

**COLLEGE OF MARINE & EARTH STUDIES**

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**R/V HUGH R. SHARP**

**Shipboard Chemical  
Hygiene Manual**

R/V HUGH R. SHARP

# Chemical Hygiene Manual

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This manual was assembled using the UNOLS Safety Manual  
([http://www.unols.org/publications/manuals/saf\\_stand/contents.htm](http://www.unols.org/publications/manuals/saf_stand/contents.htm))  
and  
the University of Delaware Chemical Hygiene manual  
(<http://www.udel.edu/OHS/chemhygieneplan.pdf>).

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# General Shipboard Safety

## RESPONSIBILITY

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The following explains the levels of responsibility for science research conducted aboard the R/V HUGH R. SHARP.

### **Captain:**

The Captain is ultimately legally responsible for safe operation of the research vessel. This means the Captain has the final word on all matters aboard the research vessel.

### **Chief Scientist:**

The Chief Scientist is responsible for the safe conduct of all science operation aboard the research vessel.

### **Technician:**

The Technician is responsible in assisting both the Captain and the Chief Scientist in the safe science operation aboard the research vessel.

### **Science Party:**

The Science Party is responsible to conduct all science operation safely aboard the research vessel.

### **Crew Members:**

The Crew Members are responsible in assisting the Science Party to conduct all science operation safely aboard the research vessel.

DEFINITIONS

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**Chemical Daily Amount** – This is defined as the normal amount of a specific chemical, which is needed to process a days worth of samples. It is recommended that the amount does not exceed a liter.

**Cruise MSDS booklet** – This is a booklet of MSDS for each of the chemicals currently aboard for scientific use.

**Labs** – This includes the ship's dry lab, ship's wet lab, and any lab van placed on the ship for science proposes.

**Master Scientific MSDS booklet** – This is a booklet of commonly and currently used science chemical kept on the bridge.

## GENERAL SAFETY

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**Right to know:**

It is the chief scientist responsibility to ensure that each member of the science party as been advised and trained about the Right to Know. If requested, the chief scientist must be able to provide this information in a timely fashion. Refer to University of Delaware Chemical Hygiene Plan section 4.3

**Science Safety Training:**

It is the chief scientist task to make sure the each member of the science party has been advised and trained about the safety for his or her discipline. The chief scientist should also brief the science party on other safety issues pertaining to other disciplines participating on the cruise.

**Food & Drink:**

No food or drink is allowed in the Lab areas. This includes all types of cruise operations (chemical or physical).

## MSDS AND LABELS

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**MSDS Booklets:**

It is the technician's task to work with the chief scientist or delegated science personal to assemble a current MSDS booklet for each cruise. Two copies of this booklet called the "Cruise MSDS booklet" in hard copy shall be assembled. One copy will be stored for the duration of the cruise at the forward entrance of the dry lab in the hallway. A second copy will be stored for the duration of the cruise at the aft entrance of the dry lab, in the van vestibule. It is the technician's responsibility to check the cruise MSDS booklet against the master science MSDS booklet kept on the bridge. It is the technician's responsibility to update the booklet with updated information on a yearly basis or when there is a discrepancy between this booklet and the cruise MSDS booklet.

**Chemical Lists:**

It is the technician's responsibility to assemble chemical lists and place them at the proper entry locations for each lab.

**Labels:**

It is the Chief Scientist task to ensure all that all chemical containers are properly marked to ensure their safe usage. As a minimum, the label should meet OSHA labeling regulations.

## CHEMICAL HANDLING

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### **Daily Usage:**

The Chief Scientist and Science Party shall restrict chemicals in the labs to a daily amount. When these chemicals are not in direct use they will be secured from spillage and breakage due to ship's motion or accident.

### **Pouring Chemicals:**

The Chief Scientist and Science Party shall use extra precautions when pouring quantities of chemicals from storage containers to daily (lab) containers. It is recommended that where appropriate funnels and secondary catch containers be used. Ship's motion must be considered to ensure the safety of personal and ship.

