ESTUARINE ECOLOGICAL RISK ASSESSMENT HEALTH AND SAFETY PLAN NSY PORTSMOUTH ME

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NCCOSC/ERLN CASE STUDY

ESTUARINE ECOLOGICAL RISK ASSESSMENT AT NAVAL SHIPYARD PORTSMOUTH KITTERY, MAINE

Health and Safety Plan

Prepared by

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PURPOSE

Potentially hazardous field and laboratory procedures conducted during this project and the handling of sediment, water, and biological samples contaminated with unknown toxicants may represent health and safety threats to project personnel, the public, and the environment. This Health and Safety Plan (PLAN) identifies provisions required of the responsible parties to insure human health and environmental compliance, and establishes mandatory guidelines for the safe practices of personnel involved in the field and laboratory studies associated with this project.

APPLICATION

Proposed project activities (described in Section 7.4.1 of the Work/Quality Assurance Project Plan for the NOSC/ERLN Case Study of Estuarine Ecological Risk Assessment at Naval Shipyard Portsmouth) will be performed by several parties, each of whom is responsible for the preparation and implementation of Health and Safety Plans needed to insure safe conduct. All participating personnel shall be familiar with this PLAN and comply with its requirements. Specific training, identified in this PLAN, for each activity will be addressed in the Health and Safety Plans prepared by each responsible party. If any project activities are modified after the issue date of this PLAN, the hazards associated with these modifications will be reassessed and the specific provisions of this PLAN will be modified accordingly.

NOSC and ERLN will have an oversight and coordination role throughout the project and will develop the preliminary ecological risk characterization. The University of New Hampshire - Jackson Estuarine Laboratory (UNH-JEL), currently under subcontract to Science Applications International Corporation (SAIC), the support services contractor for ERLN, and UNH-JEL's subcontractor Normandeau Associates, will perform the majority of field sampling and measurement activities. Limited field sampling will be conducted by McLaren/Hart Environmental Engineering Corporation, the Navy's RFI contractor for the Naval Shipyard Portsmouth. NOSC will perform the required butyltin analyses on selected samples but the majority of chemical analyses will be performed by Ceimic Corporation, under subcontract to McLaren/Hart. ERLN will conduct specific toxicological assessments and physiological determinations.

RESPONSIBILITES

It is the responsibility of all project personnel to comply with local, state and Federal environmental health and safety regulations and to implement every reasonable precaution to protect the health and safety of the public, the environment, and co-workers. Each participant is responsible for the safe conduct of specific project activities (described in Section 7.4.1 of the Work/Quality Assurance Project Plan for the NOSC/ERLN Case Study of Estuarine Ecological Risk Assessment at Naval Shipyard Portsmouth) as documented above. These identifed parties are responsible for the preparation and implementation of Health and Safety Plans and have the primary responsibility for their respective personnel in regard to:

- assuring that appropriate personnel protective equipment is available and properly utilized by all personnel potentially exposed to contaminants and other hazards,

- assuring that personnel are aware of the provisions of the PLAN and are instructed in the work practices necessary to insure safety and in procedures for emergencies,

- assuring that personnel are aware of potential hazards associated with project activities,
- monitoring performance of personnel to ensure that the required work practices are employed and directing corrective action as necessary,
- correcting any work practices or conditions that may result in injury or exposure to hazardous conditions or substances,
- preparing any accident/incident reports as necessary,
- assuring that personnel who may have been exposed to a hazardous substance or condition seek medical attention,
- and assuring that personnel have recieved the required training and medical monitoring.

Project personnel are responsible for:

- taking all responsible precautions to prevent injury to themselves and to their fellow workers,
- implementing this PLAN,
- reporting to the responsible party identified any deviations from the anticipated conditions described in this PLAN,
- performing only those tasks that have been addressed in this PLAN,
- and immediately reporting any accidents or unsafe conditions to the project manager.

TRAINING

It is the responsibility of each party to prepare and implement a Health and Safety Plan for the conduct of specific project activities, which address the following training requirements:

- health effects and hazards of potential contaminants,
- safe work practices and procedures to prevent chemical exposure,
- general safe work practices for laboratory and field operations,
- use, care, fitting, limitations, and effectiveness of personal protective equipment,
- decontamination procedures,
- emergency procedures,
- medical requirements,

- and disposal procedures.

PARTICIPANT HEALTH AND SAFETY PLANS

All parties are responsible for the preparation and implementation of Health and Safety Plans to insure safe conduct of project activities. The Safety Orientation Manual (attached as Appendix A) delineates the general health and safety policies required for all activities at ERLN. Included are sections on procedures for safe practices and the handling, storage and disposal of hazardous material, laboratory zone maps, first aid, health monitoring, the location of safety stations, an evacuation plan, and explanations of alarm, emergency power, and fire suppression systems. The safety plan for the conduct of the scope for growth determinations at ERLN is presented Appendix B. This attachment addresses the specific training requirements identified in this PLAN including health effects and hazards of potential contaminants, safe work practices and procedures to prevent chemical exposure, general safe work practices for laboratory and field operations, the use, care, fitting, limitations, and effectiveness of personal protective equipment, decontamination procedures, emergency procedures, medical requirements, and disposal procedures.

