CHEMICAL HYGIENE PLAN

Laboratories covered under this Plan:

Geochemistry Lab
X-Ray/Carbon Lab
Microscope Lab
Aqueous Chemistry Lab
Sediment Lab
Photography Lab
Geotechnical Lab (GHASTLI)

Laboratory Supervisors:

Geochemistry Lab- Ellen Mecray	(508) 457-2213	(508) 548-9601 (h)
Sediment Lab- Larry Poppe	(508) 457-2314	(508) 540-3805 (h)
X-Ray/Carbon Lab- Ellen Mecray	(508) 457-2213	(508) 548-9601 (h)
Photography Lab- Dann Blackwood	(508) 457-2227	(508) 477-9252 (h)
Geotechnical Lab (GHASTLI)- Bill Winters	(508) 457-2358	(508) 548-7365 (h)

Laboratory Personnel (in addition to supervisors listed above):

Mike Bothner	(508) 457-2240	(508) 548-3125 (h)
Marilyn ten Brink	(508) 457-2392	(508) 548-5092 (h)
Michael Casso	(508) 457-2338	(508) 540-6160 (h)
Steve Colman	(508) 457-2341	(508) 540-8183 (h)
Rick Rendigs	(508) 457-2294	(508) 540-2248 (h)
Sarah Jablonski	(508) 457-2276	(508) 457-6407 (h)
John Bratton	(508) 457-2254	(508) 548-2506 (h)
Dave Mason	(508) 457-2333	(508) 563-3508 (h)
Bill Waite	(508) 457-2346	(508) 540-8958 (h)
Jeff Zwinakis	(508) 457-2287	(508) 563-7820 (h)
Mario Santos	(508) 457-2261	(508) 457-1291 (h)

Approved By: _____

(Signature of the Lab Supervisor)

Date: April 24, 2002, Reviewed by Ellen L. Mecray

Emergency Numbers and other Safety Contacts:

Team Safety Officer:	Ray Davis	(508) 457-2325	(508) 540-1156
Collateral Duty Safety Officers:	Ellen Mecray	(508) 457-2213	(508) 548-9601
	Bill Winters	(508) 457-2358	(508) 548-7365
EPA Compliance Officer:	Larry Poppe	(508) 457-2314	(508) 540-3805
Regional GD Safety Officer:	Wayne Martin	(703) 648-5289	
GD Safety Manager:	Wayne Martin	(703) 648-5289	

It is mandatory that all lab workers read the enclosed Chemical Hygiene Plan then initial the Training Log.

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Laboratory Operation:

Name of Lab: Geochemistry Lab Room No.: Gosnold, Rm. 15

This is a wet and dry sediment laboratory. Sediment core and grab samples are stored refrigerated or frozen and brought to this lab for subsampling and aliquot preparation. Cores are sectioned, grab samples are subsampled, tools are acid-washed, samples are dried in ovens,

ground to a powder, and transferred to smaller sample vessels for later analysis in contract laboratories. Acid-washing involves dilute nitric acid and methanol steps.

Instrumentation includes: balances (3) and microbalances (1), laminar flow (1), perchloric acid (1), and standard flow hoods (3) (5 total), distilled water makers (2), a core sectioning stand, a ball-mill grinder, a laboratory-grade refrigerator, drying ovens (2), a small muffle furnace, a Perkin-Elmer CHN analyzer, high-speed centrifuges (2), freeze dryers (2), and microscopes (2+).

Analyses are conducted to measure carbon, nitrogen, and hydrogen concentrations in sediment samples. Other analyses are performed to enumerate the biogenic silica concentrations in sediment samples.

Potential Hazards for this laboratory:

- Chemical hazards from acids are present.
- Chemical hazards from organic solvents are present.
- Physical hazards from the grinder and the ovens are present.
- Physical hazards from compressed gases are present.

Laboratory Operation:

Name of Lab: Sediment Lab Room No.: Crawford, Rm. 18

This is a wet and dry sediment laboratory. Sediment core and grab samples are stored refrigerated or dried and brought to this lab for determination of grain size/texture variation. Samples are dried in ovens, sieved in shaker systems, suspended in sodium hexametaphosphate, and analyzed by Coulter Counter.

Instrumentation includes: balances (2), a laminar flow hood, standard fume hoods (2), a distilled water maker, a laboratory-grade refrigerator, drying oven, a mechanical-sieve shaker, Rapid Sediment Analyzer, and a Coulter Counter (particle size analyzer).

Analyses are conducted to measure the grain-size distribution of sediment samples.

Potential Hazards for this laboratory:

- Chemical hazards from acids are present.

- Chemical hazards from organic solvents are present.

- Physical hazards from broken glassware, electrical shock, and the ovens are present.

Laboratory Operation:

Name of Lab: Geotechnical Lab/GHASTLI Room No.: Crawford, Rm. 2A

This is a wet and dry sediment laboratory that determines the physical and engineering properties of natural and reconstituted marine, terrigenous, and terrestrial material. Sediment cores are occasionally cut and reconstituted coarse and fine-grained samples are set up in this lab. Sediment properties determined in this lab include: water content, grain density, bulk density and related parameters, consolidation and stress history parameters, vane shear and triaxial strengths, permeability, acoustic velocities, and electrical resistivity.

Instrumentation and devices in this lab include: high-capacity balance (1), top-loading balances (2), high-precision balance (1), microwave oven (1), large-capacity air-convection oven with roof vent (1), large-capacity refrigerator (1), small-capacity refrigerator (1), air-comparison helium pycnometer (1), Geotest universal consolidometer (1), Nold water deaerator (1), Wykeham_Farrence consolidation and triaxial load frames (2), gas booster (1), and Gas Hydrate And Sediment Test Laboratory Instrument (GHASTLI) (1).

GHASTLI is a one-of-a-kind test system that forms gas hydrate in sediment at simulated seafloor high-pressure, low-temperature conditions and measures physical properties including acoustics, strength, permeability, and electrical resistivity. A number of sub-systems are used during operation: high-pressure syringe pumps (5), a main test sample pressure vessel (1), and other high-pressure interface chambers (3). A number of safety-related improvements exist around GHASTLI because flammable, explosive methane gas is routinely used at high pressure for extended periods of time during testing. The ceiling is sealed to prevent methane gas from leaking into the space between the drop ceiling and the underside of the roof. A dedicated vent system removes methane from the room by means of a methane-sensitive sensor-controlled (2) dual-speed fan system. A dedicated line vented to the roof will relieve pressure generated by gas hydrate dissociation in the main pressure vessel during extended power failures. A dedicated UPS can keep GHASTLI functional for hours to days before hydrate will dissociate.

Potential Hazards for this laboratory:

1. Chemical hazards from silicone oil, solvents, lubricants, and acoustic couplants are present.
2. Physical hazards from broken glassware, broken mercury-containing thermometers, and the oven are present.
3. Physical hazards from compressed gases are present.
4. Physical hazards from moving hydraulic rams are present.

Laboratory Operation:

Name of Lab: Photography Lab Room No.: Crawford, Rm. 14 and 12C

This is a Photographic Lab consisting of a studio/copystand area (Room14) and a darkroom (Room 12C).

The main equipment in the Studio consists of a 8 x 10 View Camera on a mobile cart that moves horizontally along a angle iron track installed flush in the raised floor. A vacuum copystand is installed at one end of the room that pivots to align it with the view camera. The strobe/tungsten light heads are on a movable rail system suspended from the ceiling. Other equipment in the room consists of vertical copystand with strobe and tungsten lighting, light table, slide duping equipment, dry mounting press, and a rotary cutter.

The darkroom is accessed by passage through a rotating door at the end of Room 14 opposite of the vacuum copystand. This room has three photographic enlargers, two on counters and one freestanding. Two photographic sinks are used for film and paper processing. A rotary paper processor is installed on a counter. One safelight is installed from the ceiling to light the entire room. Other smaller safelights are used when needed.