### **Transporting Chemicals from Lab to Lab:**

The Chief Scientist and Scientist Party shall use extra precautions when transporting chemicals from lab to lab and chemical storage areas to labs. Ship's motion must be considered to ensure there is no spillage during transporting. Where appropriate, a secondary transporting container should be used to move daily chemical containers. The secondary containers should provide some method of securing the daily amount container so it does not slide around in the secondary catch container.

### **Contamination Concerns:**

Because of sensitivity of many samples for trace analyses, precautions must be taken in chemical and sample handling and storage. There are several categories of potential contaminant problems.

Preservatives or fixatives used for biological specimens (e.g., paraformaldehyde) are especially of concern because of their pervasive nature that jeopardizes living biological materials and can present major contamination for low level organic samples. These preservatives often have long-lived residual impact; they can permeate wood and plastics and once exposure takes place, removal is very difficult. Volatile organic chemicals, like acetone and alcohols, can also present immediate contamination problems with low level organic analyses. However, most of these solvents are rapidly dispersed and do not have the residual effect of aldehydes that are found in preservatives.

A second concern is biological materials, especially larger organisms like fish, benthic animals, and concentrated plankton samples. Both alive and dead, they can create problems with low level organic and with ammonium-N sample analyses. Sediment samples also pose a similar risk. These materials also have a long-lived residual contaminant nature.

Metals and rust can cause problems with trace metal analyses.

For natural abundance analyses of radioisotopes and stable isotopes, experiments using tagging with radioactive or stable isotope materials present a serious contamination problem that also can be very



## CHEMICAL HANDLING (CONT.)

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long-lived. All of these chemical contaminant problems can be minimized with proper isolation and separation.

**Additional Information:**

Additional helpful information for safe handling and general safety guidelines can be found in the University of Delaware Chemicals Hygiene Manual section 9.

## CHEMICAL STORAGE

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There are three areas for chemical storage aboard the R/V HUGH R. SHARP. The acids and bases lockers are located just outside the van vestibule (aft of the dry lab) on the port side. The organic solvent locker is located in the van vestibule (aft of the dry lab). All three areas are vented. All three areas are to be kept locked at all times, and chemicals must be placed in the appropriate locker. The technician will provide access to the keys. Chemical containers should be of proper design for the material stored. Glass should be avoided. If glass is used it should be of the PVC design. Many manufacturers sell chemicals in glass with safety coat on the glass prevent breakage.

## CHEMICAL SPILL

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**Intent:**

The primary intent of this policy is to ensure a safe lab-working environment for the science groups using the R/V HUGH R. SHARP.

**Responsibility:**

Any chemical spill action shall be brought to the Captain's attention, as soon as possible. The Captain shall decide a course of action and designate the proper personal (typically the Chief Scientist and the Ship Board Technician) to address the issue. The Captain shall make proper notations involving the spill, in the ship's logbook.

**Supplies:**

Supplies for a chemical spill kits shall be located in the dry lab as deemed appropriate by the Captain and Coordinator of Technical Services. Any specialized chemical cleanup materials are the responsibility of the Chief Scientist.

**Procedure:**

Procedures for chemical cleanup shall be provided by the P.I. or shore based safety personal. (See emergency phone numbers in the University of Delaware Chemical Hygiene Manual of helpful phone numbers and section 24 for additional helpful information).

## CHEMICAL WASTE

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Chemical waste materials (both liquid waste and solid waste) generated during a cruise must be kept there until the end of the cruise when it can be removed. At the end of the cruise the chief scientist and science party will remove all materials, chemicals, wastes and samples. It is the Chief Scientist's task to ensure the chemical waste is properly secured and protocol is followed. It is the technician's task to assist the science party. See the University of Delaware Chemical Hygiene Manual section 23 for additional helpful information.

