIAL	CONTACT
126	Bridge
200	Ship's Hospital
122	TSF Drilling Superintendent's Office
115	ODP Drilling Superintendent's Office
114	Lab Officer's Office
50	Paging / Public Announcement System

AT ODP HEADQUARTERS:

Position	Phone #	Pager #
Director	917-845-8480	
Deputy Director	917-845-9297	
Manager of Science Services	917-862-2283	
Supervisor of Technical Support	979-845-6716	
Manager of Drilling Services	917-845-2024	
Materials Services Team - Supervisor	917-845-2113	
Manager of Information Services	917-845-9324	
Network and Admin. Services - Supervisor	917-845-9298	917-228-0022
Administrator (TAMRF)	917-845-3068	
Human Resources - Supervisor	917-845-9288	
Travel - Supervisor	917-845-0924	

APPENDIX III: TAMU HAZARDOUS WASTE PROGRAM

Use only as a guide unless shipping hazardous waste back to TAMU for disposal.

Management And Disposal Of Hazardous Waste

Generators are responsible for following the University disposal procedures, for assuring that their employees are trained in proper disposal procedures, and for properly identifying the hazardous chemical waste generated. The TAMU Hazardous Waste Program (http://ehsd-online.tamu.edu/programs/environmental/environmental.htm) is intended to:

- Assure compliance with applicable Federal and State regulations for the proper management of hazardous chemical waste
- To reduce adverse effects to human health and the environment.

A material becomes "waste" when the individual generator determines that it is no longer useful and should be discarded. If the material is to be discarded, EHSD will determine whether the chemical waste is non-hazardous or hazardous.

Hazardous waste includes materials that has been classified as:

- Ignitable
- Reactive
- Corrosive
- Toxic
- Universal Waste
- Material is not excluded from regulations

Non-hazardous waste may be disposed of using the sanitary sewer or regular trash. Additional information about non-hazardous waste disposal can be obtained from EHSD.

Gas cylinders should be returned to the manufacturer or distributor whenever possible. Non-returnable cylinders should be tagged as hazardous waste.

Photographic lab waste containing silver must be disposed as hazardous chemical waste. However, some new developing equipment includes a filtration system that removes the silver. Photographic lab effluent that does not contain silver may be discarded through the sanitary sewer system. Please notify the EHSD if you have this type of equipment.

"Mixed Waste" (includes both radioactive material and hazardous chemicals) should be initially routed through the EHSD Division of Radiological Safety.

"Unknown Waste" is chemical waste that can't be identified by the generator. Such material should be should be identified as "Unknown" on the Waste Disposal Tag. Unknowns will be picked up by EHSD. Generators will be charged for the cost of analysis necessary to determine the chemical identity for proper disposal.

<u>Separation and Segregation of Hazardous Waste</u>

Hazardous chemical waste is categorized into the following hazard classes:

- Halogenated solvents
- Non-halogenated solvents
- Acids (inorganic or organic)
- Bases (inorganic or organic)
- Heavy metals (silver, cadmium, lead, mercury, etc.)
- Poisons (inorganic or organic)
- Reactives (cyanides, sulfides, water reactive chemicals, peroxides, etc.)
- Do not commingle these classes in the same waste container
- Do not combine inorganic heavy metal compounds and organic waste solvents.
- Do not combine non-hazardous waste (e.g., mixture of water, dilute acetic acid, and sodium bicarbonate) with hazardous chemical waste.
- Dry materials (paper, rags, towels, gloves, or Kim Wipes, etc.) contaminated with flammable or extremely toxic chemicals must be double-bagged in heavy-duty plastic bags and must be treated as hazardous chemical waste. Do not use biohazard bags.
- Sharps (needles, razor blades, etc.) are classified as biohazardous waste even if they are not contaminated. Sharps must be encapsulated (Place the sharps in a "puncture resistant" container or plastic/metal container and then fill it with paraffin or plaster of Paris.). Discard the containers of sharps as biohazardous waste. Contact EHSD for additional information.

<u>Hazardous Waste Containers</u>

- Waste generators are required to provide their own waste containers that are compatible with the chemical contents (e.g., do not use metal containers for corrosive waste or plastic containers for organic solvent).
- Containers must be in good condition and not leak. All containers must have suitable screw caps or other means of secure closure. When large waste containers (>10 gallons, total volume) are required, contact EHSD for assistance on selection and placement of appropriate container type and size.
- Never overfill hazardous waste containers. Expansion and excess weight can lead to spills, explosions, and extensive environmental exposure.
- Containers of solids must not be filled beyond their weight and volume capacity.
- Jugs and bottles should not be filled above the shoulder of the container.
- Closed head cans) should have at least two inches (5 gallons or less) or four inches (larger than 5 gallons) of headspace between the liquid level and the head of the container.

Containers must be closed or sealed to prevent leakage. All waste collection containers must be kept closed except when adding or removing material.

<u>Containment and Storage of Hazardous Chemical Waste</u>
Waste generators must maintain custody and control of the storage areas and ensure the waste is accessible to EHSD personnel.

Individual waste generators shall assure that their hazardous chemical wastes are accumulated in safe, transportable containers, properly labeled, and stored to prevent human exposure to or environmental release of the waste materials.

"Satellite Accumulation Areas" are locations designated by EHSD for storage of hazardous waste awaiting pickup and disposal. Consult with your supervisor or EHSD to determine the location of hazardous waste for your workplace.

<u>Labels and Labeling</u>

- The original chemical label on containers used for waste accumulation must be destroyed or defaced.
- EPA regulations require that waste containers be labeled with the chemical contents and the words "Hazardous Waste" when the chemical waste is first added.
- DO NOT DATE THE CONTAINER UNTIL READY FOR PICKUP AND DISPOSAL
- Containers at TAMU can be labeled in one of two methods:

1. Using string, attach a completed (except for the accumulation start date) Hazard Waste Disposal Tag (available from EHSD) to each waste container is first added. Print the information on the tag legibly.
2. For containers larger than 5-gallons, a Hazardous Waste Label (available from EHSD) can be used. These labels have an adhesive back and are placed on the container when the chemical is first added.

<u>Disposal of Hazardous Chemical Waste</u>
Waste containers that are full and/or ready for disposal are:

- Tagged with a Hazardous Waste Disposal Tag. (See below) Fill in the accumulation start date on the disposal tag, separate the bottom part of the tag, and mail it to MS 4472. EHSD schedules to collect the waste upon receipt the bottom part of the tag
- Labeled with a Hazardous Waste Label. Attach a completed Hazardous Waste Disposal Tag including the accumulation start date, separate the bottom part of the tag, and mail it to MS 4472. Upon receiving the bottom part of the tag, EHSD schedules to collect the waste. EHSD makes weekly pickups at designated Satellite Accumulation Areas.

EHSD will not pickup containers with improper caps, leaks, outside contamination, or improper labeling.

It is violation of federal and state law to dispose of hazardous chemicals in any of the following ways:

- Disposal through the sanitary drain (sewer).

- Intentional disposal by evaporation in a fume hood. (This does not refer to normal fume hood use).

- Disposal in the regular trash.

<u>Disposal of Empty Chemical Containers</u>
Empty containers should be placed in a dumpster for disposal with other non-hazardous trash when the following requirements are satisfied.

Not contain free liquid or solid residue

- Be triple rinsed
- Have the label removed or defaced
- Have the lid or cap removed
- Have a hole punched in the bottom (metal or plastic containers).

It is not necessary to break empty glass containers when placed in a dumpster. Empty chemical containers not handled in this manner must be treated as hazardous chemical waste (very expensive).

(ATTACH TAG TO CONTAINER WITH STRING)

HAZARDOUS WASTE
DISPOSAL TAG

REQUESTOR: ** John Doe
DEPT/PART: Chemistry .
PHONE: 5-3140
CHEMICAL(S): *** Methylene Chloride, Toluene
.

602
HAZARDOUS WASTE
DISPOSAL TAG

ACCUMULATION START DATE: * 5/22/96
REQUESTOR: ** John Doe
DEPT/PART: Chemistry
BLDG.NAME & NO: Chemistry - 376
ROOM NO. 2002 **PHONE**: 5-3140
CHEMICAL(S): *** Methylene Chloride, Toluene
.

____

PHYSICAL PROPERTY: ☐ Liquid ☐ Solid ☐ Gas ☐ Other

____

QUANTITY: ☐ Pint ☐ Quart ☐ Gallon ☐ 5-Gallon ☐ Other 4 liter
.

CONTAINER TYPE: ☐ Glass ☐ Metal ☐ Other

____

REACTS WITH: ☐ None ☐ Air ☐ Water ☐ Other

____

HAZARDS: ☐ Flammable ☐ Explosive ☐ Carcinogen

Follow the example below to properly complete your hazardous waste disposal tag:

HAZARDOUS CHEMICAL WASTE

Accumulation Start Date: (*Date waste first added*)__
Contents: (Chemical(s) identity and percentage)

HANDLE WITH CARE
Contains Hazardous or Toxic Waste

Attach An Individual Hazardous Waste Disposal Tag To **Each** Waste Container

Both upper and lower sections of the tag must be filled out completely and legibly **except for the accumulation date** when chemical is first added to a waste container. (This information is essential for record keeping).

* Fill in the **Accumulation Start Date** when the waste container is full and/or ready for pickup.

Secure the top part of the tag with a string that encircles the top of the container - **rubber bands, tape, and wire are not acceptable**.

** The "REQUESTOR" is the Principal Investigator or person in charge of the lab that generated the waste.

*** Chemical name/Common name. Chemical formulas or abbreviations are not acceptable.

*** List all chemical components in a waste container (including water). Lists may be continued on the back of the tag.

***Tags for containers of potentially explosive materials such as picric acid, silanes, nitro compounds, and ethers must indicate the percent concentration of these chemicals.

Place any additional Hazard Information about container contents in **REMARKS.**

Section 8: ATTACHMENTS

ATTACHMENT 1: WORKPLACE HAZARD COMMUNICATION IMPLEMENTATION PLAN

Each workplace must have a written plan that describes how the TAMU Hazard Communication Program is implemented in that workplace.

TAMU HAZARD COMMUNICATION PROGRAM
WORK PLACE IMPLEMENTATION PLAN

Name of Unit:
Ocean Drilling Program

Positions responsible for assuring compliance with training requirements:
Supervisor of Technical Support
Lab Officer
Staff Scientist
Operations Superintendent

Location of Employee Training Records:
Primary Copy:
Ocean Drilling Program's Human Resource Office, 1000 Discovery Dr., College Station, TX

Shipboard Copy:
Technical Support Office, *R/V Joides Resolution*

Location of Material Safety Data Sheets:
Aboard the *R/V Joides Resolution* MSDS Files are posted in the following work areas and labs:

Work Area	Location	Deck
Library & ODP Offices	Technical Support Office	Bridge
Lab Stack	Thin Section Lab	Top
	Downhole Measurement Lab	Top
	Core Lab	Bridge
	Chemistry Lab	Fo'c'sle
	Microbiology Lab & ICP Prep. Room	Fo'c'sle
	Paleontology Lab	Fo'c'sle
	Main Deck Spaces (copy area)	Main
	Photo Lab	Upper 'Tween
	ET Shop	Upper 'Tween
	Upper 'Tween Mezzanine	Upper 'Tween
	Lower 'Tween Deck Spaces (landing)	Lower 'Tween
	Hold & Hold Reefer Store Rooms	Hold
Aft & Mid Ship Spaces	Underway Geophysical Lab (includes Fantail)	Poop
	Subsea Shop	Beneath Rig Floor
Research & Support Vans	Vans are portable units that are installed on the ship on a need basis.	Above Core Tech Shop

Location(s) where the "NOTICE TO EMPLOYEES" is permanently posted:

Work Area	Location
Library & ODP Offices	In Technical Support Office
Lab Stack	Stairway landing between Main and Fo'c'sle decks
Aft & Mid Ship Spaces	Underway Geophysical Lab
Research & Support Vans	Inside the van

Positions responsible for compiling the annual Workplace Chemical Inventory:

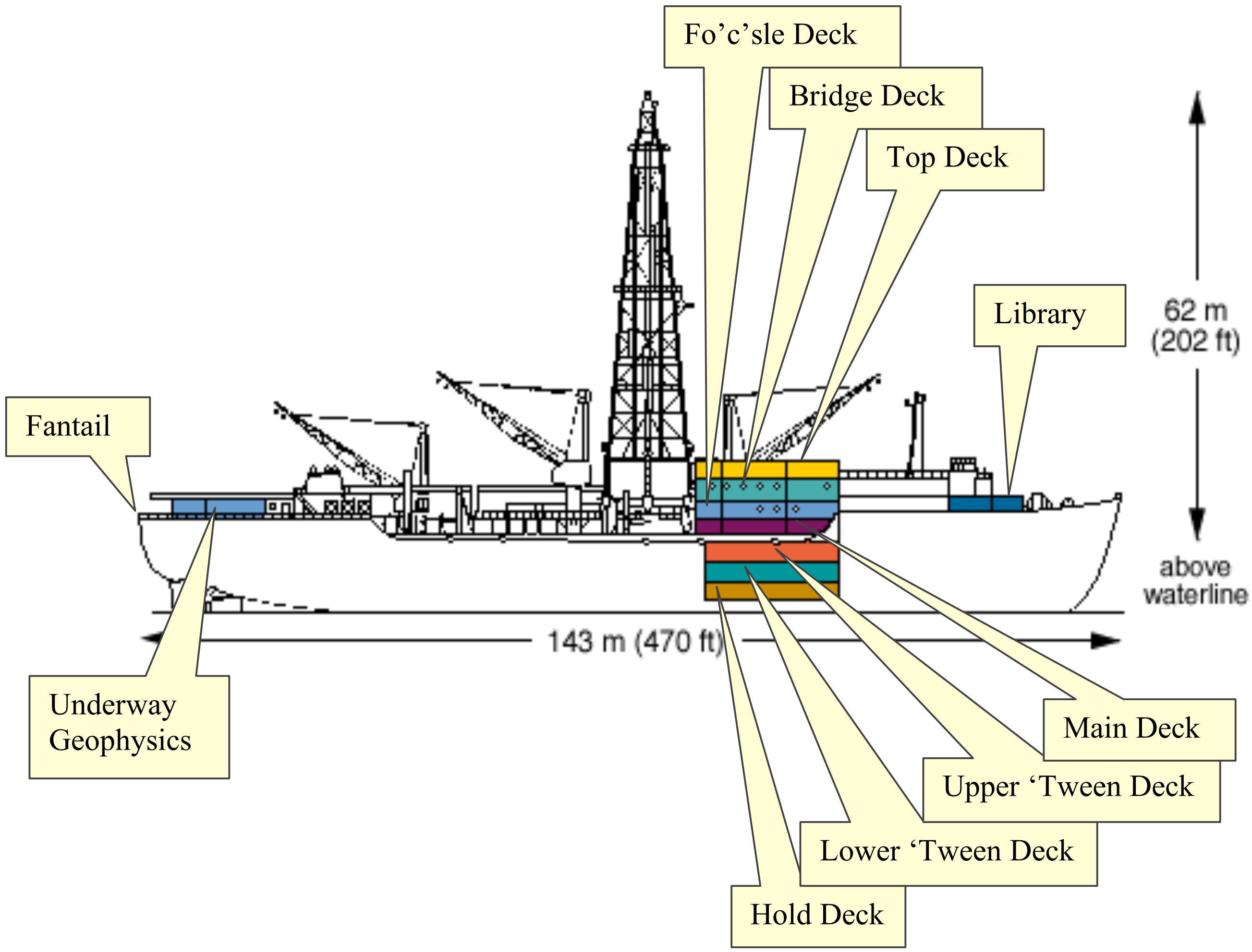
Supervisor of Technical Support
Lab Officer

Location where the Workplace Chemical Inventory Records are filed:

The Workplace Chemical Inventory is kept in the Technical Support Office aboard the *R/V Joides Resolution*.

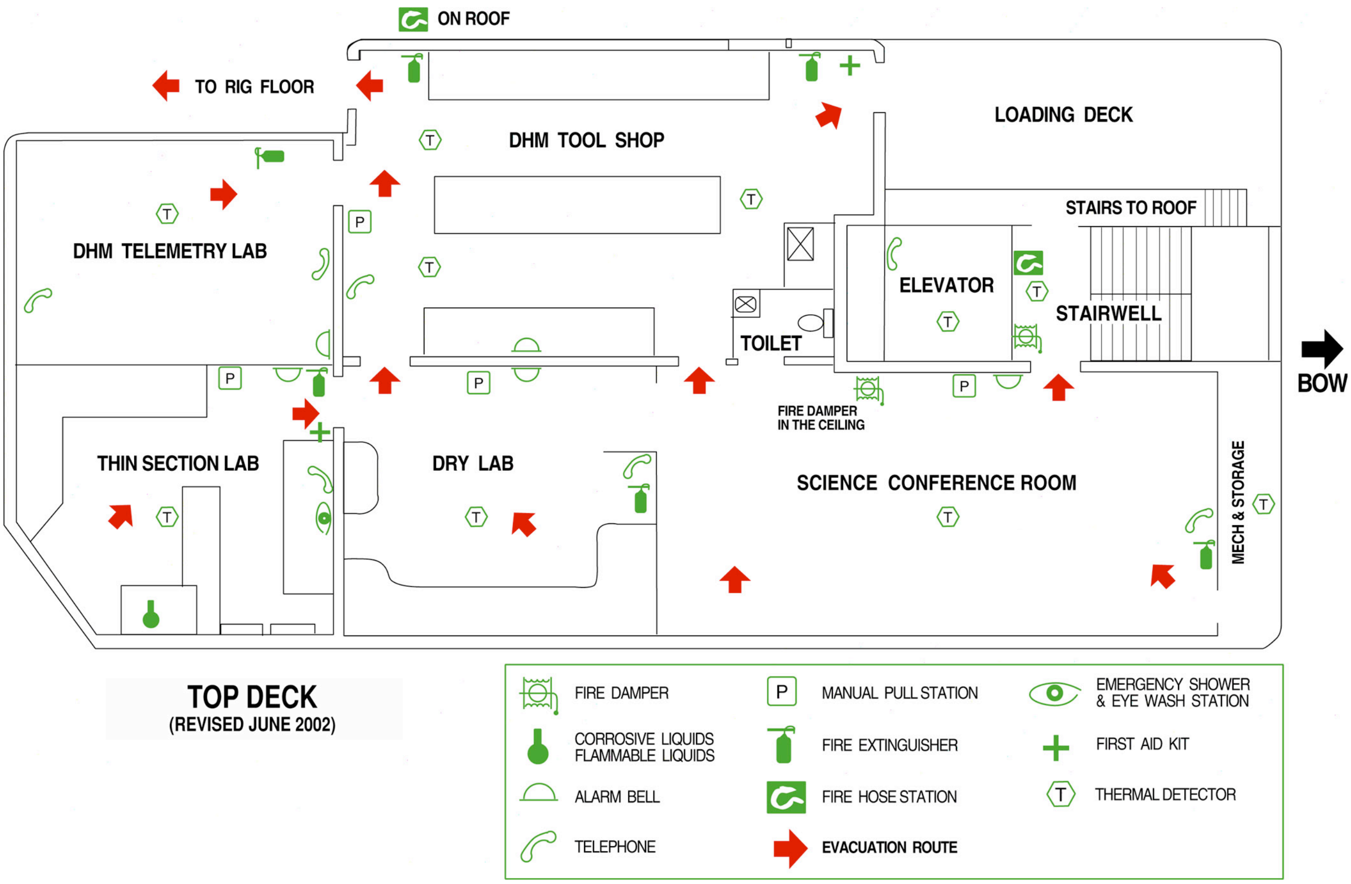
ATTACHMENT 2: WORK AREA FLOOR PLANS WITH SPECIFIC HAZARDS AND EMERGENCY RESPONSE PLANS

Cross Section View of the *R/V Joides Resolution* showing the location of spaces operated by the Ocean Drilling Program.



Deck	Area	Hazard	Comments
TOP	Conference Room	Dust	Toner from copier
	Dry Lab	Varies	The use of this lab changes as necessary to meet the needs of the current science program. Hazardous Materials and/or Equipment can be used in this lab
		Microwave Oven	
	Thin Section Lab	Flammable Liquids	Cleaning solutions and lubricants
		Corrosive Liquids	
	BRG Office	None	
	Downhole Measurement Shop	Flammable Liquids	Cleaning solutions and lubricants
		Electrical	Power supplies
		High Pressure	Test pumps, sample chambers, and pressure cases

TOP DECK: Special Emergency Response Instructions:



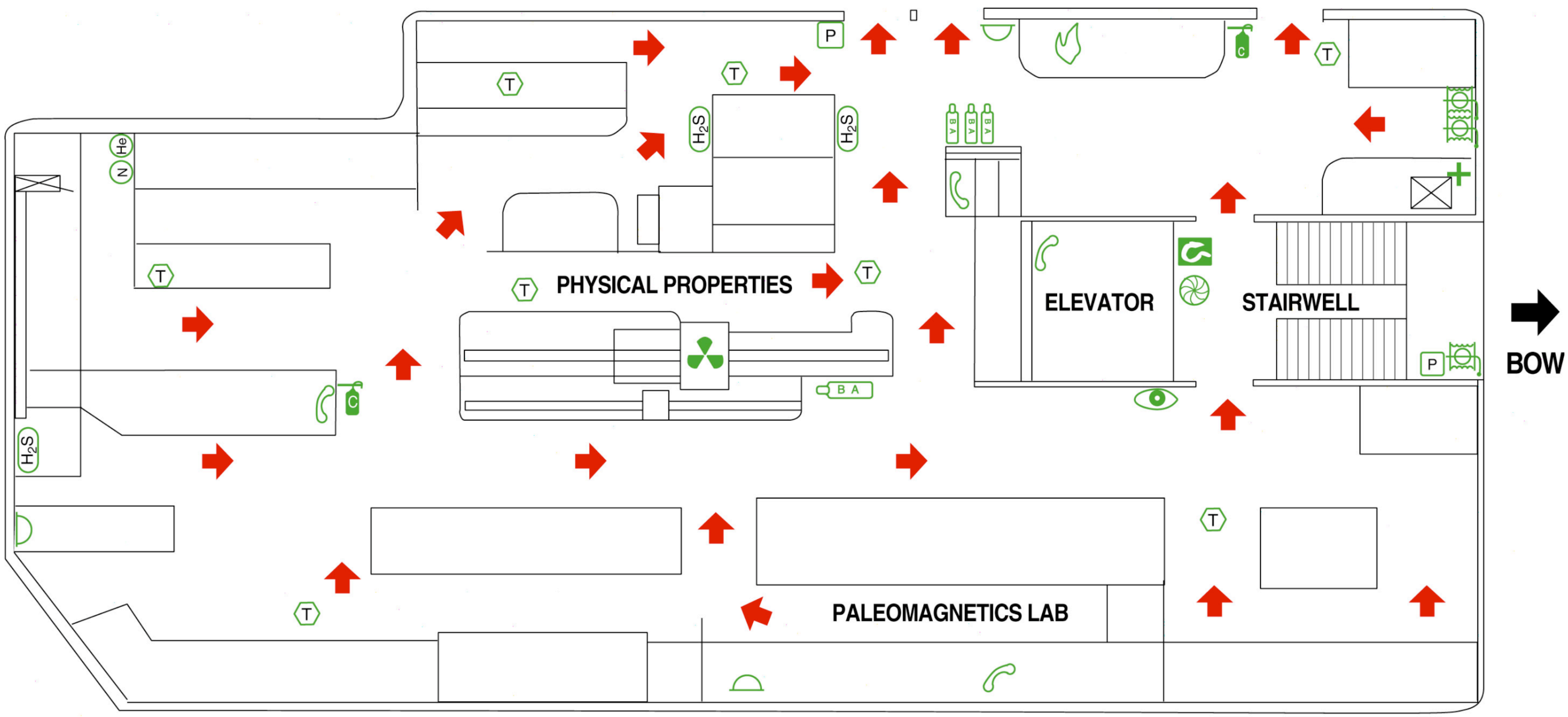
Deck	Area	Hazard	Comments
BRIDGE	Core Receiving Platform	Flammable Liquids	Mostly Acetone used for gluing end caps
		H_2S & toxic fumes	Gases that emanate from cores
		High Pressures	Gas pressure that builds within cores can cause an explosive failure of the core liner
		Cutting tools	Knives, spatulas, and core liner cutters
	Core Entry	H_2S & toxic fumes	Gases that emanate from cores
	Core Splitting Room	Flammable Liquids	Mostly Acetone used for gluing end caps and liner dividers Cleaning, paints, glues and lubrication
		H_2S & toxic fumes	Gases that emanate from cores
		Noise	Rock saws and sonic welder
		Cutting tools	Knives, spatulas, and core liner cutters
	Core Sampling Area	H_2S & toxic fumes	Gases that emanate from cores
		Noise	Rock saws and sonic welder
		Cutting tools	Knives, spatulas, and core liner cutters
	Physical Properties Lab	High Pressure	He gas bottle used on pycnometer
		Radiation	GRAPE Cesium source NGR standards
		Glassware	

Deck	Area	Hazard	Comments
BRIDGE (continued)	Physical Properties Lab (continued)	Mechanical	MST track system
	Core Description Lab	H_2S & toxic fumes	Gases that emanate from cores
		Flammable Liquids	Glues
		Corrosive Liquids	Dilute HCL acid used to identify carbonates
		Glassware	
	Paleomagnetics Lab	Cryogenic Liquids	Liquid He used in magnetometer
		Electrical	Power supplies and capacitors used demagnetization system
		Magnetic Fields	Demagnetization coils
		Heat	Thermal demagnetization system
		Glassware	

BRIDGE DECK: Special Emergency Response Instructions:

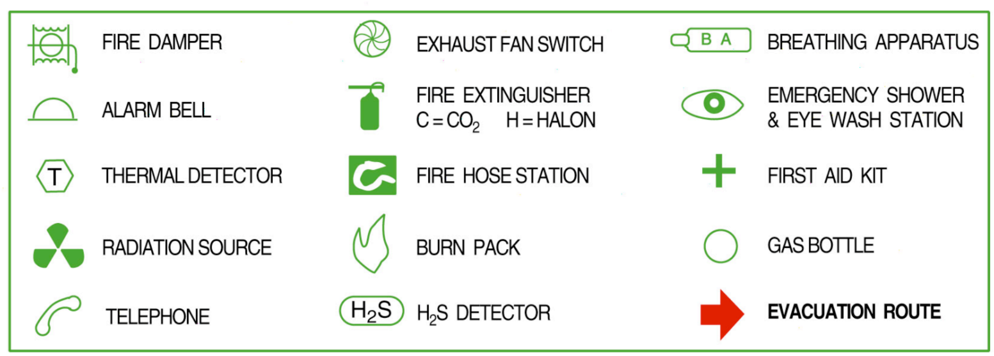
Policy for working with the GRAPE CS-137, 10 miCu Source:

- The GRAPE source is part of the Multi-Sensor Track and is fixed to the supporting bench.
- The source is housed in lead shielding inside a chromed steel container.
- The source housing comes with two plugs.
    - One is solid and will block all radiation coming from the source. This plug MUST be used when shipping the source or when working on other instruments close to the source. When shipping, two retaining screws must be tighten to prevent the plug from coming loose.
    - The second plug has a collimated opening that allows a 1/8 diameter beam of gamma rays to leave the source that penetrates the target and then enters the detector. When ever the collimated plug is in the source must be pointed at the detector, which is shielded to prevent the gamma rays from passing through and into the lab behind. In addition the hand shield, which connects the source and detector housing, must be installed to prevent hands from slipping into the beam.
- The source must never be removed, for any reason by staff. When it is time to replace the source the entire housing is shipped to the vendor and returned to the ship as a unit.
- While onboard the ship the source housing is always secured in its mount on the MST.



CORE LAB (BRIDDGE) DECK

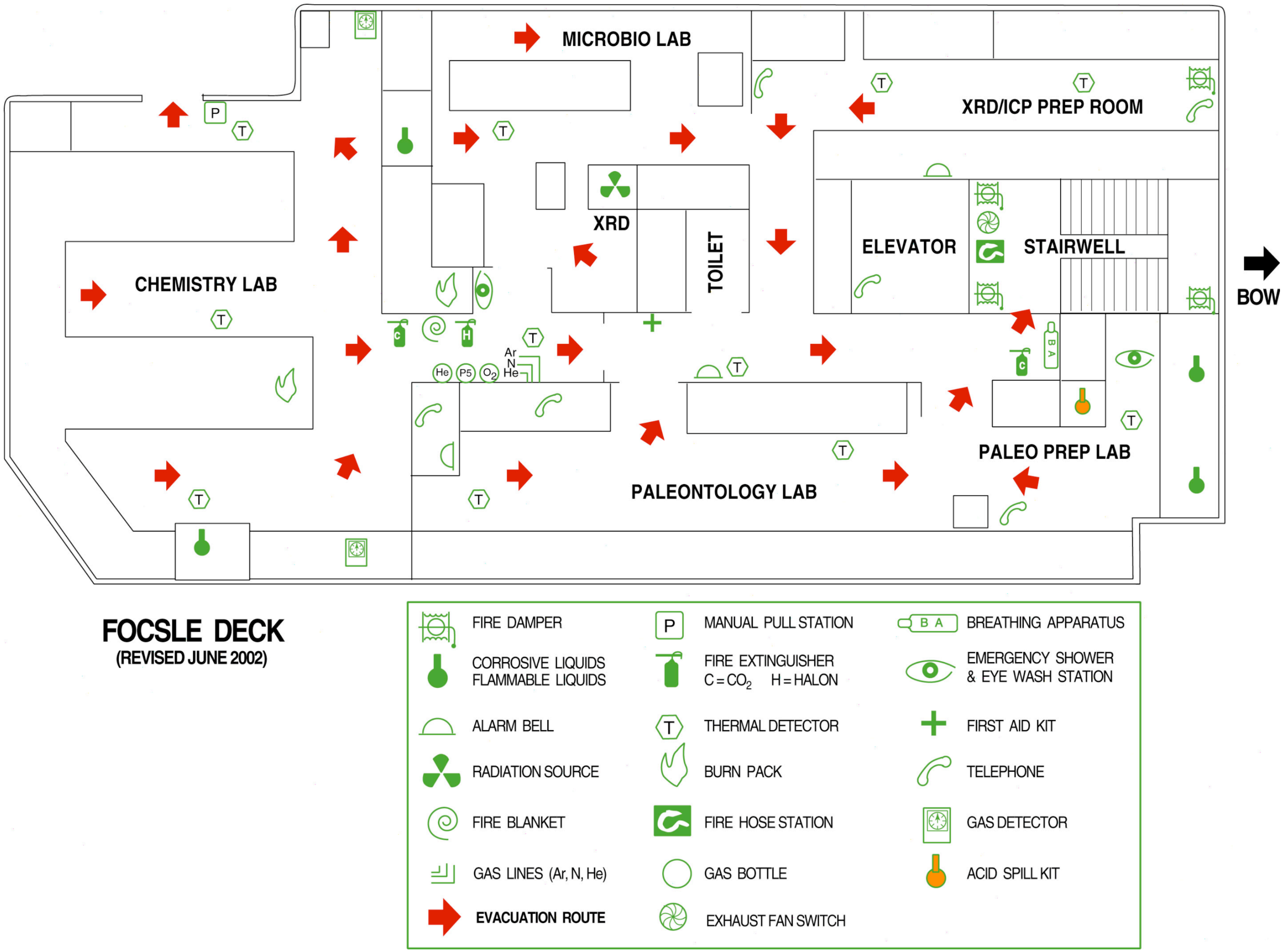
(REVISED JUNE 2002)



Deck	Area	Hazard	Comments
FO’C’SLE	XRD- ICP Preparation Lab	Heat	Bead Maker can reach temperatures of 2000° C
		Radio waves	Bead Maker uses radio induction to heat materials
		Dust	Grinding equipment
		Flammable Liquids	Cleaning solutions and lubricants
		Glassware	
	Microbiology Lab	Corrosive Liquids	Sample processing
		Oxidizers	
		Flammable Liquids & Gases	
		Toxic	
		Freezing	-86° C Freezer
		High Pressure	Pump, gas bottles, and gas plumbing
		Suffocation	Anaerobic chamber
		Glassware	
		Heat	Hotplates and ovens

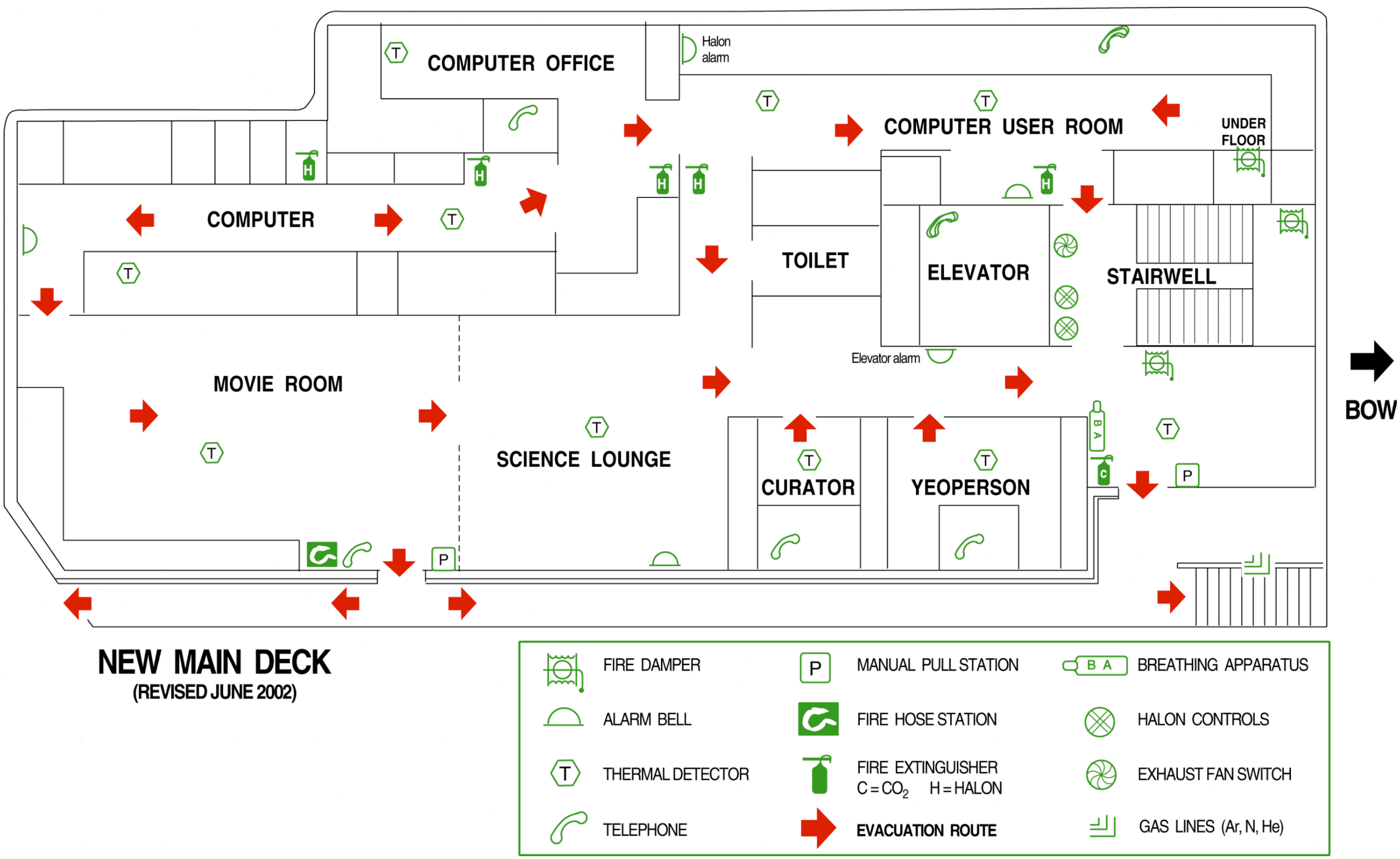
Deck	Area	Hazard	Comments
FO'C'SLE (continued)	Chemistry Lab	Corrosive Liquids	Sample processing
		Oxidizers	
		Flammable Liquids & Gases	
		Toxic	
		High Pressure	Sample squeezers, pumps, gas bottles, and gas plumbing
		Flammable gases	Hydrogen generator
		Glassware	
		Heat	Hotplates and ovens
	Paleontology Lab	Corrosive Liquids	Sample processing
		Oxidizers	
		Flammable Liquids	
		Toxic	
		Heat	Hotplates and ovens
		Glassware	
	XRD Lab	Radiation	X-ray tube

FOCSLE DECK: Special Emergency Response Instructions:


MICROBIO LAB
XRD/ICP PREP ROOM
XRD
TOILET
ELEVATOR
STAIRWELL
BOW
CHEMISTRY LAB
PALEO PREP LAB
PALEONTOLOGY LAB
Ar
N
He
He
P5
O2
FOCSLE DECK
(REVISED JUNE 2002)
FIRE DAMPER
CORROSIVE LIQUIDS
FLAMMABLE LIQUIDS
ALARM BELL
RADIATION SOURCE
FIRE BLANKET
GAS LINES (Ar, N, He)
EVACUATION ROUTE
MANUAL PULL STATION
FIRE EXTINGUISHER
C = CO2 H = HALON
THERMAL DETECTOR
BURN PACK
FIRE HOSE STATION
GAS BOTTLE
EXHAUST FAN SWITCH
BREATHING APPARATUS
EMERGENCY SHOWER
& EYE WASH STATION
FIRST AID KIT
TELEPHONE
GAS DETECTOR
ACID SPILL KIT