Standard operating procedures which contain procedure-specific safety considerations are attached for the conduct of the amphipod sediment toxicity test (Appendix C) and the sea urchin fertilization test (Appendix D) at SAIC's Environmental Testing Center (ETC). The ETC's Safety Manual (Appendix E) addresses Right-to-Know requirements, procedures for emergency actions, evacuation, fire prevention, gas and electrical shutdowns, bomb threats, monthly housekeeping inspections, medical emergencies, clean-up of hazardous waste spills, handling of hazardous wastes, spill control, personal protection and accident reporting, Also included is a written hazard communication program with MSDSs and a chemical hygiene plan.

UNH-JEL's safety plan (Appendix F) contains procedures for the safe conduct of field collections and the transport of field samples, laboratory sample handling, and waste disposal.

The Table of Contents for Ceimic's Safety Manual and their Chemical Hygiene are included in Appendices G and H. These documents, under development, will contain sections on safe work practices, use of personal protective equipment, medical requirements, emergency procedures, decontamination, and disposal procedures.

Normandeau's safety plan (Appendix I) contains guidelines for the collection of contaminated samples and the processing of contaminated samples, a site description, MSDSs which include health and hazard risks, safe work practices, and procedures to prevent chemical exposure associated with the processing of contaminated samples, and emergency and decontamination procedures.

APPENDIX A

SAFETY BOOKLET ORIENTATION

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
ENVIRONMENTAL RESEARCH LABORATORY
SOUTH FERRY ROAD
NARRAGANSETT, RHODE ISLAND 02882

U.S. Environmental Protection Agency

Environmental Research Laboratory, Narragansett

SAFETY ORIENTATION BOOKLET
1988

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF RESEARCH AND DEVELOPMENT

ENVIRONMENTAL RESEARCH LABORATORY
SOUTH FERRY ROAD
NARRAGANSETT, RHODE ISLAND 02882

June 20, 1988

SUBJECT: Revision of the Safety Orientation Booklet

FROM: Norbert A. Jaworski, Director
ERL-Narragansett

TO: All Employees

With the fine effort of the Health and Safety Committee, revisions have been made to the second edition of the Safety Orientation Booklet which was issued three years ago. Their advice and assistance help to make our Laboratory more conscious of the appropriate procedures and practices which apply to all programs and operations. This is only part of the picture, however, as the safety program at ERLN depends on each of us; 1) contributing through suggestions and questions to supervisors, 2) observing and enforcing the procedures and practices we all live by, and 3) supporting the Health and Safety Committee by direct participation or through our attitude.

The Safety Orientation Booklet revisions are attached to this memorandum. In fact, this memo should replace the former front page of your booklet. Please take the time to review the entire text while you are reading and inserting the replacement sheets. I also call your attention to the attached leaflet, Occupational Health and Safety at EPA: How to Make the Program Work for You. Our Agency's Occupational Health and Safety Staff have put together an excellent summary of employees' rights and responsibilities. I urge you to read this as well.

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INTRODUCTION

This Safety Orientation Booklet is intended to acquaint Laboratory employees with the Safety Program, the safety related systems and features of the facility, and the general safety practices of the Laboratory. It is not intended to be a safety manual of operations to include every anticipated hazard or contingency. The Laboratory Safety Program consists partly of rules and guidelines and partly of common sense, judgment, and experience. The Booklet is designed to provide basic information and to heighten the safety awareness of all employees. Employees are expected to adhere to the rules and guidelines, maintaining a high level of safety consciousness. For specific rights and responsibilities, consult the EPA Occupational Health and Safety Manual, Transmittal 1440, March 1986.

The Laboratory Health and Safety Committee prepared this material. It should be reviewed by all employees on a periodic basis and any suggestions for improvement will be welcomed by the Committee. A list of current members of the Health and Safety Committee and other safety related personnel is posted on the Health and Safety bulletin board located outside room 174, in the Standard Operating Procedure (SOP) A-1, and in SOP G-1 which addresses Health and Safety Management. Additionally, a list of safety reference books, material safety data sheets, articles and regulations are posted. These materials are available from the Library, the Health and Safety Designee, or the Waste Control Officer.

For further safety information, please contact your supervisor or a Health and Safety Committee member.

Richard L. Lapan, Jr., Health and Safety Designee
Second Edition Revision - June, 1988

Quick Reference Summary

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SOB = Safety Orientation Booklet SOP = Standard Operating Procedure
NRC = "Prudent Practices for Handling Hazardous Chemicals in Laboratories"

Emergency Telephone Numbers

The names and telephone numbers of most emergency services are posted at the telephone switchboard, in the First Aid Room, and below. In addition, basic emergency numbers are listed on all telephones.