Potential Hazards for this laboratory:

- Physical hazards from high-voltage, strobe power packs are present.
- Physical hazards from injury while working in complete darkness are present.
- Physical hazards from hot surfaces on the dry mounting press are present.
- Physical hazards from electrical components used near sinks are present.
- Chemical hazards from developers, fixers, wetting agents and clearing solutions are present.

Laboratory Operation:

Name of Lab: X-ray Diffraction Lab Room No.: Gosnold, Rm. 13

This is a wet and dry sediment laboratory. Samples are subsampled, dried in an oven, and ground to a powder. Centrifugation and vacuum-filtration are used to separate fractions. Samples are analyzed by x-ray powder diffraction. Smear slide preparation involves acetone. One clay mineral treatment uses ethylene glycol; two other treatments utilize a muffle furnace.

Instrumentation includes: ovens (2), centrifuge, desiccators (3), vacuum pump, sieves, mortars and pestles, glassware, and a Phillips X-ray Powder Diffractometer.

Analyses are conducted to determine the mineral composition of geological samples.

Potential Hazards for this laboratory:

- Chemical hazards, from acetone and ethylene glycol, are present.
- Physical hazards, from ovens, broken glassware, and the centrifuge, are present.
- Radiation hazards are present from the x-ray diffractometer.

CHEMICAL HYGIENE PLAN

A. Standard Operating Procedures for Handling Hazardous Chemicals

1. Protective apparel and protective equipment (PPE):

It is important to emphasize that appropriate dress be worn when working in any of the laboratories. This means that the wearing of any loose fitting clothing or long dangling jewelry is to be avoided. Open-toed shoes or sandals are not to be worn in areas that require the use of acids or corrosive and toxic materials. A set of plastic footwear is provided as an alternative should one be in the laboratory unprepared. The type of personal protective clothing or equipment used in the laboratory environment should match the potential hazard. Please ask for assistance in locating the proper PPE for your task AND refer to the Job Hazard Analysis (JHA) for each specific task.

A. Eyes

Protection will be worn when there is the chance that projectiles, hazardous liquids, or other foreign matter can enter the eye. Hardened, shatter-proof lenses with side shields are provided for protection from projectiles. Splash goggles are provided and will be worn when working with hazardous liquids. Safety glasses may be found in each laboratory in the wall-mounted cases and in the PPE section of the storeroom. NOTE: When working in the laboratories, wearing contact lenses is prohibited.

Full-face shields are provided and should be worn when dispensing, mixing or otherwise using flammable liquids. Full-face shields are the best choice in terms of overall face protection. Full-face shields are kept in the geochemistry laboratory and in the hood room.

B. Hands

Gloves will be worn when handling chemicals and solvents. Always check the chemical compatibility of the glove material for the chemical or solvent being used. Chemical compatibility charts are posted in the lab and can also be found in the lab supervisor's office. Various glove materials are available in the PPE section of the laboratory storeroom. Ask others for assistance in locating the proper gloves for your task.

When working within a walk-in freezer, hands should always be covered by gloves. If dexterity is necessary for some procedures, outer gloves may be removed for a short period of time (a couple of minutes). In those cases thin, chemically-activated, heating pads may be worn between two sets of glove liners and covered by a removable outer heavier glove. Chemical heating pads should not be placed against bare skin. Gloves (and other freezer-appropriate PPE) are available for this task in the geochemistry lab underneath the grinder.

C. Respiratory Protection

Disposable dust masks will be worn when performing tasks that generate dust and particles. Half-mask respirators with the appropriate disposable cartridges will be worn when acid or solvent vapors are present at less than 1 percent of the

atmosphere and oxygen is at least 19.5 percent. NOTE: Use of a half-mask and other respirator devices requires the USGS training course, proper personalized fitting, and awareness of the rules governing respirator use (including a medical surveillance record and minimized facial hair).

All work involving acids, solvents and other airborne contaminants will be performed in a fume hood. The perchloric acid hood has an audible alarm that is triggered when the exhaust level has dropped below a set threshold.

D. Body

Lab coats, aprons, and/or chemically-resistant disposable coveralls, will be worn when working with ANY hazardous liquid materials. Lab coats are available on the door between the geochemistry laboratory and the hood room as well as in the PPE section of the storeroom. Aprons are hanging in the hood room.

All employees working with and around operating x-ray equipment will wear an x-ray film badge. These badges are maintained for the X-ray officer and one visitor. The badges are kept on top of the X-ray diffractometer in the X-ray laboratory. The exposed badges are evaluated and the results are reported to the x-ray officer, Larry Poppe, on a monthly basis. Exposure records on all personnel are filed for future reference in the X-ray officer's office.

A certified and calibrated Geiger counter is kept with all operating x-ray equipment and used on a regular basis to check for any radiation leakage. A log is kept with the X-ray diffractometer recording this information.

When working within a walk-in freezer, the warmest possible clothing, including hat and boots, is required. PPE for cold temperature use is available in the geochemistry laboratory underneath the grinder area. A hood provides additional protection from heat loss. A mask is optional. If feet, hands, face or ears feel very cold or begin to hurt, immediately leave the freezer and proceed to a warmer environment.

E. Miscellaneous

1. Gas cylinders:

The handling and transportation of compressed gas cylinders will be done as instructed by the laboratory manager. All tanks will be moved using a hand-truck made for cylinder transport. All tanks must be secured upright with straps or cylinder holders. When gas is not in use, the protective cap must be in place.

All compressed gases will be ordered through the laboratory manager using the company under contract. Orders for gases will be placed via telephone and the gases delivered on Mondays, Wednesdays, or Fridays.

Liquid nitrogen is used and stored in the geochemistry equipment laboratory. Please read further uin the CHP and pay special attention to p. 20 (G. Special Precautions for Work with Particularly Hazardous Substances).

The gas cylinder inventory is kept by the laboratory manager for all gases used by all laboratories on the Quissett Campus. This inventory is checked periodically to insure that cylinders are stored properly and not retained for an excessive amount of time (greater than 5 years).

Rooms where gases are stored must be properly labeled.

2. Signs and labels:

It is imperative that all areas involved in the use or storage of hazardous chemicals or equipment are immediately identifiable by signs, placards, labels or whatever deems necessary in order insure the safety of fellow employees and outside safety personnel (fire, WHOI, ambulance).

Label all containers with chemical names, formulas, and the associated hazard (i.e. flammable or corrosive). Include the date opened on any large containers being used for dispensing. The labels are to be made with indelible pens and a material suited to the chemical being labeled (i.e. solvents have the capability of removing an indelible pen label, use tape to cover the writing). If a label is to be put on a paper medium to be attached to a bottle or container, the paper medium must be chemically inert to liquids or fumes so that the label does not disappear. The white label tape used throughout the lab is approved for such use. There is a supply of press on labels by Nalgene that are also chemically inert; these are kept in the tape drawer in the storeroom.

The following areas and equipment are posted or labeled in order to identify a potential hazard:

X-ray Lab - X-ray generator
Geochemistry lab- gas cylinders
WRD lab- gas cylinders
Geotechnical Lab – Microwave and gas cylinders

There are signs identifying exits, eyewash stations, emergency showers, MSDS locations, fire extinguishers, and fire blankets. These signs should not be blocked, and the areas around them must be kept clear.

Wall charts listing chemical disposal procedures, as well as chemical hazards, are posted in the x-ray lab as well as on the wall in the fume hood room. These charts are to remain clearly visible and not be obstructed by equipment or supplies.

Emergency phone numbers, the names of emergency personnel, and emergency procedures for spills, fires, and natural disasters are posted on each laboratory wall. See the Occupant Emergency Plan (OEP). The OEP is posted in all laboratory spaces by the exit and also near the exits in all buildings. It is also included at the front of this binder.

3. Spills and accidents:

EMERGENCY PHONE NUMBERS: First dial **9-911**
FIRE: (508) 548-2323

AMBULANCE: (508) 548-2323
POLICE: (508) 548-1212
WHOI SPILL RESPONSE (Safety office): (508) 289-2244 or 2242.