## PERSONAL PROTECTIVE EQUIPMENT

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**Eye:**

All operations, which present any hazard to eyesight, whether chemical, mechanical or other, requires that safety eye protection appropriate for the type of hazard be worn. Disposable safety eyeglass protection is available in the dry lab.

**Coats:**

Although lab coats are not required, they are strongly recommended. The risk of accidental spillage is greater on a moving platform such as a ship, then in a land-based lab.

**Footwear:**

Proper footwear is required at all times. In the labs closed toe shoes are required. No sandals are permitted in the labs.

For deck work, steel tipped shoes or boots are recommended.

**Food & Drink:**

No food or drink is allowed in the Lab areas. This includes all types of cruise operations (chemical or physical).

## Lab Equipment

### LAB BENCHES

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The R/V HUGH R. SHARP provides laboratory benches for use in both the ship's labs and vans. There are two basic sizes to the laboratory benches, 48" x 30" and 48" x 22". These benches are also modular in manner. This allows for customized laboratory spaces. The bench tops are made of sealed wooden tops. They can be screwed into or drilled as needed for securing science equipment to prevent motion due to ship's motion. The types of laboratory benches are listed below.

1. Standard 48" x 30" bench with bench top only. This provides a working top with storage below.
2. Narrow 48" x 22" bench with bench top only. As above, usable in pathway area where more walking room is needed.
3. Standard 48" x 30" bench with bench top and storage draws.
4. Standard 48" x 30" bench with bench top and standard sink. Provides hot, cold, and seawater.
5. Standard 48" x 30" bench with bench top and deep sink. Provided hot, cold, and seawater, with large volume deep sink.
6. Narrow 48" x 22" bench with bench top, small sink and seawater pumps. This contains two diaphragm pumps. One for standard use, the other for trace metal clean use.
7. Narrow 48" x 22" bench with bench top and chemical storage. This provides additional chemical storage for large volume or seldom used daily chemical supplies (see University of Delaware Chemical Hygiene Manual section 9.1.2).

## F U M E   H O O D S

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Fume hoods should be utilized as engineering controls when using flammable solvents, toxic gases and chemicals, reproductive toxins, or known or suspected carcinogens. Fume hoods should be used as follows:

- Experiments should be set up six inches behind the sash. Set-up should allow a maximum flow of air across the deck surface. It may be necessary to elevate large, bulky equipment on blocks to allow flow under the equipment and into the rear exhaust slot.
- To increase the capture of fumes, limit pedestrian traffic, limit operator body movement, and lower the sash to the designated height or as far as practical.
- Refer to the yellow sticker for certification of velocity to ascertain whether the hood will meet the face velocity needs of the procedure. Check the label on the hood to confirm that the fume hood is working.
- The best ventilating efficiency is attained with the hood sash set at the 100 cfm calibration arrow.
- The operating condition of a hood should be determined before the hood is put to use; be certain that the labels shows a positive reading and current inspection date before the hood is used. If the hood is not operational, close the hood sash and notify the Captain and Shipboard technician immediately.

## REFRIGERATORS

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For cold storage, separate sets of refrigerators and freezers are needed for strict isolation of samples to avoid contamination problems.

The ship provides refrigerators and freezers for science that are located in the vans, the wet lab or the dry lab.

Labels and use records will be placed on these.

For refrigerators, three categories are used:

1. General purpose – can be used for general chemicals excluding aldehyde preservatives. Also, no large biological samples should be stored here.
2. Living biological materials – no preservatives or strongly volatile chemicals (e.g., acetone) should be stored here. Both macro and microorganisms (e.g. protists) organisms are sensitive to residual volatiles like aldehydes. This refrigerator should be available for short term storage of living organisms to be used for physiological experiments.
3. Preservatives – aldehyde preservatives and small amounts of volatile chemicals can be stored in this refrigerator.



### F R E E Z E R S

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For cold storage, separate sets of refrigerators and freezers are needed for strict isolation of samples to avoid contamination problems.

The ship provides refrigerators and freezers for science that located in the vans, the wet lab or the dry lab.