Narragansett:	
Fire Department	789-1011
Police Department (emergency)	789-1011
Police Department (routine)	789-1091
Rescue Squad	789-1011
Ambulance Services:	
South Kingstown	783-3341
Intercity (Wakefield)	789-8463
North Kingstown	294-3344
Hospital Emergency Departments:	
South County Hospital	783-0333
Kent County Memorial Hospital	737-7000 *
Rhode Island Hospital	277-4000 *
Poison Control Center (emergency)	277-5727 *
Poison Control Center (routine)	277-5906 *
Rhode Island:	
State Police (Hope Valley)	539-2323
United States:	
Coast Guard (Pt. Judith)	783-3021
Coast Guard (Castle Hill)	846-3675 *
Coast Guard (Block Island)	466-2411 *
FBI (Newport)	849-2226 *
Navy Decompression (New London)	644-4907 FTS

* Denotes telephone numbers outside the local direct dialing area. Use pertinent FTS or direct long distance access prefix when dialing these numbers.

ERL-Narragansett Procedure for Health and Safety Management
Excerpted from SOP G1

BACKGROUND

The EPA Safety Directives require certain Safety Officials be designated at each facility. Safety is a line responsibility. Every manager, supervisor and employee is responsible for identifying risks, hazards, or unsafe situations or practices and for taking steps to assure adequate safety in the activities under his/her supervision or in which he/she participates. All must be concerned about the seriousness of operational breakdown, losses, and destruction of property and personal injuries or loss of life.

POLICY

The Laboratory Director as "Officer-in-Charge" shall be responsible for conducting the Health and Safety Program within his area of responsibility. He is assisted in this responsibility by an organization of staff officers and committee members.