Chemical Spills

In ALL cases involving a spill or accident:

1) CALL FOR HELP! Let it be known that there is a problem and then try to control the situation *as long as you aren't endangering yourself*. Do not attempt to cleanup an area unless you are familiar with the proper procedures.
2) Call the Chemical Hygiene officer and the USGS/WHFC environmental safety personnel (Ellen Mecray and Larry Poppe).
3) Notify your supervisor.
4) If needed, call emergency numbers (listed above and posted in the OEP) and clear the area.

Material Safety Data Sheets (MSDS's) for all chemical materials used in the laboratories are located in the lab manager's office and in a binder outside of the laboratory door. Selected MSDS's (those for the most commonly used materials) are located in the labs where the materials are being handled (sediment and geotechnical labs). Refer to the MSDS for guidance in the cleanup and handling of any chemical or hazardous material.

Chemical spill cleanup kits are available in all labs where chemicals are in use. In geochemistry, the Spill-X is located on dedicated shelves in the fume hood room. In the sediment lab, the Spill-X is located in the fume hood in the main room. Make sure to use the correct kit for the particular spill; flammables for flammables, acids for acids, solvents for solvents and read the instructions before applying the spill material.

Chemical spill pillows and absorbent materials are also stored in the dedicated spill cabinet in the fume hood room and above the flammables cabinet near the door leading into the fume hood room from the geochemistry room. These materials are to be used for the cleanup of all chemical spills.

Spill cleanup is the responsibility of the user. Assistance and guidance will be provided by the Chemical Hygiene Officer or the USGS/WHFC environmental personnel. For spills greater than one liter (>1L), the WHOI Spill Response Team should be notified (as written in the OEP, see contact numbers above).

Chemical first aid requires immediate application of large amounts of running water to the affected area, from 5 to 15 minutes, regardless of the compound involved. All persons requiring chemical first aid should be accompanied by another laboratory employee. Eyewash stations are located in every lab at each sink. Eyes should be held open by an attending person. Water flow through the eye wash is sufficient for rinsing, but it is not over-pressured! Safety showers are located in the fume hood room, in the hallway outside the Gas Chromatography lab (WRD lab), and in the sediment laboratory. Proper use of the shower warrants removal of all clothing that may absorb the chemical (including leather shoes).

Accidents/Injury

Most cases of accident or injury are minor and can be attended to by common first aid procedures and use of first aid supplies located in all labs, hallways and public areas.

First aid and CPR training are required for all employees who go into the field and is highly recommended for all other employees. Training is provided by the American Red Cross and/or the American Heart Association through the Woods Hole Oceanographic Institution (WHOI). Class attendance may be scheduled through the Center Safety Officer. WHOI has a continuing schedule of first aid, CPR, respirator, and first responder training sessions. These sessions and classes are open to all USGS employees in the Woods Hole Field Center. Class schedules are posted at MOF, on the Safety bulletin board in Gosnold, or contact the WHOI safety office (548-2242 or 2244).

Report all injuries, however minor, to the lab supervisor and the Center Safety Officer.

4. Emergency procedures:

FIRE:

If fire is small, use extinguishers (dry chemical) located in hallways and marked by reflective red/white tape. Extinguishers are also located near the exit in the sediment lab, in the lab supervisor's office for the geotechnical lab, and in the hood room of the geochemistry lab.

If fire is large, call for help immediately, shut all doors and windows, evacuate the area, and pull the fire alarm near the building exit as you leave.

Annual fire drills and emergency evacuations are conducted for each of the USGS/WHFC buildings on the Quissett campus and at MOF.

MEDICAL:

If an employee needs medical attention, call for help and then call 9-911. Call the nearest employee trained in first aid, CPR, defibrulation, or oxygen administration. A list of employees trained in these skills is located at every first aid station in each building as well as the exits of each laboratory. These lists are sorted by building for closer contact. Notify the Center Safety Officer or any member of the Command Team listed in the OEP.

5. Laboratory storage:

There are no chemicals used at this facility that require refrigeration. Refrigerators and freezers located in laboratory spaces are for samples only. Food is not allowed in laboratory areas or in the cold storage units.

All liquid chemicals (acids, bases, organics, solvents) are stored in the fume hood room and are arranged under the hoods and in flammable cabinets according to their chemical compatibility. If there is a question about compatibility, consult the posted charts or the Chemical Hygiene Officer.

The maximum quantity of flammable liquids that are permitted to be outside of safety storage cabinets is 8 gallons total. All other flammable liquids are stored in the metal, flammable liquid, storage cabinets located in the fume hood room as well as in the X-ray/carbons laboratory.

Dry chemical storage is limited to cabinets above the work-bench in the x-ray lab and in the wall cabinets in the chemistry labs. Dry chemicals are sorted on the shelves by anion to insure compatibility. Dry chemicals in the sediment lab are stored in the gray metal cabinet outside the lab supervisor's office.

6. Waste disposal:

Liquid waste can be disposed of by way of the sanitary sewage system if it meets the following criteria:

A. The liquid has a pH greater than 5.5 and less than 10.0
B. The liquid is not flammable, corrosive, or toxic.
C. The drain used for disposal has a non-reactive trap (glass).

The following liquid wastes are collected in specially designated locations and containers at our marine facilities warehouse:

Ammonium hydroxide (oxilid printer waste)
Petroleum ink (multi-ink plotter)
Oil (vacuum pumps, mechanical pumps)

Solid waste can be disposed in the common trash if it is neither ignitable, corrosive, toxic, nor reactive.

All other solid and liquid waste is labeled with the completed hazardous waste label (orange, available through the lab supervisor), held in the chemistry fume hood room and at the warehouse, and collected by the contracted waste management company every six (6) months.

The hazardous waste storage is kept in closed containers suitable to the waste type. The dedicated space is visually inspected periodically to insure proper containment.

Chemicals, both liquid and solid, are kept to an absolute minimum in quantity and volume in an effort to minimize hazardous waste generation. Only volumes that have reached full capacity are disposed to limit the amounts sent to landfills and disposal. The WHFC is considered a very small quantity hazardous waste generator.

Example: The first step in proper waste management is to identify and characterize all wastes generated by your activities. This begins by thinking of laboratory operations in terms of waste generating operations. The following identifies categories of Geologic Division activities that do, or could, result in the creation of wastes.

Sample Collection-	This category includes all field operations and transportation activities that are intended to provide samples of materials for laboratory processing and analysis.
Sample Preparation-	This category includes all processes that are designed to prepare samples for laboratory examination and analysis by any means.
Photographic Processing-	This includes work in darkrooms that involve the use of corrosive liquids and silver-bearing materials to process photographic film.
Maintenance and Cleanup-	This category includes all activities designed, or to clean items used in the laboratory such as glassware and other types of vessels and container, tools, and equipment such as saws, grinders, analytical equipment, and the like.
Excess/Unusable Materials-	This category includes any chemical or other material being held in a laboratory or storage area that are not presently being used in any of the laboratory operations, no longer fit for the projected purposes of the laboratory, are contaminated or otherwise unusable.

7. Working alone:

No one is allowed to work alone when using extremely toxic or highly flammable chemicals, such as Class 1A flammables or Hydrofluoric Acid.

If it is necessary to work alone, or to work before or after normal working hours (9am-5pm), the lab supervisor must be consulted. Especially after hours, the night watchman should also be told of your presence in the lab.

Before beginning to work in a walk-in freezer, tell a responsible person where you are going and how long you will be. If you do not return after the expected elapsed time (not longer than one hour) instruct the person to check on you. Whenever working in a freezer, or refrigerator, take the door padlock inside with you to avoid the possibility of being locked inside. Taking the lock is also a signal to others that someone might be inside.

8. Unattended operations:

Lab ovens and furnaces may operate during evening hours. Temperatures must be moderate and contents non-reactive and non-volatile.

Laboratory stills may run after hours if equipped with an operating failsafe system.

Lab fume hoods and laminar flow hoods operate 24 hours.

In the event of a utility failure (power or water disruption), all unattended equipment (with motors) should be manually shut down and returned to power by responsible

laboratory personnel. In the event of an emergency, names of these personnel and their contact numbers are posted in the laboratory and in the front of this document.