Labels and use records will be placed on these.

For freezer, three categories used:

1. Seawater – must be kept free of samples containing preservatives and biological materials.
2. Preservatives – samples with preservatives like paraformaldehyde can be stored.
3. Biological – large biological organisms like fish and benthic macro and meiofauna, plankton samples, and sediment samples.

### - 80 DEGREE FREEZER

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For cold storage, separate sets of refrigerators and freezers are needed for strict isolation of samples to avoid contamination problems.

The ship provides a – 80 degree Celsius freezer for science that is located in the dry lab. Labels and use records will be placed on these.

## GENERAL PURPOSE VAN

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A general-purpose portable lab van is meant to be a general propose van. This includes the van, and the refrigerator and freezer in it. If there are concerns about possible contamination from other types of research conducted aboard the R/V HUGH R. SHARP the areas designated to prevent these issues should be used. This van will be available for general biogeochemical and microbiological studies where contamination from a general-purpose van is not a concern. This van can also be used for electronics, similar research purposes, large biological organisms and large sediment samples. On occasion, the General Purpose Van can be used as a stable isotope van (see chapter 4 stable isotopes). All efforts will be made to keep the van cleaned between cruises to minimize problems associated with being a multidisciplinary laboratory van.

## ISOTOPE VAN

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The portable isotope laboratory van has a refrigerator and freezer that will be kept in that van and never used in other vans or within the ship's labs. Also, the furniture in the Isotope Van will be kept isolated from other furniture and not moved outside the van to other areas of the ship. Similarly, furniture, equipment, and other materials from outside the Isotope Van will not be taken into that van. Aside from certain incubations (see Isotope Use chapter 3), all materials used in the Isotope Van must remain in the van for the duration of the cruise. See chapter 3 on Isotope Use. When the Isotope Van is used for radioisotopes, it must be thoroughly cleaned and certified by wipe tests to be clean at the end of the cruise. When used with radioisotopes during a cruise, strict limited access rules will apply. Since it should be "decontaminated" after use, it can be considered a low risk at other times and can be used in a slightly different fashion for stable isotope experiments (see chapter 3).

### UNOLS CLEAN VAN

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A specialized designed laboratory van has been made available for trace metal clean work. This van can be used only for trace metal work and no other type of research. No metal objects should be stored in this van. Gas cylinders must be kept outside the van in the ship's connection vestibule and have lines plumbed into the van. Booties must be used to cover shoes when working in the clean lab van so that there is no contamination from deck work or from the ship's laboratories. The vestibule of the clean lab van should be maintained as clean as possible to minimize any contamination during entry to the lab area. Sticky mats will be placed in this vestibule to minimize contamination when entering.

### UNOLS COLD VAN

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A specialized designed laboratory van has been made available for cold work (37 degree Celsius). This van can be used only for cold and no other type of research. Gas cylinders must be kept outside the van in the ship's connection vestibule and have lines plumbed into the van.

# Isotopes

## ISOTOPE TRANSPORTATION

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It is the task of the chief scientist to provide transportation of the isotope materials to and from the ship, here at Lewes or at port of call. This includes materials, chemical, equipment, waste, and samples. The technical group is neither trained in nor has the equipment, to receive shipment of isotopic materials. If it is needed, arrangements will have to be made well in advance with scientists at the College of Marine & Earth Studies. The technical group can assist in these arrangements.

## ISOTOPE STORAGE

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All isotope materials, chemicals, and samples must be stored in the isotope van. There is both a refrigerator and freezer available in the isotope van. A fume hood is also provided. Care must be taken when securing the isotope materials, chemicals, and samples to ensure ship's motion will not cause a spill or contamination. It is highly recommended that a secondary or catch container be used in the securing process and usage process. The shipboard technician can provide assistance where need.