ORGANIZATION

The following organization structure outlines the Laboratory Health and Safety Staff and Committee functions:

```
                    Officer-in-Charge
                          |
                    Safety Designee
                          |
Laboratory Health Officer --|-- Laboratory Safety Officer
                          |
Radiation Safety Officer  --|-- Toxic Substances Control Officer
                          |
Medical Monitoring Coord. --|-- Diving Officer
                          |
        Laboratory Health and Safety Committee
                          |
Radioisotope Subcommittee --|-- Hazardous Materials Subcommittee
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RESPONSIBILITIES

The following Health and Safety responsibilities describe the functions outlined under ORGANIZATION:

Officer-in-Charge - Responsible for overall implementation of the Health and Safety program at the reporting unit.

Safety Designee - Responsible for assissting the Officer-in-Charge in developing, organizing, directing, and evaluating the Health and Safety Program; and coordinating illness and injury reporting and recordkeeping requirements of the reporting unit.

Laboratory Safety Officer - Responsible for providing technical advice and guidance on safety (including boat and motor vehicle) subjects to the Officer-in-Charge and the Laboratory Health and Safety Committee and otherwise assist in developing, organizing, directing, and evaluating the safety elements of the Health and Safety Program.

Laboratory Health Officer - Responsible for providing technical advice and guidance on occupational health-related subjects to the Officer-in-Charge and the Laboratory Health and Safety Committee and otherwise assist in developing, organizing, directing, and evaluating the occupational health elements of the Health and Safety Program.

Toxic Substances Control Officer - Responsible for ensuring that safe operations are conducted in the procurement, receiving, storage, control, and disposal of toxic substances.

Radiation Safety Officer - Responsible for ensuring that safe operations are conducted in the procurement, receiving, storage, control, and disposal of radioactive materials and in accordance with NRC license.

Diving Safety Officer - Resonsible for ensuring that safe diving operations are conducted including: certification, physical examination, and conformance to regulations set forth in EPA diving operations manual.

Medical Monitoring Coordinator - Responsible for managing the Laboratory's Medical Monitoring Program including: administrative arrangements with contract physician, scheduling, transportation, and recordkeeping.

Laboratory Health and Safety Committee - Shall provide the Officer-in-Charge a continuing appraisal of the health and safety efforts under their jurisdiction; advise on and assist with the development and implementation of a comprehensive occupational health and safety program; and the evaluation of the health and safety of working conditions in the Laboratory.

Hazardous Materials Subcommittee - Shall establish administrative responsibilities, procedures and controls for work with toxic materials in the Laboratory. Evaluates the hazards associated with proposed uses of controlled materials and recommends to the Officer-in-Charge detailed protocols for usage in the Laboratory.

Radioisotope Subcommittee - Shall establish administrative responsibilities, procedures, and controls for work with radioactive materials in the Laboratory. Evaluates the hazards associated with the proposed uses of controlled materials and recommends to the Officer-in-Charge detailed protocols for usage in the Laboratory.

Alarm Systems

Our Laboratory complex has many alarm systems. The first aspect which should be stressed for the safety and well-being of all employees is that when an alarm sounds, don't just silence the alarm and walk away. Report all alarms to the switchboard operator (dial 0), even if you are authorized to deal with the alarm. There are key personnel who know what to do under the circumstance of a given alarm. Only authorized personnel who have been trained to operate these systems will be permitted to clear an alarm.

FIRE ALARM:

When a fire alarm is sounded (a pulsating, claxon noise), only the Narragansett Fire Department is authorized to reset the alarm and restore the Laboratory to normal operation. (See LABORATORY EVACUATION PLAN, page 12.)

There are four fire alarm panels. The main panel is located in the lower stairwell of the front lobby. Auxiliary panels are located in the corridor outside room 172, the stairwell at room G11 and in the caged portion of the Chemical Storage Building. When the night by-pass switch is armed, the fire alarm will be sounded throughout all Laboratory buildings, except for the so-called "Metal" and "Wooden" buildings. Without the night by-pass switch, the alarm will sound only in the affected building. When an alarm does sound, there are red lights atop each building which will flash intermittently, directing Fire Department personnel to the trouble area.