9. General rules or procedures:

No horseplay, suctioning by mouth, or eating, drinking, or smoking will be permitted in the laboratory. Under no circumstance will laboratory glassware be used as containers for food or drink. All unsafe practices or conditions will be reported to the responsible supervisor or other authority (verbally and then in writing).

Standard operating procedures (SOPs) are written for general laboratory tasks. These have been placed in the binder with this CHP and the associated JHAs for reference.

B. Criteria to be used for Implementation of Measures to Reduce Exposures

1. Procurement and distribution:

All hazardous chemicals required by the Center (e.g., high acute or chronic toxicity, class 1A flammable liquid, highly reactive chemical) shall be procured by the Chemical Hygiene Officer. This is to insure that proper handling, storage, inventory, and disposal criteria are followed. The laboratory supervisor will require that all personnel who will be using or exposed to the material read a current MSDS and be trained on proper handling, storage, and disposal of the chemical. Material Safety Data Sheets (MSDS) are required, by the Department of Transportation, to be included in the shipping. Accept no container or package without an identifying label. If not in their original shipping containers, chemicals will be transported (between buildings, labs, and field operations) using a suitable container, such as a rubber acid bucket or other suitable device. Field personnel should remember that all chemicals must be accompanied by the MSDS and the MSDS should be made available to the ship's crew.

2. Environmental monitoring:

Conduct environmental monitoring when there is any mechanical failure of the exhaust hood(s) or after any uncontrolled release of a hazardous chemical.

Notify the lab supervisor of any exhaust hood failures. The facilities engineers will be contacted and a repair made.

3. Chemical inventories:

An annual chemical inventory is conducted for each laboratory. A copy of the inventory will be kept in the laboratory and in the CHP. Electronic copies are distributed to the Chemical Hygiene Officer and the Regional and Discipline Safety Officers in Reston, VA. Inventories will reside electronically in the Regional Laboratory Information Management System (LIMS) accessible by the Center safety personnel. When chemicals are disposed of, ensure the inventory reflects the change appropriately.

Expiration dates are checked on all chemicals, by the employees, at time of use. Any chemicals exceeding the expiration date will be disposed of according to established lab procedures (see above).

C. Fume Hood Performance

1. Use of laboratory hoods:

Sediment lab:	2 Class B hoods.
Chemistry lab:	1 Perchloric Acid hood (washdown)
	3 Class B hoods
Drafting:	1 exhaust system for ammonia vapors

Sash height on hoods will be adjusted to maximize protection for the employee but not restrict movement or obscure vision. Sash heights should not differ greatly from the height used to determine the face velocity. Understand that the face velocity increases as the sash height decreases.

Perchloric acid hood will be thoroughly washed down after every use. This includes the vent stack and the benchtop.

Loose papers or toweling will not be allowed under the hoods unattended. They can be drawn up into the exhaust and will restrict the flow of air.

2. Recommended hood face velocity:

Hood face velocities are determined once per year. Average face velocities should be between 60 and 100 linear feet per minute (LFM); however, velocities up to 150 LFM are acceptable. Averages are determined by measuring the flow at the face, using no less than 3 uniform quadrants. The results of the measurements are recorded on the face of the hood. The average LFM, date, and the initials of the person making the determination are included. The sash height used during the measurement is also marked on the side of the hood.

Hoods with average face velocities of less than 60 LFM will not be used for any toxic chemicals. If hood average face velocities exceed 150 LFM, then smoke tubes or equivalent smoke generators will be used to determine if air turbulence exists within the hood. When the smoke is thrown back into the breathing zone of the user hood performance is unacceptable. When unacceptable turbulence is noted, identify the reason for the turbulence and take steps to improve the hood's performance.

3. Special ventilation areas.
none

D. Employee Information and Training

1. Chemical Hygiene Plan:

It is required that all lab personnel read, discuss, practice safety procedures, and sign the training log (kept on file in the laboratory manager's office), signifying that they have read and understand the procedures and rules. All lab personnel must understand and be capable of acting to uphold the contents of this CHP. They should understand and be able to act in the event of an emergency, and be able to access hazard and/or chemical information, including MSDS's.

Copies of the CHP are kept in the offices of both the lab managers and the collateral duty safety officers. There are additional copies kept in a rack outside of the geochemistry laboratory and on the wall of the sediment laboratory above the balance table.

2. Hazard Communication:

Employees working within the laboratory are provided with information regarding both chemical and physical hazards. The employees are made aware of available resources (MSDS's, container labels, reference books, permissible exposure limits) and their location. Employee orientation includes a thorough read of the CHP and a laboratory tour including all safety equipment (showers and eye wash), PPE, and potential hazards. Annual HAZCOM training is provided that describes methods and observations for detecting the presence of hazardous chemicals and signs and symptoms of overexposure. First-aid treatment and emergency response is discussed. The employee will receive and understand all of this information prior to being allowed to work with chemicals.

3. Frequency of training:

Training is conducted whenever there is a new employee introduced to the laboratory or when a new procedure or method is developed and employed (see next section, E. Requirements for Prior Approval of Laboratory Activities). This training is an integral part of the overall safety program. Topical information, new procedures, new regulations, etc., are brought to the attention of the employee in a timely manner. Employees using hazardous laboratory equipment or extremely hazardous chemicals will receive specialized training.

It is recommended that all persons working in the laboratories take a Laboratory Safety Course.

4. Personal Protective Equipment (PPE) and Laboratory Safety Devices:

Procedures designed to provide employee protection, including engineering controls, work practices, and personal protective equipment are discussed informally and as an on-going process. Employees required to wear PPE of any kind will be instructed in the proper use, inspection, wearing, cleaning, maintenance, and limitations before wearing such equipment. Employees will also know the location and use of eye-washes, deluge showers, and fire extinguishers.

E. Requirements for Prior Approval of Laboratory Activities:

All new laboratory procedures being considered must be discussed, planned, and approved by the individual's supervisor, the laboratory supervisor, and the Center Safety Officer. In conjunction with all verbal approvals, an operations plan and all associated JHA's must be written, discussed, and approved by the people named above. The procedure must also be read and signed by all employees exposed to the procedure should it involve and hazardous chemicals. Be reminded that all

procurements of hazardous chemicals must go through the Chemical Hygiene Officer. That officer must be a part of all pre-planning and approval discussions involving chemicals. The pre-operations plans and JHA's will be kept on file in the Center Safety Officer's office as well as at the location of the operation.
The pre-planning of all new procedures must include provisions for structural, engineered, and personal protective controls. These controls must be in place, tested, and operational prior to the commencement of any new activity. All controls recommended in the MSDS for the new chemicals must be adhered to. Procurement of any new controls not previously available must be discussed and planned in coordination with the Center Safety Officer, the laboratory manager, and the laboratory supervisor.

F. Medical Consultation and Surveillance:

Seek medical consultation when an employee is exposed to a hazardous chemical due to failure of a laboratory hood or personal protective equipment, spill or other release, or environmental monitoring has determined the presence of an airborne contaminant above the recommended permissible exposure limit.

When medical consultation is required, provide the physician with specific information on the identity of the chemical, conditions under which the exposure occurred, and a description of the signs and symptoms of exposure. Ask the attending physician to provide a written opinion for recommended follow up examination and test results; any detected medical conditions of the employee that place the employee at increased risk; and a statement that the employee was informed of the results.

A medical surveillance program will be established for an employee when any employee is exposed to any chemical regulated by the Occupational Safety and Health Administration (SEE ATTACHED LIST) and the employee's exposure was deemed to be above the chemical's permissible exposure limit. This program is also required for users of respirator protection.

Laboratory workers are responsible for making the lab supervisor and others in authority aware of a changing health/medical condition, which would make it necessary to reevaluate the laboratory Job Hazard for them. EXAMPLE- pregnancy.