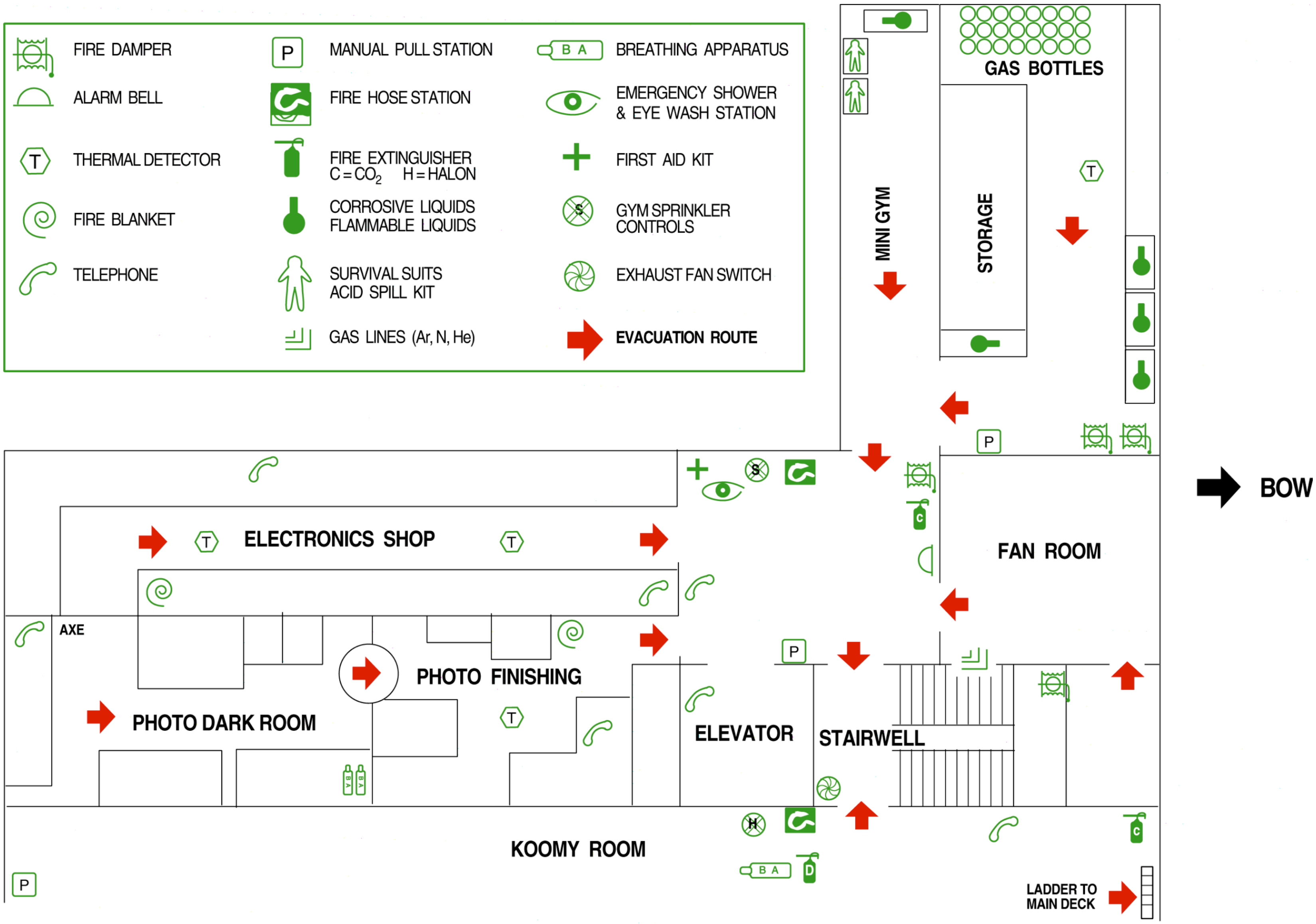
Deck	Area	Hazard	Comments
MAIN	Yeoperson's Office	None	
	Copier Area	Dust	Toner from copier
	Curation Office	None	
	Science Lounge	None	
	User's Room	None	
	System Manager's Office	None	
	Computer Machine Room	Electrical	Power conditioners
		Explosive/Corrosive	Batteries in UPS

MAIN DECK: Special Emergency Response Instructions:


COMPUTER OFFICE
Halon alarm
COMPUTER USER ROOM
UNDER FLOOR
COMPUTER
TOILET
ELEVATOR
STAIRWELL
MOVIE ROOM
Elevator alarm
SCIENCE LOUNGE
CURATOR
YEOPERSON
BOW
NEW MAIN DECK
(REVISED JUNE 2002)
FIRE DAMPER
MANUAL PULL STATION
BREATHING APPARATUS
ALARM BELL
FIRE HOSE STATION
HALON CONTROLS
THERMAL DETECTOR
FIRE EXTINGUISHER
C = CO2 H = HALON
EXHAUST FAN SWITCH
TELEPHONE
EVACUATION ROUTE
GAS LINES (Ar, N, He)

Deck	Area	Hazard	Comments
UPPER ‘TWEEN	Photo Lab	Corrosive Liquids	Photo Processing
		Toxic Liquids	
		Flammable Liquids	Cleaning solutions and silk screen inks
	Electronic Support Shop	Flammable Liquids	Cleaning and lubrication
		Electrical	Power supplies and capacitors
		Explosive/Corrosive	Batteries
	Mezzanine Storage	Corrosive Liquids	Bulk Storage
		Oxidizers	
		Fire	Plastic and Papers supplies

UPPER ‘TWEEN DECK: Special Emergency Response Instructions:

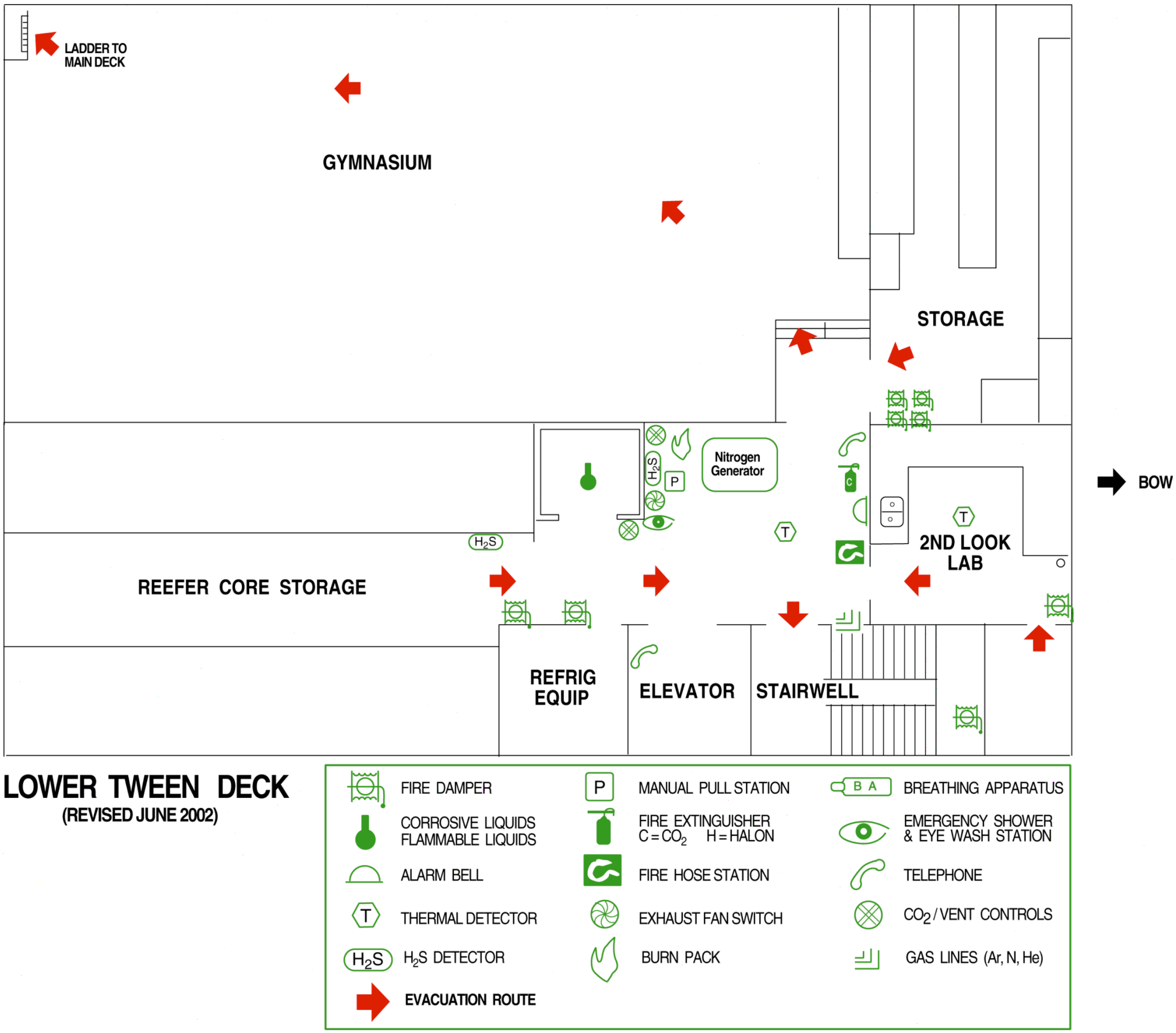


UPPER TWEEN DECK

(REVISED JUNE 2002)

Deck	Area	Hazard	Comments
LOWER 'TWEEN	Lower 'Tween Core Refrigerator	None	
	Second Look Lab	Varies	The use of this lab changes as necessary to meet the needs of the current science program. Hazardous Materials and/or Equipment can be used in this lab
	Lower 'Tween Store Room	Flammable Liquids	Printer inks
		Dust	Copier toner
	Gym	High Pressure	Accumulator bottles for drill string compensator
	Lower 'Tween Landing	High Pressure	N_2 Generator

LOWER 'TWEEN DECK: Special Emergency Response Instructions:



LOWER TWEEN DECK

(REVISED JUNE 2002)

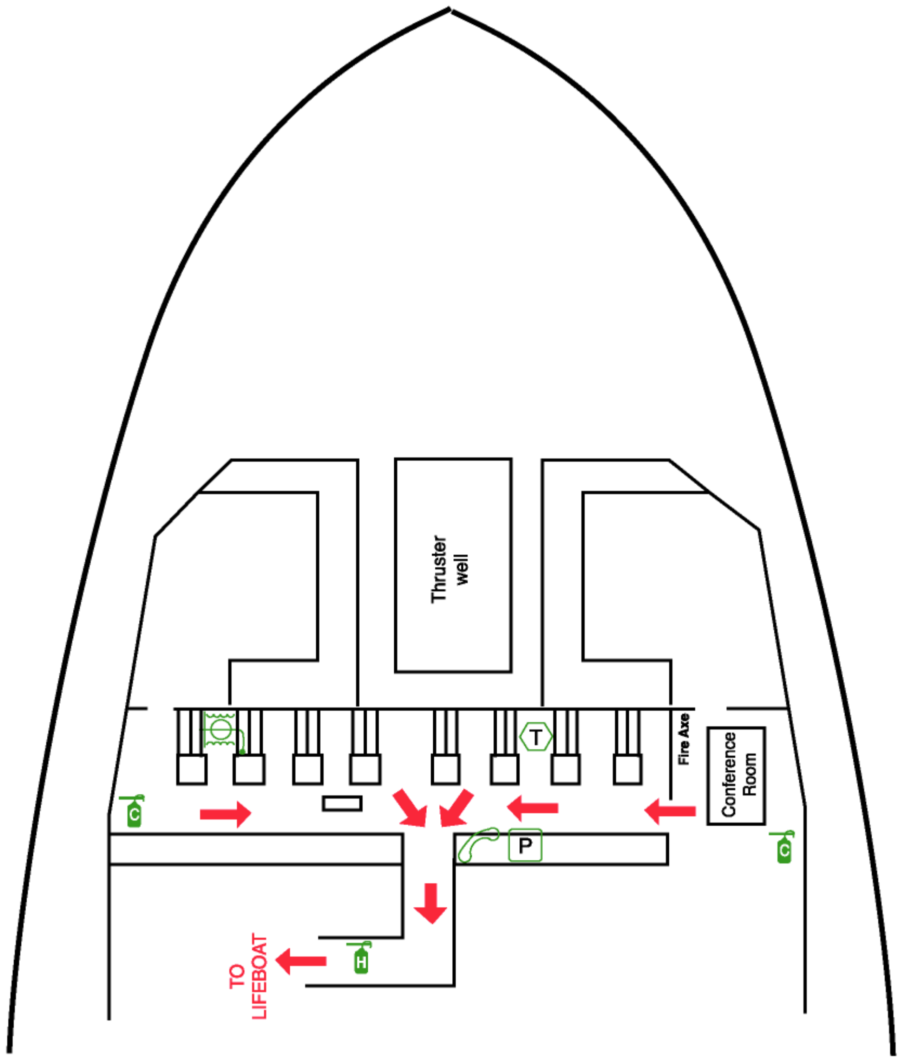
Deck	Area	Hazard	Comments
HOLD	Hold Core Refrigerator	Toxic Chemicals	Photo and Chemistry Lab supplies
		Corrosive Liquids	
		Flammable Gases	
		Cryogenic	Liquid N_2 dewars
	Hold Stores	Flammable Liquids and Gases	Cleaning solutions, lubricants, and paints
	Hold	Flammable Liquids	Cleaning solutions, lubricants, and paints
		Mechanical	Wood working tools
		Dust	Saw dust
		High Pressure	Gas bottle storage

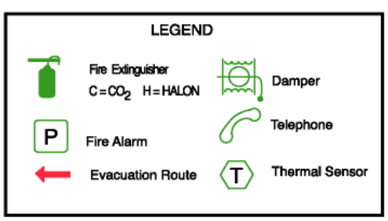
HOLD DECK: Special Emergency Response Instructions:

HOLD DECK: Special Emergency Response Instructions:

Deck	Area	Hazard	Comments
SHIP'S HOUSE	Library	Dust	Toner from copier
	ODP Offices		

SHIP’S HOUSE: Special Emergency Response Instructions:



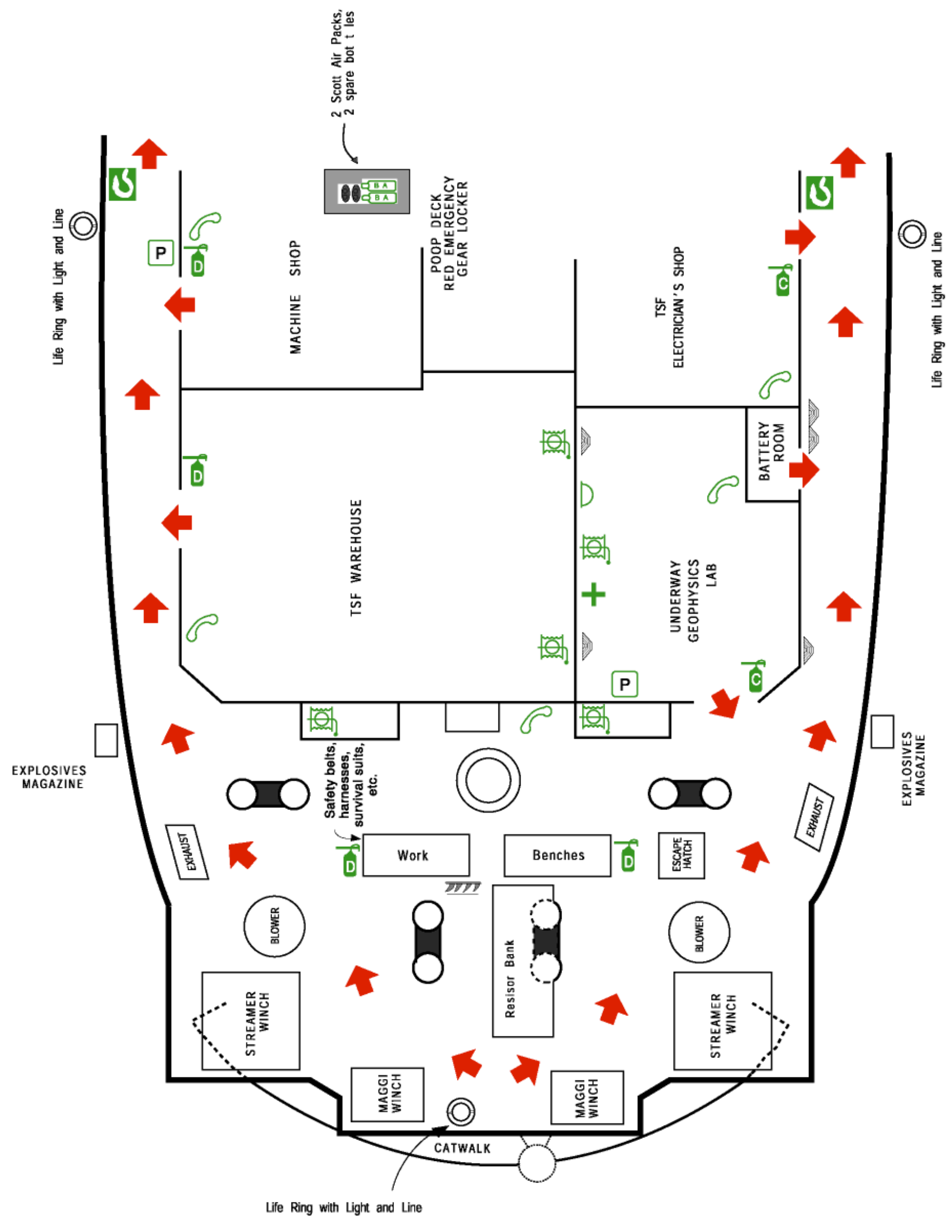


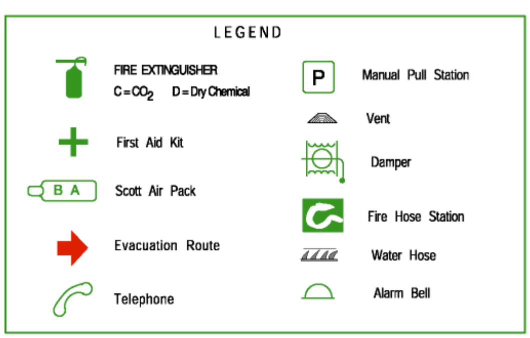
LIBRARY
EMERGENCY EQUIPMENT LOCATION
AND EVACUATION ROUTE

(REVISED MARCH 2002)

Deck	Area	Hazard	Comments
POOP	Fantail	High Pressure	High pressure air supply and hydraulic pumps
		Mechanical	Lifting equipment and winches
		Falling	Deploying geophysical equipment
		Noise	Engine room supply and exhaust fans
		Flammable Liquids	Cleaning solutions and lubricants
	Underway Geophysical Lab	Flammable Liquids	Cleaning solutions and lubricants
		Electrical	Power supplies and capacitors

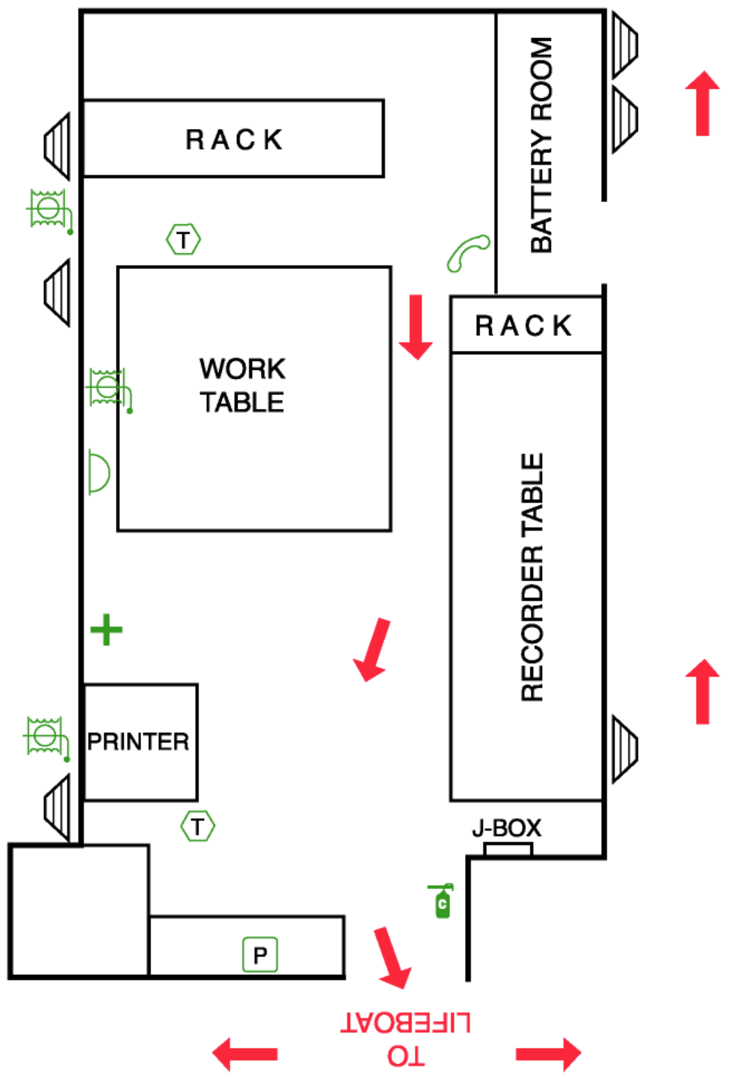
FANTAIL & UNDERWAY LAB: Special Emergency Response Instruction

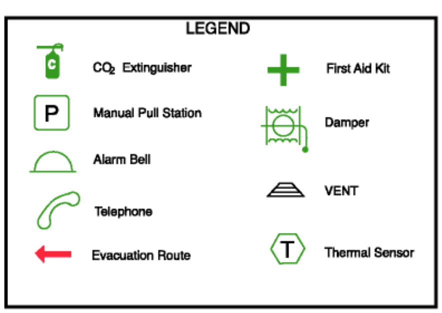




FANTAIL

(REVISED MARCH 2002)

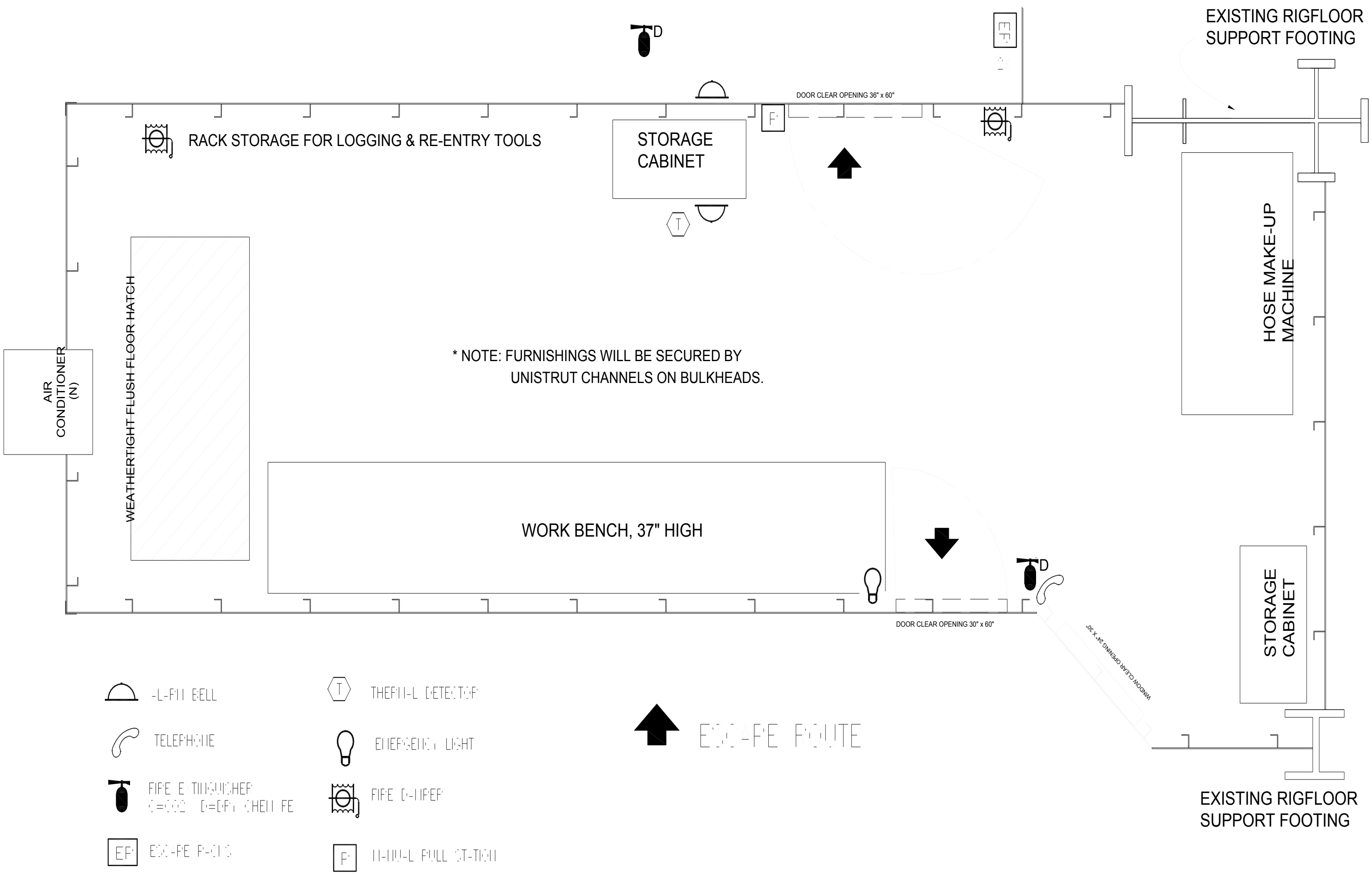




UNDERWAY GEOPHYSICS LAB EMERGENCY EQUIPMENT LOCATION AND EVACUATION ROUTE

Deck	Area	Hazard	Comments
Under Rig Floor	Subsea Shop	Flammable Liquids	Cleaning solutions and lubricants
		Electrical	Power supplies and capacitors
		Noise	Drilling equipment
		Mechanical	Hose making machines and grinders

SUB SEA SHOP: Special Emergency Response Instructions:

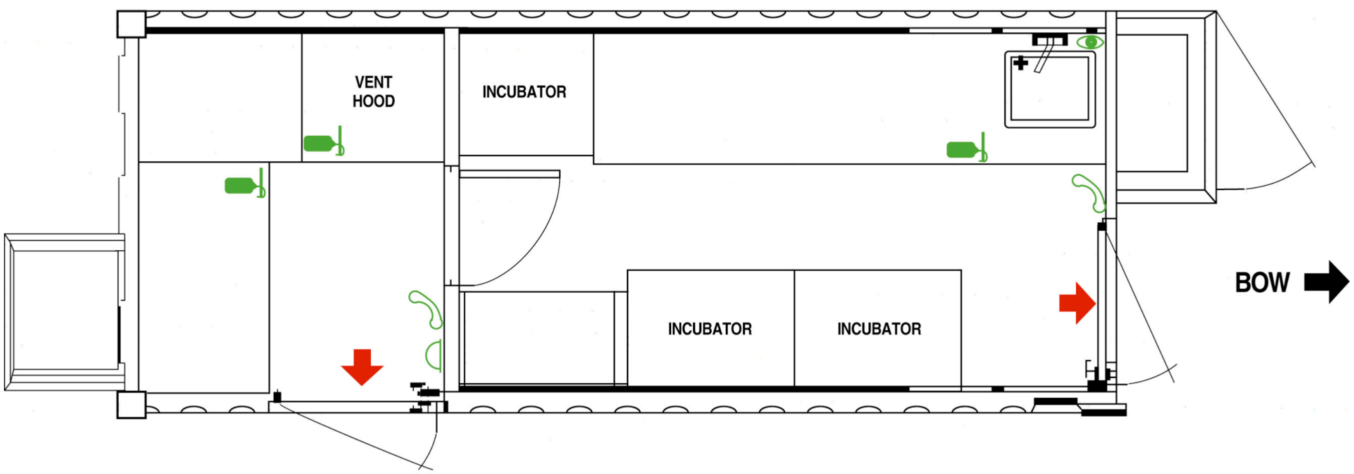


SUB SEA SHOP EMERGENCY PLAN

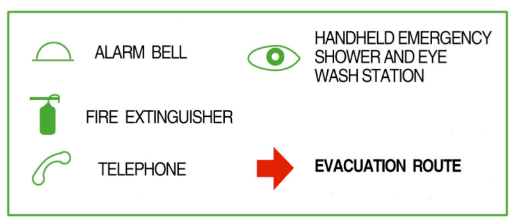
Deck	Area	Hazard	Comments
Core Tech Shop Roof	Radiation Van	Radiation	Bio-tracers
	Engineering Van	Flammable Liquids	Cleaning solutions and lubricants

RADIATION VAN: Special Emergency Response Instructions:

INCUBATOR



MICROBIOLOGY RADIATION VAN
(JUNE 2002)



ENGINEERING VAN: Special Emergency Response Instructions:

NOTE: The engineering van is not presently on the ship. In the event that it is reconfigured, an updated figure will be included in this policy manual.

ATTACHMENT 3: GUIDE TO THE NFPA HAZARD LABEL

While National Fire Protection Agency codes cover several aspects of flammable materials pertinent to MSDS's, perhaps the most significant is the NFPA 704 Hazard Identification ratings system (the familiar NFPA "hazard diamond" shown on the right) for health, flammability, and instability.

<u>Hazard Rating System</u>
What do the numbers on an NFPA fire diamond mean? The diamond is broken into four sections. Numbers in the three colored sections range from 0 (least severe hazard) to 4 (most severe hazard). The blue color refers to health hazard, the red to flammability hazard, the yellow to reactive hazard. The white section is left blank and is used only to denote special fire fighting measures/hazards.

HEALTH HAZARD		
	4	Very short exposure could cause death or serious residual injury even though prompt medical attention was given.
	3	Short exposure could cause serious temporary or residual injury even though prompt medical attention was given.
	2	Intense or continued exposure could cause temporary incapacitation or possible residual injury unless prompt medical attention is given.
	1	Exposure could cause irritation but only minor residual injury even if no treatment is given.
	0	Exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials.

FLAMMABILITY HAZARD		
	4	Will rapidly or completely vaporize at normal pressure and temperature, or is readily dispersed in air and will burn readily.
	3	Liquids and solids that can be ignited under almost all ambient conditions.
	2	Must be moderately heated or exposed to relatively high temperature before ignition can occur.
	1	Must be preheated before ignition can occur.
	0	Materials that will not burn.

REACTIVITY HAZARD		
	4	Readily capable of detonation or of explosive decomposition or reaction at normal temperatures and pressures.
	3	Capable of detonation or explosive reaction, but requires a strong initiating source or must be heated under confinement before initiation, or reacts explosively with water.
	2	Normally unstable and readily undergo violent decomposition but do not detonate. Also, may react violently with water or may form potentially explosive mixtures with water.
	1	Normally stable, but can become unstable at elevated temperatures and pressures or may react with water with some release of energy, but not violently.
	0	Normally stable, even under fire exposure conditions, and are not reactive with water.

SPECIAL HAZARD

This section is used to denote special hazards. One of the most common is unusual reactivity with water. The letter W with a horizontal line through it (as shown on the left) indicates a potential hazard using water to fight a fire involving this material.

Other symbols, abbreviations or words may appear here to indicate unusual hazards. Some examples include the following (not all of which are necessarily part of the NFPA system):

OX	This denotes an oxidizer, a chemical that can greatly increase the rate of combustion or fire.
ACID	This indicates that the material is an acid, a corrosive material that has a pH lower than 7.0
ALK	This denotes an alkaline material, also called a base. These caustic materials have a pH greater than 7.0
COR	This denotes a material that is corrosive (it could be either an acid or a base).
~~W~~	This denotes a material that is not compatible with water (keep dry)
	This is another symbol used for corrosive.
	The skull and crossbones is used to denote a poison or highly toxic material.
	The international symbol for radioactivity is used to denote radioactive hazards; radioactive materials are extremely hazardous when inhaled.
	Indicates an explosive material. This symbol is somewhat redundant because explosives are easily recognized by their Reactivity Rating.

ATTACHMENT 4: EMPLOYEE TRAINING RECORD FORMS

Ocean Drilling Program Hazard Communication Training Record *R/V Joides Resolution*

Name: ________________________

- ☐ Staff, Department: __________________________
- ☐ Visiting Scientist, Institution: __________________________
- ☐ Consultant, Company: __________________________
- ☐ Observer, Country: __________________________

I hereby acknowledge receipt of the Texas A&M University (TAMU) Hazard Communication Program Training, which includes:

GENERAL AND CHEMICAL SAFETY TRAINING

1. Information on interpreting MSDSs and labels, and the relationship between the two methods of hazard communication;
2. General methods of obtaining MSDSs at aboard the *R/V Joides Resolution* and at TAMU;
3. Generic information on hazardous chemicals;
4. Hazards associated with chemical hazard groups (e.g., flammables, corrosives, toxics, and reactives) including acute and chronic effects;
5. Methods for identifying specific chemicals within each chemical hazard group (e.g., DOT labels, NFPA 704 System, chemical container labels);
6. Safe handling procedures, including proper storage and separation of incompatibles;
7. Proper use of appropriate protective equipment to minimize exposure to hazardous chemicals and first aid treatment to be used with respect to the hazardous chemicals;
8. General instructions on spill cleanup procedures and proper disposal of hazardous chemicals.

__________________________________ __________________________

Instructor Name(s) (print) Date

WORK AREA SPECIFIC TRAINING

9. Information on hazardous chemicals known to be present in the employees work area and to which the employees may be exposed, including:
   - Location within the work area
   - Specific hazards, including acute and chronic effects
   - Safe handling procedures

10. Work area location of MSDSs, or procedures for obtaining MSDSs;
11. How to obtain and use appropriate personal protective equipment and first aid treatment to be used with respect to the hazardous chemicals;
12. Instructions on spill cleanup procedures, and proper disposal of hazardous chemical specific to that work area.
13. How to properly use and shut down hazardous equipment (i.e. high pressure systems, powered radiation sources, lifting equipment, etc.)

__________________________________ __________________________

Instructor Name(s) (Print) Date

____

Name (Print)

__________________________________ __________________________

Signature Date

Chemical Specific Training

Only required for personnel working directly with the materials that have acute or chronic toxicity, including mutagens, radioactive materials, and other biohazards. (Attach to the Hazard Communication Record.)

MSDS Name Of Material	Signature+	Supervisor's Signature++

+Your signature indicates that you have read the MSDS and understand the following:

- *Hazards associated with the material*
- *How to use and store the material*
- *How to cleanup laboratory spills*
- *What PPE is needed and how to use it*

++The Supervisor's signature indicates that the trainee has has read the MSDS.

ATTACHMENT 5: VISITING SCIENTIST'S SIGN-OFF FORM

VISITING SCIENTIST'S CERTIFICATION OF LABORATORY TRAINING

Texas A&M University's policy governing hazardous materials (TAMU HAZCom) requires that ODP ensure that all employees and members of the science party working in the laboratories aboard *JOIDES Resolution* have received proper training before working with or in an area containing hazardous chemicals and maintain a record of the training. In accordance with TAMU HAZCom, members of the science party must be provided three levels of training: General, Work Area Specific, and Chemical Specific. Training materials are available on board JOIDES Resolution.

The General Training includes understanding and interpretaion of Material Safety Data Sheets (MSDS) and basic safe handling procedures for hazardous chemicals. For individuals who are not already familiar with the MSDS used in the United States, there is a set of these available on the ship and ODP/TAMU will provide you with appropriate training in their interpretation. Visiting scientists, observers and consultants can sign a statement (below) that they have already received equivalent training from their institution or employer.

Work Area Specific, and Chemical Specific training will be scheduled by the Lab Officer at the beginning of the leg.

GENERAL TRAINING CERTIFICATION

My signature below confirms that I have received basic laboratory training, and that I am familiar with the necessary procedures for safe handling of hazardous materials used in the laboratories on board *JOIDES Resolution*.

Signature:_________________________ Date:________________

Witness:_________________________ Date:________________

ATTACHMENT 6: Hazardous Material Usage Approval Form

Hazardous Material Usage Approval Form

R/V Joides Resolution Ocean Drilling Program, Texas A&&M University

Materials MSDS Name:	
Brand Name:	
Maximum Quantity Of Material Onboard At Any Time:	
Date Material First Stored On Ship:	
Date Material Removed From Ship:	
SIMAN Inventory Number (optional):	

Documents, Training, & Notifications

- ☐ Do we have a Material Safety Data Sheet (MSDS) for this material?
- ☐ Has the MSDS been posted in all work areas where the material is stored and used?
- ☐ Has the MSDS been posted in the Lab Officer's Office? (Electronic version - OK)
- ☐ Has the material been entered into the ODP Hazardous Material Inventory?
- ☐ Has the staff working with the material received specific training per our ODP/TAMU Hazard Communication Program plan?
- ☐ If this material presents a new type of hazard, has the ship's doctor been informed?

If this is a new hazard then the ship's physician must sign off on the following:

I have read the MSDS and have determined that I have the necessary medications, equipment, and tı to stabilize a patient exposure to this material until evacuated to a medical facility.

Ship's Physician's Signature: Date:

Labeling & Safety Equipment

- ☐ Do we have the proper PPE for lab work?
- ☐ Do we have the proper PPE for containing and cleaning up a large spill (total quantity onboard)?
- ☐ Are the containers properly labeled with product name and hazard warning?

Storage, Disposal, & Shipping

- ☐ Do we have the correct storage area?
- ☐ Do we have the proper disposal containers?
- ☐ Does each container have or been tagged with the NFPA diamond?
- ☐ Is the material separated from other non-compatible materials?
- ☐ When the material is used on a sample, does it produce a hazardous waste that will require special disposal considerations in portcall?
- ☐ When the material is used on a sample, will it make the sample a hazardous material that will require special shipping considerations?