OTHER ALARMS:

Door Alarms - (a steady buzz) All doors are monitored by ten alarm stations wired to a control panel in the lower stairwell of the front lobby. These doors are typically secured between the hours of 1700 to 0700 and on weekends and holidays. When the door alarms are on, entrance to and exit from the Laboratory is permitted only through the front lobby.

Sonalert Signals - (an electronic whine) These are found on the fire alarm panels, the freezer and refrigerator controls, the 450 kW generator, incubators, and in several other locations. Each alarm has an identification sign nearby to indicate the nature of the problem. In some instances, lighted displays will indicate a problem with a subsystem.

Night Telephone Bell - (a loud, pulsed ring) This enables the guard or any personnel to answer an incoming call at any extension in the building by dialing 75. This bell and the front door bell below are heard only in the "Old Building".

Front Door Bell - (used to summon a security guard during off-hours) The button is located to the left of the front door.

Fire Suppression

Fire suppression is, above all, an individual responsibility. Although automatic systems are available in some areas of the facility, the most effective fire suppression will result from prompt individual action. Fire suppression may be as simple as placing a cover over a flaming vessel or trash can. In other cases, the Halon system or a fire extinguisher may be used. It is important to close a door to limit the oxygen supply to a fire. Within our facility, simple containment of a blaze within a small area is an important aspect of fire suppression.

It is important to know that, as you move from one part of the facility to another, different means of fire suppression are available. Be aware of these different systems as you work in various parts of Laboratory complex.

AREA	HEAT DETECTOR	SMOKE DETECTOR	HALON SYSTEM	PULL STATION	ELECTROMAGNETIC DOOR RELEASE
High Hazard Labs	*	*	*	*	*
Rooms 133 & 134	*	*	*		*
East Offices		*			
Corridors		*		*	*
"New" Wet Lab	*	*		*	
"Old" Bldg.	*			*	*
"Old" Wet Lab				*	
Facility Sup. Bldg.	*	*		*	
Chem. Storage Bldg.	*	*	*	*	
"Metal" Bldg.					
"Wooden" Bldg.					

* = YES

In general, the fire suppression procedures are as follows:

1 Activate nearest alarm, regardless of size of fire;
2 If fire is in exhaust hood, close sash immediately;
3 Try controlling the fire with appropriate fire extinguisher (see page 25) if you feel comfortable in doing so. Even if you are successful in controlling the fire, leave the building quickly, closing the door behind you.

When a fire alarm is triggered in a high hazard laboratory, a number of things happen simultaneously and automatically:

1 The alarm sounds throughout the building;
2 Electromagnetic door holders release throughout the building;
3 Air supply and discharge of the affected room ceases;
4 The high speed purge fan stops, if running in that room;
5 Exhaust hood fans stop and dampers close;
6 HALON discharges into that room in which the alarm was triggered.

Of the items listed above, it is especially important to realize that AN EXHAUST HOOD WILL NOT CONTINUE TO EXHAUST TOXIC OR EXPLOSIVE VAPORS IN THE EVENT OF A FIRE.

The few corridor and stairwell doors which are not equipped with electromagnetic door releases must be kept closed. This is necessary to assure the safety of that stairwell or corridor. The use of "wedges" creates a hazard to all employees.

Emergency Power

The Laboratory is equipped with a 450 kW emergency power generator which automatically turns on when the normal power source is interrupted. The emergency generator has only enough capacity to serve essential electrical needs. These include the seawater pumping system, alarm systems, EXIT lights, and minimal lighting in labs, corridors, and offices. In addition, emergency power outlets are available in some laboratory rooms. Employees having questions about the availability of these outlets should contact Mr. Robert Guilmette or Mr. Denis Body.

Laboratory Evacuation Plan

THE PROMPT AND ORDERLY EVACUATION OF ALL THE PERSONNEL FROM THE BUILDING IS THE FIRST, AND MOST IMPORTANT, ACTION TO BE TAKEN IN THE EVENT OF A FIRE OR OTHER EMERGENCY.

A Laboratory evacuation plan has been established to effect a safe and rapid exit of all individuals under emergency conditions. Zone Fire Marshalls and Alternates are designated for several areas of the Laboratory main building to aid and assist in the orderly evacuation of the facility.