G. Special Precautions for Work with Particularly Hazardous Substances

Exposure to Hydrofluoric acid (HF):

Skin contact with HF causes tissue destruction. The exposed area will be white in appearance. HF will penetrate intact skin causing tissue damage as it migrates to the bone. HF penetration to the bone should be avoided. The manifestation of pain or burns may be delayed from one to twenty four hours when contact has been with a 1-20% solution. Blisters may result from contact with higher concentrations of HF. **Immediate first aid treatment is essential, along with timely medical treatment.**

Before beginning to work with HF, the following precautions should be in place:

A magnesium sulfate solution is prepared and located within easy reach.
All clutter is removed from work area and hood is running properly.

Gloves are used and examined for any punctures or tears.
It is recommended that a lightweight vinyl glove be worn under the actual working glove as added protection.
Worker has been fully trained in the use and hazards of HF.
When mixing liquids that release flammable vapors, only use equipment that you are sure will not ignite the vapor.

Follow the Job Hazards Analyses and operating procedures outlined in the appendices.

Liquid Nitrogen (LN2):

Liquid nitrogen is present at the USGS WHFC in the instrument laboratory where it is used to store gas hydrate samples.

Nonflammable cryogens (chiefly liquid nitrogen) can cause tissue damage (skin or eye) from extreme cold (frostbite) because of contact with either the liquid or the boil-off gases. In poorly ventilated areas, inhalation of gas due to boil-off or spills can result in asphyxiation. Container failure is another potential problem because 1 volume of liquid nitrogen at STP vaporizes to nearly 700 volumes of nitrogen gas at 20^0C, the warming of such in a sealed container produces enormous pressure which may lead to container rupture with explosive force. Container embrittlement is another common problem to be mindful of.

Transfer should be done very slowly to prevent boiling and splashing. Unprotected parts of the body should not be in contact with uninsulated vessels or pipes that contain the subject material as extremely cold material may bond firmly to the skin and tear flesh if separation is attempted. Insulated gloves must be impervious to the fluid being handled and loose enough to be tossed off easily.

Before beginning to work with LN2, the following precautions should be in place:
Worker has been fully trained in the use and hazards of LN2.
Goggles must be worn when decanting or transferring LN2. Nitrogen can spatter (possibly in eyes) when being poured.
Gloves must be worn that are specific for cryogenic use (insulated and waterproof). Use gloves whenever nitrogen is being transferred, or when handling the dewar or samples entering the nitrogen.

Mercury (Hg):

Elemental mercury is present at the USGS WHFC in mercury-containing instruments.
Mercury exposures in the workplace occur primarily through inhalation of contaminated air, direct skin contact, or oral exposure through contaminated hands or food. The amount of mercury absorbed by the body, and thus the degree of toxicity, is dependent upon the chemical form of mercury. Elemental mercury is highly volatile and is most hazardous when inhaled (only about 25% of an inhaled dose is exhaled).
Mercury used in USGS facilities should be there for a specific purpose. Substitutes for mercury-containing medical devices should be sought out and used whenever possible. When mercury devices must be used, special precautions should be taken. These devices should never be used on or near fabrics. If a spill occurred in such an area, the material would need to be discarded as it could not be effectively decontaminated. If mercury-containing devices are used, a mercury

spill kit should be kept readily accessible. The kit should contain a sulfur powder to suppress volatilization and a collection device.

Before beginning to work with Hg, the following precautions should be in place:

Worker has been fully trained in the use, hazards, and spill control of Hg.

GEOLOGIC DIVISION AND WOODS HOLE FIELD CENTER ENVIRONMENTAL-POLICY MISSION STATEMENT

The Woods Hole Field Center (WHFC) of the Coastal and Marine Geology Program in the Geologic Division of the U.S. Geological Survey is committed to improved environmental compliance. Our environmental performance is accomplished through established policies that emphasize pollution prevention and ensure compliance with environmental requirements. The WHFC aggressively identifies and addresses potential environmental problems and implements all necessary measures. Actions are taken to enable personnel to perform their functions consistent with the overall mission, regulatory requirements, and environmental policies within the agency. The WHFC develops programs to meet environmental goals and assess environmental performance.

TRAINING LOG

I, ____(print full name here)_____, have read, or reviewed, the General Laboratory rules for _____(Lab, Rm., Bldg.), _____. I have also read, and sign that I understand and will comply fully with, the Chemical Hygiene Plan, the Occupant Emergency Plan, and the set of Job Hazard Analyses for the tasks I will perform. I realize it is my responsibility to:

1. Follow and obey all laboratory and facility rules, which are part of regular operations.

2. Handle equipment properly, follow all safety recommendations, and use the equipment for the task intended.

3. Use and maintain all the required personal protective equipment prescribed for the task.

4. Report accidents and injuries, no matter how minor, to the lab supervisor and to obtain first aid and/or medical treatment.

5. Perform my job in the correct manner to reduce loss incidents to others, the lab, the equipment, and myself.

6. Report all unsafe or hazardous conditions to the lab supervisor as soon as possible.

Print Name	Initials	Date	HAZCOM or other training	Date

Appendix A:

[The JHA is task specific. Identify each task in the "Basic Job Steps" column and list all associated hazards for the task. Then outline the safe procedure to follow (include the use of engineering controls and PPE)]

JOB HAZARD ANALYSIS	**JOB ACTIVITY**: *(List job activity that may be hazardous)*	
BASIC JOB STEPS	HAZARDS	SAFE JOB PRO
(List the basic job steps)	*(List the hazards possible by doing the job)*	*(List the safe job procedu*

Appendix B:

ANNUAL ENVIRONMENTAL RISK ASSESSMENT LOG

AERAL FY 2002

ORGANIZATION: USGS/GD/ Eastern Region, Woods Hole Field Center
ADDRESS (BLDG. #): Quissett Campus, 384 Woods Hole Road, Woods Hole, MA
LAB NAME AND RM. #: Geochemistry Lab, Gosnold, Rooms 13-15
LAB CLASSIFICATION (circle appropriate description): biological; chemical; electronic; instrument; mechanical/rock crusher; photographic; physics; machine shop
CHIEF SCIENTIST: Bill Schwab LAB SUPERVISOR: Ellen Mecray
TEAM SAFETY OFFICER: Ray Davis
NAMES OF WORKERS
Mike Bothner, Marilyn ten Brink, Michael Casso, Sarah Jablonski, Joel Moore, Rick Rendigs, John Bratton, Jennifer Moore, Mario Santos, and Bill Waite

Is a Chemical Hygiene Plan in place and up to date? Circle Yes or No
Are written waste disposal policies in place? Circle Yes or No
Are drains connected to a neutralization sump? Circle Yes or No
Are drains connected to a sediment trap / sump? Circle Yes or No

MATERIALS ENTERING DRAINS

CHEMICALS: (List each by Name & approx. amount per month)
METALS (in sol'n or solid) NONE
ORGANICS (INSOLUBLE SOLVENTS & COMPOUNDS) NONE
INORGANICS (COMPOUNDS / SOLUTIONS) POTASSIUM IODIDE (10 mL/6 mos.)
ACIDS: NEUTRALIZED NITRIC AND HYDROCHLORIC ACIDS, <50mL (ea./month)
BASES: NONE
RADIOACTIVE MATERIALS: NONE

GEOLOGIC SAMPLE RESIDUES: Circle Yes (Y) or No (N)

Clays: Y N Sand/Silt: Y N Rock Debris: Y N Rock Saw Oils: Y N
Trace Metals: Y N Drilling Mud: Y N Rock Suspensions: Y N

VOLATILE MATERIALS EXHAUSTED BY HOODS

CHEMICALS: (List each by Name or Formula & approx. amount per month)
ORGANICS (VOLATILE SOLVENTS & COMPOUNDS):
ALCOHOLS (denatured, isopropyl), ACETONE, METHANOL, FORMALIN, AND TETRAHYDROFURAN <50mL (Ea./month)
INORGANICS (COMPOUNDS / SOLUTIONS): HYDROGEN PEROXIDE, SODIUM CARBONATE, SODIUM AZIDE, POTASSIUM IODIDE, SILVER

NITRATE, ‘CATHODE AND ANODE’ SOLUTIONS, HYDROXYLAMINE HYDROCHLORIDE

ACIDS: NITRIC, HYDROCHLORIC, HYDROFLOURIC, SULFUROUS ACID,

BASES: SODIUM HYDROXIDE, POTASSIUM HYDROXIDE, (rarely)