## ISOTOPE USAGE

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We are committed to insuring that the RV HUGH R. SHARP be available for use of enriched radioisotope tracer work and enriched stable isotope tracer work, while still preserving it as a “clean” platform for natural abundance radioactive and stable isotopic research. After considerable discussion, it was decided stable isotope tracer work must follow similar, but not identical, precautions and restrictions to those used for radioactive tracer work.

### **Radioactive Isotope Tracer Work:**

All radioactive isotope tracer work must be restricted to the Isotope Van. This specifically means all work with open containers that contain radioisotopes. Solid sealed radiation sources can be treated in a separate fashion and permitted in the dry or wet laboratory (such as those used as internal source in measurement equipment). Any use of liquid, powder, or gas forms of enriched radioisotopes must be exclusively limited to the Isotope Van. Carefully sealed and well protected sample bottles can be carried out of the Isotope Van and incubated in natural sunlight using the ship’s deck-board incubators. Protective transfer vessels must be used to carry any bottles from the van to the incubator (such as sturdy buckets and plastic trays). It must be ensured that the exterior surfaces of sample bottles and transfer containers have been cleaned of any extant radiation prior to transport out of the Isotope Van.

The deck incubators must have the overflow water waste line in solid pipe that exits directly overboard and cannot be splashed on the deck. The incubator design and placement must also assure that there is no splash spillage onto to deck; the incubator tray should be in a containment tray that also exits into the water away from the deck. A flow-through surface seawater line will be available inside the Isotope Van so that incubations not needing sunlight can be made within the van. The effluent from this incubator will also exit overboard.

Any sample manipulation, including tagging and sectioning of cores, must be performed within the Isotope Van. Any storage of enriched isotopes, supplies used for radiation work, or radioactively tagged samples must use the refrigerator and freezer within the Isotope Van. No samples from radiation experiments may be stored outside the Isotope Van.

When working in the Isotope Van, workers must use booties within the van that are left there, or workers should change shoes when exiting the van. The ship will provide booties and disposable “sticky mats” inside the doors of the van. When working in the Isotope Van, protective measures (lab coats and gloves) must be used and left within the Isotope Van. Access to the Isotope Van during cruises is strictly limited to only those isotope workers who are properly trained and prepared to follow all the restrictions. Coat hooks and a small bench to assist in changing shoes and lab coats will be available adjacent to the aft door for use when entering and leaving the Isotope Van. Outside shoes should be placed on the mat when entering and prior to leaving the van. Gloves should be worn while working with isotopes in the van and left in the van. Upon exiting the Isotope Van,

## ISOTOPE USAGE (CONT.)

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workers should wash their hands thoroughly with soap in the dry lab or wet lab sink to further assure preventing tracking trace amounts of isotopes to other areas of the ship.

At the end of a cruise, prior to leaving the ship, the Isotope Van must be carefully cleaned and wipe tests conducted with results showing that there is no contamination of bench, sink, and floor surfaces or of refrigerator and freezers. After successful cleaning and certification, the van can be considered “decontaminated”.

As much as reasonably possible, equipment that is used in the Isotope Van of the RV HUGH R. SHARP (or has been used with radiation previously) should not be placed in the dry lab, wet lab, or other vans. It should be possible to clean (decontaminate) glassware and filtration equipment sufficiently to decommission it from radiation work.

There shall be no exceptions to the radiation rules for the ship.

## ISOTOPE WASTE

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Radioactive waste materials (both liquid waste and solid waste) generated in the Isotope Van must be kept there until the end of the cruise when it can be carefully removed, assuring first that all surfaces are clean of potential trace contamination. Upon departure, all isotope materials, chemicals, wastes and samples will be removed and disposed of by the chief scientist and science party. It is the Chief Scientist's task to ensure the isotope waste is properly secured and protocol is followed. It is the technician task to assist the science party.

## DAILY WIPE TEST

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**Intent:**

The primary intent of the Daily Radiation Wipe Tests is to ensure a safe working environment and protect the science data collected from contamination for science groups using the R/V HUGH R. SHARP.