Laboratory plans showing primary and secondary exit routes, the First Aid Room and Safety Stations are posted at the exit to each room. It is the responsibility of each employee to become familiar with the evacuation plan and the exit routes from his/her work station. Each individual should also acquaint themselves with the location of the fire alarm pull stations and fire extinguishers in each room they use.

The following evacuation procedures are to be followed in the case of fire or for other emergencies which would require personnel to vacate the facility.

AN EMPLOYEE DISCOVERING A FIRE SHOULD:

A. Warn other workers in the area;

B. PULL NEAREST FIRE ALARM WALL LEVER;

C. Call (or have someone else call) the Laboratory switchboard and give the exact location and extent of the fire;

D. If the fire can be readily controlled with a hand extinguisher, you may do so;

E. If the fire does not appear to be easily controlled, DO NOT PUT YOURSELF IN ANY DANGER; close the room and leave the building immediately. Only if the primary route is blocked by smoke or fire or if it leads past an affected space, should the secondary route be used. The routes have been chosen to minimize congestion in corridors and at exits.

HEARING A FIRE ALARM, AN EMPLOYEE SHOULD:

A. Turn off all gas, especially any flammable or oxidizing gases (natural gas, propane, hydrogen, P5, acetylene, nitrous oxide, or oxygen);

B. Confine hazardous chemicals;

C. Close all windows, doors, and exhaust hood sashes;

D. Leave building rapidly, without running, by designated routes and exits. The building should be emptied in one minute or less;

E. AVOID USING THE ELEVATOR;

F. Assemble in the parking lots at a safe distance from the laboratory buildings;

G. Remain out of the building until clearance is given by the Emergency Team through the Zone Marshalls.

ZONE FIRE MARSHALLS SHOULD:

A. Supervise the exit of personnel;

B. Make sure that all personnel are out of the building;

C. Ascertain that all doors are closed;

D. Report to Safety Officer/Designee or the Emergency Team that their zone is all clear;

E. Keep all personnel clear of buildings and any fire fighting equipment.

EMERGENCY TEAM MEMBERS SHOULD:

Report to Safety Officer/Designee at front entrance of Laboratory for assignment or dispatch instructions.

IN THE EVENT OF IMMINENT DANGER:

When the Laboratory Director or a Supervisor responsible for a given area concludes on the basis of an inspection, or upon direct notification that conditions or practices exist in a work area which could cause serious physical harm or perhaps death, he/she shall inform the affected employees, undertake their evacuation, and begin immediate abatement of the dangerous condition.

Fire Marshalls And Emergency Team Designations

Zone 1: Includes offices, laboratories, and mechanical room served by East corridor in the new addition.

Fire Marshall: Bruce Reynolds Alternate: Earl Davey

Zone 2: Includes laboratories and spaces served by central corridor in the new addition.

Fire Marshall: Frank Osterman Alternate: Roxanne Johnson

Zone 3A: Includes the offices and work spaces West of the West corridor in the new addition.

Fire Marshall: Norm Rubenstein Alternate: Wayne Davis

Zone 3B: Includes upper and lower levels of the "Old" Wet Lab.

Fire Marshall: Skip Nelson Alternate: Neal Lackie

Zone 4: Includes all offices, computer room, and work spaces on the first floor of the "Old" building.

Fire Marshall: Ed Dettman Alternate: Hal Walker

Zone 5: Includes all offices, work spaces, and conference room on the second floor of the "Old" building.

Fire Marshall: Stan Hegre Alternate: Rick Lapan

Zone 6A: Includes all spaces on the main floor of the New Wet Lab.

Fire Marshall: John Sewall Alternate: Dave Bengston

Zone 6B: Includes "New" Wet Lab Mezzanine, boiler room, air-handling rooms, and labs below the main floor.

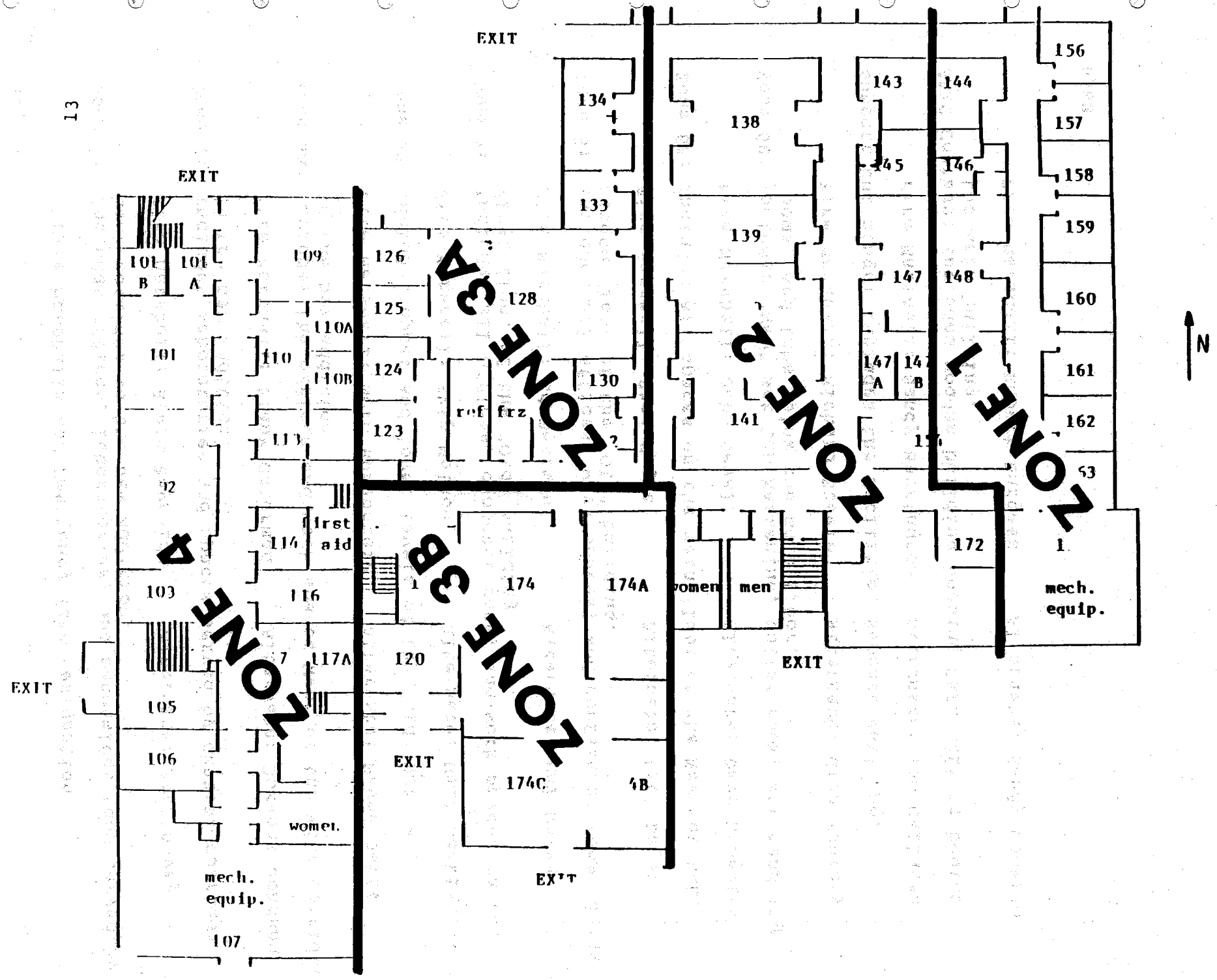
Fire Marshall: Richard Steele Alternate: Glen Thursby

Support Buildings: Includes the Facilities Support Building.

Fire Marshall: Sandy Barrington Alternate: Tom Callanan

SAIC Cottage: Includes wooden building housing SAIC offices behind the main building.

Fire Marshall: Robert Burgess Alternate: Randy Comeleo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ZONE 2
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101 A
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110A
110B
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117A
first aid
women
mech. equip.
126
125
124
123
128
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174A
174C
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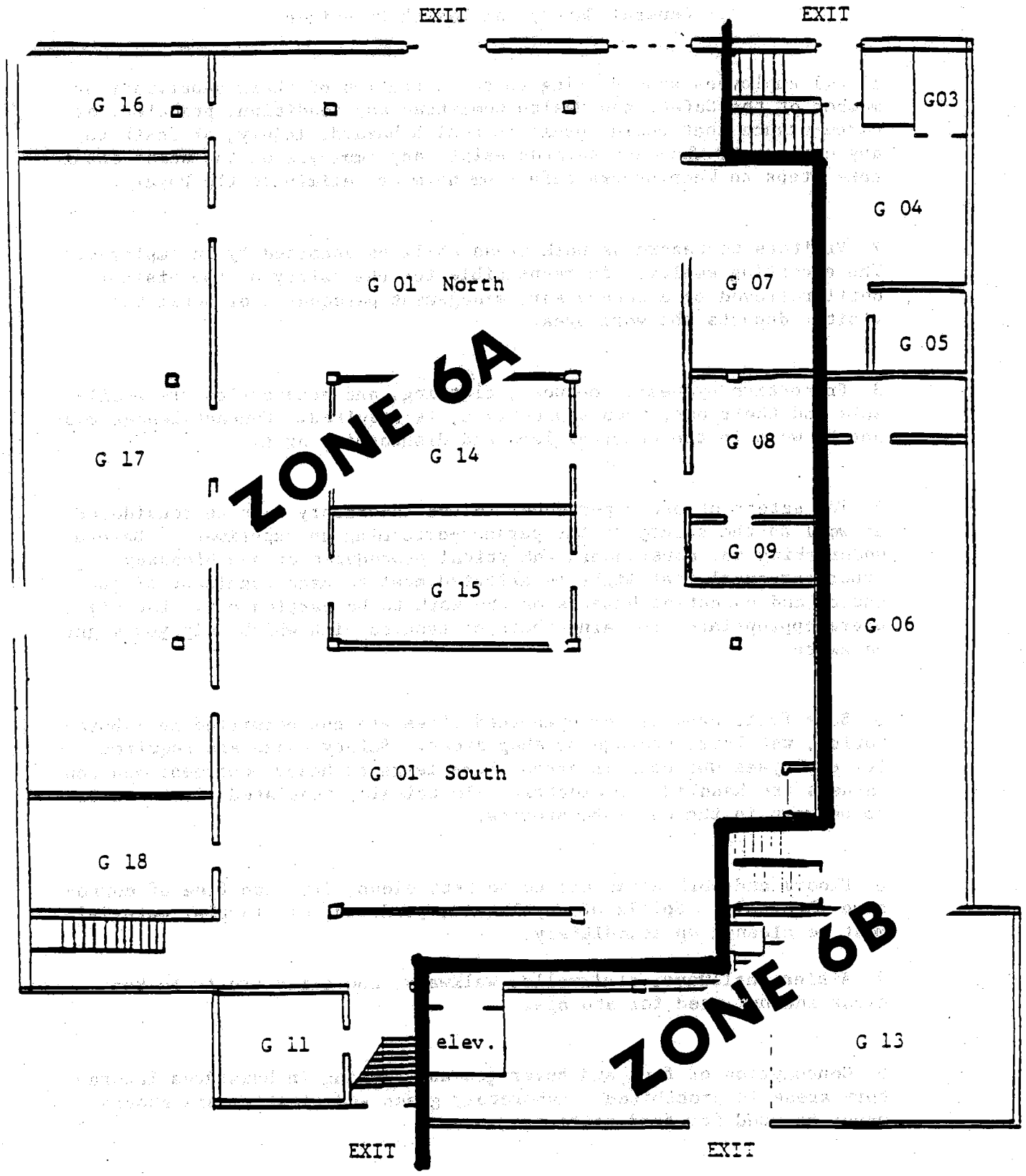
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G 04
G 01 North
G 07
G 05
ZONE 6A
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G 14
G 08
G 09
G 15
G 06
G 01 South
G 18
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EXIT

General Safety and Health Practices