RADIOACTIVE MATERIALS (is hood filtered? Y N): NONE

Chief Scientist or Representative’s Signature

Lab Supervisor’s Signature

ANNUAL ENVIRONMENTAL RISK ASSESSMENT LOG

AERAL FY 2002

ORGANIZATION: USGS/GD/ Eastern Region, Woods Hole Field Center
ADDRESS (BLDG. #): Quissett Campus, 384 Woods Hole Road, Woods Hole, MA
LAB NAME AND RM. #: Sediment lab, Crawford, Room 16-18
LAB CLASSIFICATION (circle appropriate description): biological; chemical; electronic; instrument; mechanical/rock crusher; photographic; physics; machine shop; geological
CHIEF SCIENTIST: Bill Schwab LAB SUPERVISOR: Larry Poppe
TEAM SAFETY OFFICER: Ray Davis
NAMES OF WORKERS Flavia Wood

Is a Chemical Hygiene Plan in place and up to date? Circle Yes or No
Are written waste disposal policies in place? Circle Yes or No
Are drains connected to a neutralization sump? Circle Yes or No
Are drains connected to a sediment trap / sump? Circle Yes or No

MATERIALS ENTERING DRAINS

CHEMICALS: (List each by Name & approx. amount per month)
METALS (in sol'n or solid) NONE
ORGANICS (INSOLUBLE SOLVENTS & COMPOUNDS) FORMALDEHYDE (<100mL)
INORGANICS (COMPOUNDS / SOLUTIONS) SODIUM HEXAMETAPHOSPHATE, <2000g
ACIDS: NEUTRALIZED HYDROCHLORIC AND ACETIC ACIDS, <200mL (ea.)
BASES: NONE
RADIOACTIVE MATERIALS: NONE

GEOLOGIC SAMPLE RESIDUES: Circle Yes (Y) or No (N)

Clays: Y N Sand/Silt: Y N Rock Debris: Y N Rock Saw Oils: Y N
Trace Metals: Y N Drilling Mud: Y N Rock Suspensions: Y N

VOLATILE MATERIALS EXHAUSTED BY HOODS

CHEMICALS: (List each by Name or Formula & approx. amount per month)
ORGANICS (VOLATILE SOLVENTS & COMPOUNDS): XYLENE, <5mL, METHANOL ,25mL, ACETONE <5mL
INORGANICS (COMPOUNDS / SOLUTIONS): FORMALDEHYDE
ACIDS: ACETIC ACID, HYDROCHLORIC ACID
BASES: NONE

RADIOACTIVE MATERIALS (is hood filtered? Y N): NONE

Chief Scientist or Representative's Signature

Lab Supervisor's Signature

ANNUAL ENVIRONMENTAL RISK ASSESSMENT LOG

AERAL FY 2002

ORGANIZATION: USGS/GD/ Eastern Region, Woods Hole Field Center
ADDRESS (BLDG. #): Quissett Campus, 384 Woods Hole Road, Woods Hole, MA
LAB NAME AND RM. #: Geotechnical lab/GHASTLI, Crawford, Room 2-2A
LAB CLASSIFICATION (circle appropriate description): biological; chemical; electronic; instrument; mechanical/rock crusher; photographic; physics; machine shop
CHIEF SCIENTIST: Bill Schwab LAB SUPERVISOR: Bill Winters
TEAM SAFETY OFFICER: Ray Davis
NAMES OF WORKERS Dave Mason, Bill Waite

Is a Chemical Hygiene Plan in place and up to date? Circle Yes or No
Are written waste disposal policies in place? Circle Yes or No
Are drains connected to a neutralization sump? Circle Yes or No
Are drains connected to a sediment trap / sump? Circle Yes or No

MATERIALS ENTERING DRAINS

CHEMICALS: (List each by Name & approx. amount per month)
METALS (in sol'n or solid) NONE
ORGANICS (INSOLUBLE SOLVENTS & COMPOUNDS) NONE
INORGANICS (COMPOUNDS / SOLUTIONS) SILICONE OIL (TRACE AMT.)
ACIDS: NONE
BASES: NONE
RADIOACTIVE MATERIALS: NONE

GEOLOGIC SAMPLE RESIDUES: Circle Yes (Y) or No (N)

Clays: Y N Sand/Silt: Y N Rock Debris: Y N Rock Saw Oils: Y N
Trace Metals: Y N Drilling Mud: Y N Rock Suspensions: Y N

VOLATILE MATERIALS EXHAUSTED BY ROOF VENT

CHEMICALS: (List each by Name or Formula & approx. amount per month)
ORGANICS (VOLATILE SOLVENTS & COMPOUNDS): METHANE GAS
INORGANICS (COMPOUNDS / SOLUTIONS):
ACIDS: NONE
BASES: NONE
RADIOACTIVE MATERIALS (is hood filtered? Y N): NONE

Chief Scientist or Representative's Signature	Lab Supervisor's Signature

ANNUAL ENVIRONMENTAL RISK ASSESSMENT LOG

AERAL FY 2002

ORGANIZATION: USGS/GD/ Eastern Region, Woods Hole Field Center
ADDRESS (BLDG. #): Quissett Campus, 384 Woods Hole Road, Woods Hole, MA
LAB NAME AND RM. #: Photography lab, Crawford, Room 14
LAB CLASSIFICATION (circle appropriate description): biological; chemical; electronic; instrument; mechanical/rock crusher; photographic; physics; machine shop
CHIEF SCIENTIST: Bill Schwab LAB SUPERVISOR: Dann Blackwood
TEAM SAFETY OFFICER: Ray Davis
NAMES OF WORKERS

Is a Chemical Hygiene Plan in place and up to date? Circle Yes or No
Are written waste disposal policies in place? Circle Yes or No
Are drains connected to a neutralization sump? Circle Yes or No
Are drains connected to a sediment trap / sump? Circle Yes or No

MATERIALS ENTERING DRAINS

CHEMICALS: (List each by Name & approx. amount per month)
METALS (in sol'n or solid): SILVER
ORGANICS (INSOLUBLE SOLVENTS & COMPOUNDS) NONE
INORGANICS (COMPOUNDS/SOLUTIONS) NONE
ACIDS: NONE
BASES: NONE
RADIOACTIVE MATERIALS: NONE
GEOLOGIC SAMPLE RESIDUES: Circle Yes (Y) or No (N)

Clays: Y N Sand/Silt: Y N Rock Debris: Y N Rock Saw Oils: Y N
Trace Metals: Y N Drilling Mud: Y N Rock Suspensions: Y N

VOLATILE MATERIALS EXHAUSTED BY HOODS

CHEMICALS: (List each by Name or Formula & approx. amount per month)
ORGANICS (VOLATILE SOLVENTS & COMPOUNDS): NONE
INORGANICS (COMPOUNDS/SOLUTIONS):
ACIDS: NONE
BASES: NONE
RADIOACTIVE MATERIALS (is hood filtered? Y N): NONE

Chief Scientist or Representative's Signature	Lab Supervisor's Signature

Appendix C:
CHEMICAL HYGIENE PLAN (CHP) RESPONSIBILITIES

1. Laboratory supervisor: The laboratory supervisor is assigned and has overall responsibility for chemical safety in the laboratory. The supervisor has the following specific responsibilities, as a minimum:

(a) Ensures that a CHP is prepared for the laboratory, employees know and follow the Plan, appropriate and proper personal protective equipment is available and used, and training has been conducted.

(b) Ensures that regular inspections are conducted and that substandard or hazardous acts or conditions are corrected.

(c) Ensures that good housekeeping practices are in effect and that equipment such as hoods, showers and eyewashes are in working order.

(d) Knows the current legal requirements of regulated chemicals and ensures that hazardous wastes are disposed of properly.

(e) Ensures that a chemical inventory is completed annually for those areas assigned.

(f) Reviews the Chemical Hygiene Plan annually to ensure that the Plan is up to date.