MATERIAL APPROIVED FOR USE ABOARD THE R/V JOIDES RESOLUTION

Lab Officer: Date:

Captain: Date:

February, 2002

ATTACHMENT 7: NFPA Hazard Rating Information for various chemicals

Compound	Health	Fire	Reactivity	S/N
Acetal	2	3	0	
Acetaldehyde	2	4	2	
Acetic Acid (glacial)	2	2	2	
Acetic Anhydride	3	2	2	~~W~~
Acetone	1	3	0	
Acetonitrile	2	3	0	
Acetophenone	1	2	0	
Acetyl Chloride	3	3	2	~~W~~
Acetylene	1	4	3	
Acetyl Peroxide	1	2	4	
Acrolein	3	3	2	
Acrolein Dimer	1	2	1	
Acrylic Acid (glacial)	3	2	2	
Acrylonitrile	4	3	2	
Adipic Acid	-	1	0	
Adiponitrile	4	2	0	
Aldol	3	2	1	
Allyl Acetate	1	3	0	
Allyl Alcohol	3	3	0	
Allyl Bromide	3	3	1	
Allyl Chloride	3	3	1	
Aluminum (dust or powder)	0	1	1	
3-Aminopropanol	3	2	0	
Ammonia, Anhydrous	3	1	0	
Ammonium Bromide	2	0	0	
Ammonium Chloride	2	0	0	
Ammonium Fluoride	3	0	0	
Ammonium Nitrate	2	0	3	OX
Ammonium Perchlorate	2	0	4	OX
Ammonium Permanganate	2	0	3	OX
Ammonium Sulfate	3	0	0	
Amyl Acetate	1	3	0	
Amyl Alcohol	1	3	0	
Amylamine	3	3	0	
Amylbenzene	1	2	0	
Amyl Chloride	1	3	0	
Amyl Ether	1	2	0	
Amyl Maleate	0	1	0	
Amyl Nitrate	2	2	0	OX
o-Amyl Phenol	2	1	0	
Amyl Propionate	0	2	0	
Amyl Stearate	0	1	0	
Amyl Toluene	2	2	0	
Aniline	3	2	0	
o-Anisidine	2	1	0	
Anisole	1	2	0	
Antimony Pentafluoride	3	0	1	
Antimony Pentasulfide	3	1	1	
Arsenic Chloride	3	0	0	
Arsenic Trisulfide	3	1	0	

Compound	Health	Fire	Reactivity	S/N
Barium Chlorate	1	0	2	OX
Barium Nitrate	1	0	0	OX
Barium Peroxide	1	0	0	OX
Benzaldehyde	2	2	0	
Benzoic Acid	2	1	-	
Benzol (benzene)	2	3	0	
Benzotrifluoride	4	3	0	
Benzoyl Chloride	3	2	1	~~W~~
Benzyl Acetate	1	1	0	
Benzyl Alcohol	2	1	0	
Benzyl Cyanide	2	1	0	
Benzyl Salicilate	1	1	0	
Beryllium (dust or powder)	4	1	0	
Biphenyl	2	1	0	
Boron Trifluoride	3	0	1	
Bromine	4	0	0	OX
Bromine Trifluoride	4	0	3	OX, ~~W~~
Bromobenzene	2	2	0	
o-Bromotoluene	2	2	0	
Butadiene Monoxide	2	3	2	
Butane	1	4	0	
1-Butane	1	4	0	
Butenediol	1	1	0	
Butyl Acetate	1	3	0	
Butyl Acetoacetate	1	2	0	
Butyl Acrylate	2	2	2	
Butyl Alcohol	1	3	0	
Butylamine	2	3	0	
Butylamine Oleate	3	2	0	
Butylbenzene	2	2	0	
Butyl Benzoate	1	1	0	
Butyl Bromide	2	3	0	
Butyl Chloride	2	3	0	
Butylcyclohexane	0	-	0	
Butyldecalin	1	1	0	
Butyl Formate	2	3	0	
N-Butyl Isocyanate	3	2	2	
Butyl Isovalerate	0	-	-	
Butyl Lactate	1	2	0	
Butyl Methacrylate	2	2	0	
Butyl Naphthalene	1	1	0	
Butyl Nitrate	1	3	3	
Butyl Oxalate	0	1	0	
Butyl Propionate	2	3	0	
Butyl Stearate	1	1	0	
Butyl Trichlorosilane	2	2	0	
Butyraldehyde	2	3	0	
Butyraldol	2	2	0	
Butyraldoxime	2	2	0	
Butyric Acid	2	2	0	
Calcium Carbide	1	4	2	~~W~~

Compound	Health	Fire	Reactivity	S/N
Calcium Chlorate	2	0	2	OX
Calcium Cyanide	3	0	0	
Calcium Hypochlorite	2	0	2	OX
Calcium Oxide	1	0	1	
Camphor	0	2	0	
Caproic Acid	2	1	0	
Capryladehyde	2	2	0	
Caprylyl Chloride	3	2	1	
Carbon Disulfide	2	3	0	
Carbon Monoxide	2	4	0	
Carbon Tetrachloride	3	0	0	
Castor Oil	0	1	0	
Chlorine	3	0	0	OX
Chlorine Monoxide	3	4	3	
Chloroacetic Acid	3	1	0	
Chloroaceto Phenone	2	1	0	
Chlorobenzene	2	3	0	
Chloroform	2	0	0	
Chloropicrin	4	0	3	
Chlorotoluene	2	2	0	
Chromic Acid	3	0	1	OX
Citral	0	2	0	
Cobalt Naphtha	1	2	0	
Coconut Oil	0	1	0	
Cod Liver Oil	0	1	0	
Corn Oil	0	1	0	
Creosote Oil	2	2	0	
o-Cresol	3	2	0	
Crotonaldehyde	3	3	2	
Crotonic Acid	3	2	0	
Crotononitrile	-	1	0	
Cumene	2	3	0	
Cupric Nitrate	1	0	0	OX
Cyanogen	4	4	2	
Cyanogen Bromide	3	0	2	
Cyclobutane	1	4	0	
Cyclohexane	1	3	0	
Cyclohexanol	1	2	0	
Cyclohexanone	1	2	0	
Cyclohexene	1	3	0	
Cyclohexenone	1	3	0	
Cyclohexyl Chloride	2	3	0	
Cyclopentane	1	3	0	
Cyclopentene	1	3	1	
Cyclopentanone	2	3	0	
Cyclopropane	1	4	0	
Decaborane	3	2	1	
Decane	0	2	0	
Decanol	0	2	0	
1-Decene	0	2	0	
Decylamine	2	1	0	

Compound	Health	Fire	Reactivity	S/N
Dehydroacetic Acid	1	1	0	
Denatured Alcohol	0	3	0	
Deuterium	0	4	0	
Diacetone Alcohol	1	2	0	
Diamyl Sulfide	2	2	0	
Dibenzoyl Peroxide	1	4	4	OX
Diborane	3	4	3	~~W~~
Dibutylamine	3	2	0	
Dibutyl Ether	2	3	0	
Dibutyl Oxalate	0	1	0	
Dibutyl Phosphite	3	2	0	
Dibutyl Phthalate	0	1	0	
o-Dichlorobenzene	2	2	0	
1,2-Dichlorobutane	2	2	0	
1,1-Dichloroethene	2	4	2	
1,2-Dichloroethylene	2	3	2	
Dichlorosilane	3	4	2	
Didecyl Ether	0	1	0	
Diesel Fuel Oil No. 1	0	2	0	
Diethylamine	2	3	0	
Diethylene Glycol Dimethyl Ether	1	2	1	
Diethylene Triamine	3	1	0	
Diethyl Fumarate	1	1	0	
Diethyl Ketone	1	3	0	
Diethyl Succinate	1	1	0	
Diethyl Sulfate	3	1	1	
Diethylzinc	0	3	3	~~W~~
Dihexylamne	2	1	0	
Diisobutylamine	3	3	0	
Diisobutyl Carbinol	1	2	0	
Diisobutyl Ketone	1	2	0	
Diisooctyl Phthalate	0	1	0	
Diisopropylamine	3	3	0	
Diisopropyl Benzene	0	2	0	
Diketene	2	2	2	
Dimethylamine	3	4	0	
N, N-Dimethylaniline	3	2	0	
2,2-Dimethylbutane	1	3	0	
Dimethyldioxane	2	3	0	
N, N-Dimethylformamide	1	2	0	
Dimethyl Maleate	1	1	0	
2,3-Dimethyloctane	0	2	0	
2,3-Dimethylpentane	0	3	0	
Dimethyl Phthalate	0	1	0	
Dimethyl Sulfate	4	2	0	
dimethyl Sulfide	2	4	0	
Dimethyl Sulfoxide	1	1	0	
Dinitrobenzene (ortho)	3	1	4	
2,4-Dinitrotoluene	3	1	3	
Dioctyl Ether	0	1	0	
p-Dioxane	2	3	1	

Compound	Health	Fire	Reactivity	S/N
Dioxolane	2	3	2	
Dipentene	0	2	0	
Diphenylamine	3	1	0	
Diphenyl Phthalate	0	1	0	
Dipropylamine	3	3	0	
Divinylbenzene	2	2	2	
Divinyl Ether	2	3	2	
Dodecane	0	2	0	
1-Dodecanethiol	2	1	0	
1-Dodecanol	0	1	0	
Endrin (dry)	2	0	0	
Epichlorohydrin	3	2	1	
Ethane	1	4	0	
Ethanolamine	2	2	0	
Ethoxybenzene	0	2	0	
3-Ethoxypropanal	2	2	0	
Ethyl Acetate	1	3	0	
Ethyl Acrylate	2	3	2	
Ethyl Alcohol	0	3	0	
Ethylamine	3	4	0	
Ethylbenzene	2	3	0	
Ethyl Benzoate	1	1	0	
Ethyl Borate	2	3	0	
Ethyl Bromide	2	1	0	
Ethylbutylamine	3	3	0	
Ethyl Butyl Carbonate	2	2	1	
Ethyl Butyl Ketone	1	2	0	
Ethyl Butyrate	0	3	0	
Ethyl Caprylate	2	2	0	
Ethyl Chloride	2	4	0	
Ethyl Crotonate	2	3	0	
Ethylcyclohexane	1	3	0	
Ethylene	1	4	2	
Ethylenediamine	3	2	0	
Ethylene Dichloride	2	3	0	
Ethylene Glycol	1	1	0	
Ethylene Glycol Dibutyl Ether	1	2	0	
Ethylene Glycol Ethylbutyl Ether	1	2	0	
Ethylene Glycol Monobutyl Ether Acetate	1	2	0	
Ethylene Oxide	2	4	3	
Ethyl Ether	2	4	1	
Ethyl Formate	2	3	0	
Ethyl Isobutyrate	0	3	0	
Ethyl Mercaptan	2	4	0	
4-Ethylmorpholine	2	3	0	
Ethyl Nitrate	2	3	4	
Ethyl Oxalate	0	2	0	
Ethyl Propionate	-	3	0	
Ethyl Silicate	2	2	0	
Fluorine	4	0	3	~~W~~, OX
Formaldehyde (water solution)	2	2	0	

Compound	Health	Fire	Reactivity	S/N
Formamide	2	1	-	
Formic Acid	3	2	0	
Furan	1	4	1	
Furfuryl Alcohol	1	2	1	
Gas, Natural	1	4	0	
Gasoline 56-100 Octane	1	3	0	
Glycerine	1	1	0	
Glycidyl Acrylate	0	2	0	
Heptane	1	3	0	
2-Heptanol	0	2	0	
Heptylene	0	3	0	
Hexadecane	0	1	0	
Hexanal	2	3	1	
Hexane	1	3	0	
3-Hexanone	1	3	0	
1-Hexene	1	3	0	
Hexyl Alcohol	1	2	0	
Hexyl Methacrylate	0	2	0	
Hydrazine (Anhydrous)	3	3	2	
Hydrocyanic Acid-96%	4	4	2	
Hydrogen	0	4	0	
Hydrochloric Acid	3	0	0	
Hydrobromic Acid	3	0	0	
Hydrofluoric Acid	4	0	0	
Hydrogen Peroxide (35% to 52% by weight)	2	0	1	OX
Hydrogen Sulfide	3	4	0	
Hydroquinone	2	1	0	
Isoamyl Acetate	1	3	0	
Isoamyl Alcohol	1	2	0	
Isobutane	1	4	0	
Isobutyl Acetate	1	3	0	
Isobutyl Acrylate	1	3	1	
Isobutyl Alcohol	1	3	0	
Isobutylbenzene	2	2	0	
Isobutyl Chloride	2	3	0	
Isobutyl Methyl Ketone	2	3	0	
Isobutyraldehyde	2	3	1	
Isobutyric Acid	1	2	0	
Isobutyric Anhydride	1	2	1	~~W~~
Isodecaldehyde	0	2	0	
Isodecanoic Acid	0	1	0	
Isohexane	1	3	0	
Isooctane	0	3	0	
Isooctanoic Acid	0	1	0	
Isooctyl Alcohol	0	2	0	
Isopentane	1	4	0	
Isophorone	2	2	0	
Isoprene	2	4	2	
Isopropyl Acetate	1	3	0	
Isopropyl Alcohol	1	3	0	

Compound	Health	Fire	Reactivity	S/N
Isopropyl Chloride	2	4	0	
Isopropyl Ether	2	3	1	
Jet Fuels (JP-4)	1	3	0	
Jet Fuels (JP-5)	0	2	0	
Lanolin	0	1	0	
Lead Arsenates	2	0	0	
Lead Nitrate	1	0	0	OX
Lead Thiocyanate	1	1	1	
Lithium	1	1	2	~~W~~
Lithium Hydride	3	4	2	~~W~~
Lubricating Oil, Mineral	0	1	0	
Magnesium (including all alloys)	0	1	2	~~W~~
Magnesium Nitrate	1	0	0	OX
Magnesium Perchlorate	1	0	0	OX
Maleic Anhydride	3	1	1	
Mercuric Cyanide	3	0	0	
Mesityl Oxide	3	3	0	
Methacrylic Acid	3	2	2	
Methane	1	4	0	
Methyl Acetate	1	3	0	
Methyl Acrylate	2	3	2	
Methylal	2	3	2	
Methyl Alcohol	1	3	0	
Methylamine	3	4	0	
Methyl Amyl Ketone	1	2	0	
Methyl Benzoate	0	2	0	
Methyl Borate	2	3	1	
Methyl Bromide	3	1	0	
Methyl Butyl Ketone	2	3	0	
Methyl Carbonate	2	3	1	
Methyl Cellosolve Acetate	0	2	0	
Methyl Chloride	2	4	0	
Methyl Chloroacetate	2	2	1	
Methylcyclohexane	2	3	0	
Methylcyclohexanone	-	2	0	
Methylcyclopentane	2	3	0	
Methylene Chloride	3	1	1	
Methylene Diisocyanate	1	2	1	~~W~~
Methyl Ether	2	4	1	
Methyl Ethyl Ether	2	4	1	
Methyl Ethyl Ketone	1	3	0	
Methyl Formate	2	4	0	
Methyl Glycol Acetate	1	2	0	
Methyl Hexyl Ketone	0	2	0	
Methylhydrazine	3	3	2	
Methyl Isoamyl Ketone	1	2	0	
Methyl Isobutyl Carbinol	2	2	0	
Methyl Isobutyl Ketone	2	3	0	
Methyl Isocyanate	2	3	3	~~W~~
Methyl Lactate	1	2	0	