1 All employees should bring to the attention of their supervisor or member of the Safety and Health Committee any condition, practice, or circumstance that could result in health hazard, injury, or death to any employee. When any hazards exist, any employee on the scene should take steps to keep others safe from harm and eliminate the hazard.

2 Visitors to hazardous work areas shall be escorted by an employee. The escorting employee is responsible for the safety of the visitor until relieved by a supervisor, management personnel, or until the visitor departs the work area.

3 Protective eyewear, footwear, clothing, and accessories are available and their use, when appropriate, is required. Contact lenses must not be worn in the chemical labs and dishwashing area.

4 The safety of other personnel in the Laboratory must be considered as well as the safety of the person performing an experiment. Before undertaking any nonstandard analytical procedures or new bioassay, other personnel that might be affected must be made cognizant of the nature and potential hazards of the work to be carried out. Use signs where appropriate, to warn others of hazards with which only you might be aware.

5 Bare feet, sandals, or open-toed shoes are not permitted in laboratories, wet labs, storage or shop areas. Safety shoes are required for employees who work in areas where large or heavy equipment and containers are handled. Dielectric (electrically insulated) footware is to be worn in the wet laboratories.

6 Floors and work areas are to be kept clean, dry, and free of corrosive chemicals. Spills of any liquid, powdered, or granular material must be cleaned up immediately.

7 Aisles, hallways, stairwells, walkways, and exits are to be kept clear and not used for storage.

8 Consumption of food and beverages and smoking in hazardous laboratory areas is prohibited. Laboratory glass and plastic-ware should never be used for food or beverages.

9 Food and/or beverages for human consumption are not to be stored in laboratory refrigerators or freezers just as laboratory samples are to be kept out of food storage refrigerators.

General Safety and Health Practices (cont.)

10 Instruments, glassware, equipment, and reagents should be stored in designated areas when not in use.

11 Dry ice is not to be stored in closed automobiles, walk-in refrigerators and freezers, or other non-ventilated areas unless ample warning is posted.

12 Never use damaged glassware as cracks or jagged edges are a serious hazard. Dispose of all broken glassware in a suitable waste glass receptacle.

13 Where possible, heating mantles are preferred over open flame or hot plates.

14 Chemicals are not to be pipetted by mouth.

15 All laboratory containers should be carefully labeled so there can be proper handling by all employees, including the prime user or owner. This is extremely important for radioactive, flammable, corrosive, or toxic materials.

16 Pets are not allowed in the Laboratory.

17 Lab coats and other protective equipment that might be contaminated are not to be worn in the lunchroom, library, conference rooms, and other such areas outside the designated high hazard sections.

18 Appropriate carts and containers must be used when transporting compressed gas cylinders and corrosive or flammable liquids inside or outside the Laboratory.

Employees should wash hands before eating or smoking after leaving the laboratory area.

Handling, Storage and Disposal of Hazardous Material

Many of the chemicals used in the Laboratory are hazardous to the health and safety of employees if not properly stored and handled. The hazards vary greatly in type and severity. Some substances are flammable or explosive; some are toxic; some are highly reactive, and some exhibit a combination of these characteristics.

The most important consideration is to know your material. Employees will have to make judgments on the degree of hazard associated with the use of chemicals in the laboratory. Each chemical should be evaluated for the following hazards:

1 Flammable and/or explosive properties;
2 Toxic effects, if any. These may vary from a mild skin or respiratory irritation to acute and fatal poisoning or chronic, irreversible damage to the body;
3 Reactivity with water or with other chemicals;
4 Means of cleanup and waste disposal to avoid personal injury or environmental contamination.

After you have analyzed the chemical hazards, some determination must be made to control exposures. You may decide that a highly flammable solvent can be replaced with a less flammable solvent. Where substitution is not possible, you must be able to determine procedures for use and handling of the chemical within safe limits. Enclosing and ventilating the process may be required, for example, or employees may need to wear protective clothing or respirators.

Most of the hazardous materials used and stored at the Laboratory can be grouped into the following categories:

A. Compressed Gases
B. Flammable Liquids
C. Toxic Inorganics
D. Corrosive Materials