2. Chemical Hygiene Officer: (Team Safety Officer):

(a) The TSO is responsible to verify that the laboratory supervisor performs all responsibilities.

4. Assists employees in obtaining Material Safety Data Sheets.

(c) Identifies all unattended, overnight laboratory operations, reviewing and recommending failsafe devices or procedures designed to prevent an accident in the event of a component failure.

(d) Review and report all laboratory accidents involving hazardous materials and recommends steps to prevent recurrence of similar accidents.

3. Laboratory employee:

(a) Plans and conducts all laboratory operations in accordance with the Chemical Hygiene Plan for the laboratory.

(b) Participates in the completion of the annual chemical inventory.

5. Practices good personal hygiene when working with hazardous chemicals, using required personal protective equipment and engineering controls.

6. Make supervisor and others in authority aware of changing health/medical condition, which would make it necessary to reevaluate the Job Hazard for them. EXAMPLE- pregnancy.

Appendix D:
DEFINITIONS

a. Caustics - a substance that capable of destroying or eating away by chemical action.

b. Combustible Liquids - A liquid having a flash point at or above 100 degrees F (37.8 degrees C) but below 200 degrees F (93.3 degrees C).

c. Compressed Gases – 1. A gas or mixture of gases having in a container, an absolute pressure exceeding psi at 70 F (21.1 C) or; A gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 130 F (54.4 C) regardless of the pressure at 70 F (21.1 C) or; A liquid having a vapor pressure exceeding 40 psi at 100 F (37.8 C) as determined by ASTM D-323-72.

d. Extremely Hazardous Chemical – Any of the 406 chemicals identified by the EPA on the basis of toxicity, and listed under SARA Title III.

e. Flammable Liquid, Class 1A - Any chemical with a flashpoint below 73 degrees Fahrenheit and a boiling point below 100 degrees Fahrenheit.

f. Flashpoint - The minimum temperature at which a liquid gives off a vapor in sufficient concentration to burn in the presence of any ignition source.

g. Hazardous Chemicals - Any chemical that, upon exposure, is known or can reasonably be expected to produce acute or chronic physiological harm, For example corrosives, carcinogens, combustibles, water reactive, etc…

h. Hazardous Materials – Chemicals that fit within any of the hazard classes: Explosives, flammables, oxidizing materials, corrosives, gases, poisons, radioactive substances and agents capable of causing disease.

i. Hazardous Substances – Substances which are deemed to pose imminent and substantial danger to public health and welfare; for example hazardous wastes, water pollutants, air pollutants, and substances that risk damage to the environment.

j. Hazardous Waste – Hazardous waste displays any of the four regulated hazardous characteristics: ignitability, corrosivity, reactivity, and toxicity.

k. JHA (Job Hazard Analysis) – A listing of the job activities, basic job steps, hazards, and safe job procedures of the laboratory which is included in the CHP.

L. Laboratory - Any workplace where relatively small quantities of chemicals are used in a non-production basis, multiple chemical procedures or chemicals are used, and protective practices and equipment are available and in common use to minimize exposure to chemicals.

m. Oxidizers - A chemical other than a blasting agent or explosive that initiates or promotes combustion in other materials, thereby causing fire either of itself or through the release of oxygen or other gases.

n. Perchloric Acid - a fuming corrosive strong acid $HClO_4$ that is the most highly oxidized acid of chlorine and a powerful oxidizing agent when heated.

o. Permissible Exposure Limit (PEL) - The concentration of a chemical that one can be exposed for 8 hours per day, 40 hours per week. (See 29 CFR 1910.1000 for existing PEL's.)

p. Select Carcinogen - Any chemical or substance that is known or reasonably expected to cause cancer in humans as recognized by the National Toxicology Program (Department of Health and Human Services) or the International Agency for Research Cancer Monographs.

APPENDIX E:
INCOMPATIBILITY OF COMMON LABORATORY CHEMICALS

When certain hazardous chemicals are stored or mixed together, violent reactions may occur because the chemicals are unsuitable for mixing, or are *incompatible*. Classes of incompatible chemicals should be segregated from each other during storage, according to hazard class. Use the following general guidelines for hazard class storage:

- Flammable/Combustible Liquids and Organic Acids
- Flammable Solids
- Mineral Acids
- Caustics
- Oxidizers
- Perchloric Acid
- Compressed Gases

Before mixing any chemicals, refer to this partial list, the chemicals' MSDS's or call the ORCBS to verify compatibility:

CHEMICAL	INCOMPATIBLE CHEMICAL(S)
Acetic acid	aldehyde, bases, carbonates, hydroxides, metals, oxidizers, peroxides, phosphates, xylene
Acetylene	halogens (chlorine, fluorine, etc.), mercury, potassium, oxidizers, silver
Acetone	acids, amines, oxidizers, plastics
Alkali and alkaline earth metals	acids, chromium, ethylene, halogens, hydrogen, mercury, nitrogen, oxidizers, plastics, sodium chloride, sulfur
Ammonia	acids, aldehydes, amides, halogens, heavy metals, oxidizers, plastics, sulfur
Ammonium nitrate	acids, alkalis, chloride salts, combustible materials, metals, organic materials, phosphorous, reducing agents, urea
Aniline	acids, aluminum, dibenzoyl peroxide, oxidizers, plastics
Azides	acids, heavy metals, oxidizers

Bromine	acetaldehyde, alcohols, alkalis, amines, combustible materials, ethylene, fluorine, hydrogen, ketones (acetone, carbonyls, etc.), metals, sulfur
Calcium oxide	acids, ethanol, fluorine, organic materials
Carbon (activated)	alkali metals, calcium hypochlorite, halogens, oxidizers
Carbon tetrachloride	benzoyl peroxide, ethylene, fluorine, metals, oxygen, plastics, silanes
Chlorates	powdered metals, sulfur, finely divided organic or combustible materials
Chromic acid	acetone, alcohols, alkalis, ammonia, bases
Chromium trioxide	benzene, combustible materials, hydrocarbons, metals, organic materials, phosphorous, plastics
Chlorine	alcohol's, ammonia, benzene, combustible materials, flammable compounds (hydrazine), hydrocarbons (acetylene, ethylene, etc.), hydrogen peroxide, iodine, metals, nitrogen, oxygen, sodium hydroxide
Chlorine dioxide	hydrogen, mercury, organic materials, phosphorous, potassium hydroxide, sulfur
Copper	calcium, hydrocarbons, oxidizers
Hydroperoxide	reducing agents
Cyanides	acids, alkaloids, aluminum, iodine, oxidizers, strong bases
Flammable liquids	ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide, halogens
Fluorine	alcohol's, aldehydes, ammonia, combustible materials, halocarbons, halogens, hydrocarbons, ketones, metals, organic acids
Hydrocarbons (Such as butane, propane benzene, turpentine, etc.)	acids, bases, oxidizers, plastics
Hydrofluoric acid	metals, organic materials, plastics, silica (glass), (anhydrous) sodium
Hydrogen peroxide	acetylaldehyde, acetic acid, acetone, alcohol's carboxylic acid, combustible materials, metals, nitric acid, organic compounds, phosphorous, sulfuric acid, sodium, aniline
Hydrogen sulfide	acetylaldehyde, metals, oxidizers, sodium
Hypochlorites	acids, activated carbon
Iodine	acetylaldehyde, acetylene, ammonia, metals, sodium