**Responsibility:**

The Coordinator of Technical Services shall designate the Radiation Safety Officer “RSO” (typically the technician assigned to the cruise) for each cruise. The RSO is responsible for ensuring that the daily radiation wipe tests are performed. The RSO shall inform the Captain of any issues that occur and advise on how to proceed. The Captain shall log any issues.

**Procedure:**

The following is the procedure to follow to perform daily radiation wipe tests. For the pre and Post wipe tests, all zones shall be tested. During the cruise, working zones only may be tested. Always wear proper lab safety gear (disposable gloves & safety glasses) while performing lab work.

1. Using a radiation test wipe or KIM-Wipe make sweeping “S” shapes for the distance of one meter.
2. Place the radiation test wipe into vial with SciniSafe Cocktail Mix and close vial cap. Note on wipe test map sheet the number of the vial in relation to the area wiped. Place all sample vials in counter tray with the correct protocol flag. Note the sequence position of each vial with relation to the vial number. The blank wipe must be placed in the #1 position.
3. Place the counter tray with vials in LSC.
4. Ensure protocol flag is slid to the test position to the left (no orange strip showing)
5. Press F2 to start sample process.
6. The test report will print as the test is performed.
7. Noting the relation of the sequence test number, the vial number and the zone tested fill in the results for each zone tested, on the wipe test form.
8. Inform the RSO and Captain of any area that shows test result exceeding 100 DPM.

**Supplies:**

The RSO shall ensure that enough materials, for the duration of the cruise to conduct the required tests, are located aboard in the ship’s isotope van before departure.

## SWAB TEST

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The University of Miami Tritium Laboratory will conduct periodic “SWAB tests” of the R/V HUGH R. SHARP and all vans. As much as possible, SWAB tests will be made before any cruise sampling for natural abundance radiation and after any cruise where tracer work was conducted. The ship was thoroughly surveyed by the Tritium Laboratory prior to its first cruise in March 2006.

## Additional Policies

### STABLE ISOTOPE POLICY

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When possible, stable isotope tracer work should be conducted in the Isotope Van with similar restrictions to those used for radioactive isotopes. If the Isotope Van is being used with radioactive isotopes and there is a conflict with use of stable isotope tracers, the stable isotope tracer work can be conducted in the General Purpose Van with restrictions. If no radioactive isotope work is being conducted during a cruise, the Isotope Van can be treated as non-hazardous for workers and equipment; it can be used with restrictions but needs no certification after the cruise (it should be carefully cleaned). If the General Purpose Van is used for stable isotope work, it should be carefully cleaned after the cruise.

For stable isotope tracer work, as much as possible, open containers of enriched isotopes should be restricted to the van, samples should be carried in containment vessels to deck incubators, and the same deck incubators (with overflow containment) will be used for incubations. As with radioactive isotopes, any spillage of isotopes or samples should be recorded and immediately cleaned. Since there is no easy immediate contaminant check, spills should be reported so that later SWAB tests can survey the area.

When working in the Isotope or General Purpose vans with stable isotope tracers, workers should use protective clothing and gloves as well as footwear, which should be left in the van during the cruise.

When necessary for large volume incubation experiments, it is possible to transport enriched stable isotope tracer stocks to the deck incubation area carefully using containment vessels. Additions must be made carefully with gloves and addition measurement equipment must be contained and returned to the van.

Since several researchers conducting stable isotope tracer research are also conducting natural abundance stable isotope research, precautions will be made. Any researchers wishing to conduct stable isotope tracer work who are not familiar with simultaneous natural abundance work are encouraged to contact Dr. Jonathan Sharp, Chair of the Ships Advisory Committee, for discussion before planning cruises.

## LIQUID NITROGEN POLICY

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Liquid nitrogen must be stored in proper Dewar containers. The container must be secured in a lab location where it will not be necessary to be moved or unsecured during the cruise. It is highly recommend the Dewar be placed in a secondary container capable of containing any leaks or spillage of the liquid nitrogen.

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