Compound	Health	Fire	Reactivity	S/N
Methyl Mercaptan	2	4	0	
Methyl Methacrylate	2	3	2	
Methyl Parathion (solid)	4	1	2	
2-Methyl-1-Pentene	1	3	0	
Methyl Phenylacetate	0	2	0	
1-Methyl Piperazine	2	2	0	
Methyl Propionate	1	3	0	
Methyl Propyl Ketone	2	3	0	
2-Methylpyrazine	2	2	0	
Methylpyrrole	2	3	1	
Methylpyrrolidine	2	3	1	
Methyl Salicylate	1	1	0	
Methyl Stearate	0	1	0	
Methyl Toluene Sulfonate	2	1	0	
Methyl Vinyl Ketone	3	3	2	
Mineral Oil	0	1	0	
Mineral Spirits	0	2	0	
Morpholine	2	3	0	
Mustard Oil	3	2	0	
Naptha	1	3	0	
Napthalene	2	2	0	
Nickel Carbonyl	4	3	3	
Nicotine	4	1	0	
Nitric Acid	3	0	0	OX
p-Nitroaniline	3	1	3	
Nitrobenzene	3	2	0	
Nitrobiphenyl	2	1	0	
Nitrochlorobenzene	3	1	1	
Nitroethane	1	3	3	
Nitrogen (liquified)	3	0	0	
Nitrogen Peroxide	3	0	0	OX
Nitrogen Trioxide	3	0	0	OX
Nitroglycerine	2	2	4	
Nitromethane	1	3	3	
1-Nitropropane	1	3	1	
o-Nitrotoluene	2	1	4	
Nonadecane	0	1	0	
Nonane	0	3	0	
Nonene	0	3	0	
Nonylbenzene	0	1	0	
Octadecane	0	1	0	
Octane	0	3	0	
2-Octanol	1	2	0	
1-Octene	1	3	0	
Oleic Acid	0	1	0	
Olive Oil	0	1	0	
Oxalic Acid	2	1	0	
Oxygen (liquid)	3	0	0	OX
Paraffin Oil	0	1	0	
Paraformaldehyde	2	1	0	
Paraldehyde	2	3	1	

Compound	Health	Fire	Reactivity	S/N
Parathion	4	1	2	
Pentaborane	3	3	2	
Pentachlorophenol (dry)	3	0	0	
Pentane	1	4	0	
Pentanoic acid	2	1	0	
Pentaphen	2	1	0	
1-Pentene	1	4	0	
Perchloric Acid	3	0	3	OX
Perchloroethylene	2	0	0	
Petroleum, Crude	1	3	0	
Petroleum Ether	1	4	0	
Phenol	3	2	0	
Phenylacetaldehyde	1	2	0	
Phenyl Acetate	1	2	0	
Phenylacetic Acid	1	1	0	
o-Phenylenediamine	-	1	0	
Phenylhydrazine	3	2	0	
Phenylpropyl Alcohol	0	1	0	
Phosgene	4	0	0	
Phosphine	3	4	1	
Phosphoric Acid	2	0	0	
Phosphorus Pentasulfide	3	1	2	~~W~~
Phosphorus, Red	0	1	1	
Phosphorus Trichloride	3	0	2	~~W~~
Phosphorus, White or Yellow	3	3	1	
Phosphoryl Chloride	3	0	2	~~W~~
Phthalic Acid	0	1	1	
Phthalic Anhydride	2	1	0	
Picric Acid	2	4	4	
Pine Oil	0	2	0	
Pine Tar	0	2	0	
Piperazine	2	2	0	
Piperidine	2	3	3	
Potassium	3	1	2	~~W~~
Potassium Bromate	1	0	0	OX
Potassium Chlorate	2	0	0	OX
Potassium Cyanide	3	0	0	
Potassium Hydroxide (lye)	3	0	1	
Potassium Nitrate	1	0	0	OX
Potassium Permanganate	1	0	0	OX
Potassium Peroxide	3	0	2	~~W~~, OX
Potassium Persulfate	1	0	0	OX
Potassium Sulfide	2	1	0	
Propane	1	4	0	
Propionic Acid	2	2	0	
Propionyl Chloride	3	3	1	
Propyl Acetate	1	3	0	
Propyl Alcohol	1	3	0	
Propylamine	3	3	0	
Propyl Chloride	2	3	0	
Propylene	1	4	1	

Compound	Health	Fire	Reactivity	S/N
Propylene Dichloride	2	3	0	
Propylene glycol	0	1	0	
Propylene Oxide	2	4	2	
n-Propyl Ether	-	3	0	
Propyl Nitrate	2	4	3	OX
Pyridine	2	3	0	
Pyrrole	2	2	0	
Pyrrolidine	2	3	1	
Quinoline	2	1	0	
Resorcinol	-	1	0	
Rhodinol	0	1	0	
Salicylic Acid	0	1	0	
Silane	1	4	2	
Silver Nitrate	1	0	0	OX
Sodium	3	1	2	~~W~~
Sodium Chlorate	1	0	2	OX
Sodium Chlorite	1	1	2	OX
Sodium Cyanide	3	0	0	
Sodium Fluoride	2	0	0	
Sodium Hydride	3	3	2	~~W~~
Sodium Hydroxide (lye)	3	0	1	
Sodium Nitrate	1	0	0	OX
Sodium Perchlorate	2	0	2	OX
Sodium Peroxide	3	0	2	OX, ~~W~~
Sodium-Potassium Alloys	3	3	2	~~W~~
Sodium Sulfide	2	1	0	
Stannic Chloride	3	0	1	
Stearic Acid	1	1	0	
Stearyl Alcohol	0	-	0	
Stoddard Solvent	0	2	0	
Styrene	2	3	2	
Sulfur	2	1	0	
Sulfur Chloride	2	1	2	~~W~~
Sulfur Dioxide	2	0	0	
Sulfuric Acid	3	0	2	~~W~~
Tannic Acid	0	1	0	
Terephthaloyl Chloride	3	1	0	
Tetrachlorobenzene	0	10	0	
Tetrachloroethylene	2	0	0	
Tetradecanol	0	1	0	
Tetraethylene Glycol	1	1	0	
Tetraethyl Lead, Compounds	3	2	3	
Tetrafluoroethylene	3	4	3	
Tetrahydrofuran	2	3	1	
Tetramethyl Lead, Compounds	3	3	3	
Thionyl Chloride	3	0	2	~~W~~
Thiophene	2	3	0	
Titanium Tetrachloride	3	0	1	
Toluene	2	3	0	
Toluene-2,4-Diisocyanate	3	1	1	
o-Toluidine	3	2	0	

Compound	Health	Fire	Reactivity	S/N
Triamylamine	2	1	0	
Triamylbenzene	0	1	0	
Tributylamine	2	2	0	
Tributyl Phosphate	2	1	0	
Tributylphosphine	0	1	0	
Tributyl Phosphite	2	1	1	
1,1,1-Trichloroethane	2	1	0	
Trichloroethylene	2	1	0	
Trichloroethylsilane	3	3	0	
Trichlorosilane	3	4	2	~~W~~
Triethanolamine	2	1	1	
Triethylamine	2	3	0	
Triethyl Phosphate	0	1	1	
Triisobutyl Borate	3	2	1	
Trimethylamine	2	4	0	
Trimethylchlorosilane	3	3	2	~~W~~
Trinitrobenzene	2	4	4	
Trinitrotoluene (tnt)	2	4	4	
Trioxane	2	2	0	
Triphenylmethane	0	1	0	
Tripropylene	0	3	0	
Tripropylene Glycol	0	1	0	
Turpentine	1	3	0	
2-Undecanol	1	1	0	
Valeraldehyde	1	3	0	
Vanadium Tetrachloride	3	0	2	~~W~~
Vinyl Acetate	2	3	2	
Vinyl Bromide	2	0	1	
Vinyl Butyl Ether	2	3	2	
Vinyl Chloride	2	4	1	
Vinyl Crotonate	2	3	2	
Vinyl Ethyl Alcohol	0	2	0	
Vinyl Ethyl Ether	2	4	2	
Vinyl Fluoride	1	4	2	
Vinylidene Chloride	2	4	2	
Vinylidene fluoride	1	4	2	
Vinyl Methyl Ether	2	4	2	
Vinyl Propionate	2	3	2	
Vinyl Toluene	2	2	1	
o-Xylene	2	3	0	
o-Xylidine	3	1	0	
Zinc (powder or dust)	0	1	1	
Zinc Chlorate	2	0	2	OX
Zirconium Tetrachloride	3	0	1	

ATTACHMENT 8: INSTRUCTIONS FOR USE OF CLEAN-UP KITS

INSTRUCTIONS FOR USE OF ACIDS CLEAN-UP KITS

There are two types of kits for the neutralization and absorption of an acid spill: Baker Liquid "Neutrasol" Kit and Fisher S-104 Neutralizer/Absorber Kit.

Baker Liquid "Neutrasol"Kit:
These are the 2.5-gallon plastic jugs containing the blue liquid. The 2.5-gallon jug should neutralize 2.5 litres of acid. Concentrated sulfuric acid will be 94% neutralized.

This liquid should not be used on oxidizing acids such as fuming nitric.

1) If acid concentration is over 50%, dilute with water.
2) Apply liquid around perimeter of the spill.
3) Gradually mix neutralizer with acid. Foaming and a color change from blue to pink are indicators that neutralization has started.
4) Add more neutralizer as needed until mixture retains blue color.
5) Clean up blue liquid with shop-vac or by using clay absorbent. Dispose of neutralized acid and/or clay in plastic sacks.
6) Wash spill area thoroughly. Clean shop-vac and any other tools used.

Fisher S-104 Neutralizer/Absorber Kit:
Located in a large cardboard barrel outlined with green paint. Use scoops included in the barrel. Seven scoops of neutralizer will neutralize 4 pints 38% HCl; 1.5 pints 98% H_2SO_4; 1 pint 85% H_3PO_4.

1) Sprinkle contents around (thereby containing the spill) and into spill.
2) Thoroughly mix powder with spill until color change of pink to blue occurs.
3) In order to aid the neutralization, water may be added to the slurry.
4) Continue adding powder (and water) to the spill, if needed.
5) Scoop up mixture and place in plastic bags.
6) Dispose of mixture properly.
7) Clean scoop and return to barrel.
8) Wash spill area.

INSTRUCTIONS FOR USE OF ALKALIS CLEAN-UP KITS

There are two types of kits for the neutralization and absorption of an alkalis spill: Baker Neutracit-2 kit (blue box) and Fisher S-105 kit.

Baker Neutracit-2 Kit:

1) Using scoop in box, apply powder around and into liquid spill containingthe spill.
2) If liquid concentration is greater than 40%, add cold water to dilute.
3) A yellow to blue color change indicates spill is still caustic.
4) If absorption rate seems slow, add cold water.
5) Mix slurry until yellow or yellow-green.
6) Add more mix (or water) as needed.
7) Pick up and dispose of slurry.
8) Clean spill area thoroughly.
9) Clean scoop and return to barrel.

Fisher S-105 Kit:

1) Dilute liquid alkali spills (over 50% concentration) with equal parts water.
2) Sprinkle contents of S-105A (box inside barrel) around and into spill, containing the spill if possible.
3) Add cold water to control heat, if necessary.
4) Color change of slurry from blue to pink indicates neutralization.
5) Add more neutralizer as needed.
6) Absorb liquid with clay absorbent (S-105B) in barrel.
7) Dispose of absorbent.
8) Clean area thoroughly.

INSTRUCTIONS FOR USE OF FLAMMABLE SOLVENTS CLEAN-UP KITS

There is one kit for the absorption of an flammable solvent spill: **Fisher S-106** Kit.

The flammable solvents that can be cleaned by this kit include, but are not limited to, Acetone, Alcohols, Decane, and Hexane. Seven scoops (scoop located in barrel) of this material will absorb 1 pint of solvent.

NOTE: Do not use paper towels or rags to mop up a flammable spill as this can speed the evaporation of the material and thereby increase the potential hazard.

1) Identify type of solvent and estimated volume.
2) Sprinkle contents of barrel around and into spill.
3) Mix thoroughly until liquid is completely absorbed, adding more absorbent until area is dry.
4) Scoop up dry mixture.
5) Dispose of mixture.
6) Clean tools and return to box.

Amendments