Mercury	acetylene, aluminum, amines, ammonia, calcium, fulminic acid, lithium, oxidizers, sodium
Nitrates	acids, nitrites, metals, sulfur, sulfuric acid
Nitric acid	acetic acid, acetonitrile, alcohol's, amines, (concentrated) ammonia, aniline, bases, benzene, cumene, formic acid, ketones, metals, organic materials, plastics, sodium, toluene
Oxalic acid	oxidizers, silver, sodium chlorite
Oxygen	acetaldehyde, secondary alcohol's, alkalis and alkalines, ammonia, carbon monoxide, combustible materials, ethers, flammable materials, hydrocarbons, metals, phosphorous, polymers
Perchloric acid	acetic acid, alcohols, aniline, combustible materials, dehydrating agents, ethyl benzene, hydriotic acid, hydrochloric acid, iodides, ketones, organic material, oxidizers, pyridine
Peroxides, organic	acids (organic or mineral)
Phosphorus (white)	oxygen (pure and in air), alkalis
Potassium	acetylene, acids, alcohols, halogens, hydrazine, mercury, oxidizers, selenium, sulfur
Potassium chlorate	acids, ammonia, combustible materials, fluorine, hydrocarbons, metals, organic materials, sugars
Potassium perchlorate (also see chlorates)	alcohols, combustible materials, fluorine, hydrazine, metals, organic matter, reducing agents, sulfuric acid
Potassium permanganate	benzaldehyde, ethylene glycol, glycerol, sulfuric acid
Silver	acetylene, ammonia, oxidizers, ozonides, peroxyformic acid
Sodium	acids, hydrazine, metals, oxidizers, water
Sodium nitrate	acetic anhydride, acids, metals, organic matter, peroxyformic acid, reducing agents
Sodium peroxide	acetic acid, benzene, hydrogen sulfide metals, oxidizers, peroxyformic acid, phosphorous, reducers, sugars, water
Sulfides	acids
Sulfuric acid	potassium chlorates, potassium perchlorate, potassium permanganate

Appendix F:
LIST OF SELECT AND SUSPECTED CARCINOGENS

This list is provided as a guide and is not all-inclusive. Carefully review material safety data sheets before working with chemicals.

Acetaldehyde
76-07-0
Acetamide
60-35-5
2-Acetylaminofluorene
53-96-3
Acrylamide
79-06-1
Acrylonitrile
107-13-1
ortho-Aminoazotoluene
97-56-3
4-Aminobiphenyl (4-aminodiphenyl)
92-67-1
ortho-Anisidine hydrochloride
134-29-2
1-Amino-2-methylanthraquinone

Arsenic (inorganic arsenic compounds)

Asbestos
1332-21-4
Benzene
71-43-2
Benzidine [and its salts]
92-87-5
Benzotrichloride
98-07-7
Beryllium and beryllium compounds

Bis (chloromethyl) ether
542-88-1
1,3-Butadiene
106-99-0
Cadmium and cadmium compounds

Carbon tetrachloride
56-23-5
Carbon-black extracts

Chlorendic acid
115-28-6
Chlorinated paraffins
108171-26-2
Chloroform
67-66-3
Chloromethyl methyl ether
107-30-2
3-Chloro-2-methylpropene
563-47-3
4-Chloro-ortho-phenylenediamine
95-83-0
Chromium (hexavalent)

C. I. Basic Red 9 monohydrochloride
569-61-9
Citrus Red No. 2
6358-53-8
para-Cresidine
120-71-8
Cupferron
135-20-6
Dacarbazine
4342-03-4
DDT (Dichlorodiphenyltrichloroethane)
50-29-3
2,4-Diaminoanisole sulfate
39156-41-7
2,4-Diaminotoluene
95-80-7
1,2-Dibromo-3-chloropropane (DBCP)
96-12-8
1,2-Dibromoethane (EDB)

3,3'-Dichloro-4,4'-diaminodiphenyl ether
28434-86-8
1,4-Dichlorobenzene

1,1-Dichloroethane (1,2-Dichloroethane)
75-34-3
Dichloromethane (Methylene chloride)
75-09-2
1,3-Dichloropropene
542-75-6
Diesel engine exhaust

Di(2-ethylhexyl)phthalate
117-81-7

Diepoxybutane

1,2-Diethylhydrazine
1615-80-1
Diethyl sulfate
64-67-5
Diglycidyl resorcinol ether (DGRE)
101-90-6
3,3'-Dimethoxybenzidine (ortho-Dianisidine)
119-90-4
4-Dimethylaminoazobenzene

3,3'-Dimethylbenzidine

Dimethylcarbamoyl chloride
79-44-7
1,1-Dimethylhydrazine (UDMH)
57-14-7
Dimethyl Sulfate

1,4-Dioxane
123-91-1
Direct Black 38 (technical grade)
1937-37-7
Direct Blue 6 (technical grade)
2602-46-2
Epichlorohydrin
106-89-8
Ethyl acrylate
140-88-5
Ethylene dibromide
106-93-4
Ethylene oxide
75-21-8
Ethylene thiourea
96-45-7
Formaldehyde
50-00-0
Hexachlorobenzene
118-74-1
Hydrazine
302-01-2
Hydrazine sulfate
10034-93-2
Lead acetate
301-04-2
Lead phosphate
7446-27-7

Lindane and Other Hexachlorocyclohexane Isomers

Mirex
2385-85-5
2-Naphthylamine
91-59-8
Nickel and certain nickel compounds

Nitrilotriacetric acid
139-13-9
Nitrofen (technical grade)
1836-75-5
Nitrogen mustard hydrochloride (Mechlorethamine hydrochloride
55-86-7
2-Nitropropane
79-46-9
N-Nitrosodi-n-butylamine
924-16-3
N-Nitrosodiethanolamine
1116-54-7
N-Nitrosodiethylamine
55-18-5
N-Nitrosodimethylamine
62-75-9
Polybrominated biphenyls

Polychlorinated biphenyls

Polycyclic Aromatic Hydrocarbons
- Benz(a)anthracene
- Benzo(b)fluoranthene
- Benzo(j)fluoranthene
- Benzo(k)fluoranthene
- Benzo(a)pyrene
- Dibenz(a,h)acridine
- Dibenz(a,j)acridine
- Dibenz(a,h)anthracene
- 7H-Dibenzo(c,g)carbazole
- Dibenzo(a,e)pyrene
- Dibenzo(a,h)pyrene
- Dibenzo(a,i)pyrene
- Dibenzo(a,l)pyrene
- Indeno(1,2,3-cd)pyrene
- 5-Methylchrysene

Potassium bromate
7758-01-2
Propylene oxide
75-56-9

Reserpine
50-55-5
Selenium sulfide
7446-34-6
Silica, crystalline

Sodium ortho-phenylphenate

Soots, Tars, and Mineral Oils

2,3,7,8-Tetrachlorodibenzo-para-dioxin (TCDD)
1746-01-6
Tetranitromethane
509-14-8
Thioacetamide
62-55-5
4,4' - Thiodianiline
139-65-1
Thiourea
62-56-6
Thorium dioxide
1314-20-1
Toluene diisocyanate
26471-62-5
ortho-Toluidine
95-53-4
ortho-Toluidine hydrochloride
636-21-5
2,4,6-Trichlorophenol
88-06-2
Trypan blue (commercial grade)
72-57-1
Uracil mustard
66-75-1
Urethane (Ethyl carbamate)
51-79-6
Vinyl chloride
75-01-4
Revised 1/96

Appendix G:

LIST OF OSHA REGULATED SUBSTANCES

1,2-dibromo-3-chloropropane. (1910.1044)
2-Acetylaminofluorene. (1910.1014)
3,3'-Dichlorobenzidine (and its salts) (1910.1007)
4-Aminodiphenyl. (1910.1011)
4-Dimethylaminoazobenzene. (1910.1015)
4-Nitrobiphenyl. (1910.1003)
Acrylonitrile. (1910.1045)
alpha-Naphthylamine. (1910.1004)
Asbestos, tremolite, anthophyllite, and actinolite. (1910.1001)
Asbestos. (1910.1101)
Benzene. (1910.1028)
Benzidine. (1910.1010)
Beta-Naphthylamine. (1910.1009)
beta-Propiolactone. (1910.1013)
bis-Chloromethyl ether. (1910.1008)
Coal tar pitch volatiles; interpretation of term. (1910.1002)
Coke oven emissions. (1910.1029)
Cotton dust. (1910.1043)
Ethylene oxide. (1910.1047)
Ethyleneimine. (1910.1012)
Formaldehyde. (1910.1048)
Inorganic arsenic. (1910.1018)
Lead. (1910.1025)
Methyl chloromethyl ether. (1910.1006)
N-Nitrosodimethylamine. (1910.1016)
Vinyl chloride. (1910.1017)