E. Toxic Organics
F. Radioactive Materials
G. Chemical Carcinogens
H. Chemical Wastes for Disposal

CHEMICAL STORAGE BUILDING

The Laboratory has a Chemical Storage Building which is designed to safely store and facilitate the handling of bulk quantities of most hazardous materials. Designation of responsibility for each of the rooms in the Chemical Storage Building is listed in SOP's A2 and G4. Employees observing or experiencing any problems associated with the Chemical Storage Building should notify the responsible person immediately.

The following safety practices and rules apply to the handling and storage of hazardous materials:

A. COMPRESSED GASES (see SOP's B3 and G4)

1 Gas cylinders should be moved only with an approved cart.

2 All gas cylinders, active or inactive, must be properly secured by clamp, straps, or chains to prevent toppling or falling. When not in regular use, or while being moved, the valve must be closed, regulator removed and cap replaced.

3 Gas cylinders should bear a tag showing status: FULL/IN USE/ EMPTY. Expended cylinders should be removed from service with positive pressure remaining.

4 Gas cylinders must be shut off at the cylinder valve when not in active use.

5 Only the gas cylinders required for current use are to remain in the Laboratory work area. All cylinders not in use must be removed to the Chemical Storage Building.

6 Integrity of gas connections at the valve, regulator and instrument should be leak tested with each cylinder change.

7 Cryogenic liquid handling requires the use of a face shield and gloves. Severe "burns" can result from contact with liquid nitrogen or dry ice.

B. FLAMMABLE LIQUIDS (see SOP G4)

1 Transportation of flammable liquids of one gallon volume or less should be in safety bottle carriers or approved safety cans.

2 Flammable liquids are to be stored, analytical quality permitting, in safety cans or small glass or Teflon containers within an explosion-safe refrigerator or cabinet. See table I, page 19.

3 Bulk storage of flammable liquids is permitted only in the Chemical Storage Building in drums or safety cans up to 5 gallon capacity.

4 All drums for dispensing flammable liquids must be grounded and the receiving containers must be bonded to the drum.

5 Flammable liquids are never to be used in the vicinity of heat, open flames, or sparking electrical equipment. Flammable liquids in use in open containers shall be kept in exhaust hoods. See table II, page 20.

6 Disposal of flammable liquids is to be made only into labeled safety disposal containers. See SOP G3 for more information.

Table I

NFPA Class.	D.O.T. Class.	C-flash point	C-boiling point	maximum container volume plastic/glass	metal	safety can
IA	Danger: extremely flammable	<23	<38	1 pt	1 gal	2 gal
IB		<23	>38	1 qt	5 gal	5 gal
IC	Warning: highly flammable	23-38		1 gal	5 gal	5 gal
II	Caution: flammable	38-60		1 gal	5 gal	5 gal
III	combustible	>60		1 gal	5 gal	5 gal

C. TOXIC INORGANICS (see SOP G4)

1 Persons working with toxic inorganics such as Mercury, Arsenic compounds, halogens, ammonia, etc., should familiarize themselves with the proper methods of handling and the safe exposure levels of the material.

2 The most common route of exposure of toxic inorganic chemicals is by mouth. The use of gloves and washing hands with soap and water should preclude the transferring of material to the mouth.

3 Exhaust hoods shall be used for any operation which could give off hazardous amounts of vapors. This includes wet digestions with nitric acid, boiling solutions of all volatile acids, and ammonia.

D. CORROSIVE MATERIALS (see SOP G4)

1 Rubber gloves, splash goggles, and face shield must be used when transferring corrosive liquids (an apron or Tyvek lab coat is also recommended).

2 Transfer of corrosive liquids should be in or near sinks where an adequate flow of water for rinsing spills off hands, clothing and equipment.

3 When storing corrosive liquids, care should be taken not to store concentrated acids and bases in the same cabinet. Except when approved by supervisor, two 7 pound bottles of acid or base per cabinet is the maximum which can be kept on hand.

TABLE II

CRC Ref.#	Name	Formula	°C Boiling Point @ 760mm Hg	mm Hg Vapor Pressure @ (°C)	°C Flash Point	°C auto-ignition	Spec.Grav. @ 20°C	Flammability limit in air % by volume
12	Acetone	C_3H_6O	56.2	226(25)	-20	538	0.79	2-13
92	Benzene	C_6H_6	80.1	100(26)	-17	562	0.88	1-8
203	Carbon Tet.	CCl_4	121	113(25)	A	-	1.63	-
239	Chloroform	$CHCl_3$	61.2	200(25)	A	-	1.49	-
363	Dichloromethane	CH_2Cl_2	40	440(25)	-	662	1.34	15-66(in O_2)
454	Ethanol	C_2H_6O	78.5	50(25)	13	423	0.79	3-19
471	Ether	$C_4H_{10}O$	34.5	439(20)	-45	180	0.71	2-48
501	Formalin	37%CH_2O	101	10(-88)	85	403	0.82	7-73
512	Gasoline	C_5H_{12}-C_9H_2O	-	-	-43	371	0.80	1-8
534	Hexane	C_6H_{14}	68	150(25)	-30	261	0.66	1-8
634	Methanol	CH_4O	64.9	160(30)	11	446	0.79	6-36
777	Paraffin	-	-	-	199	245	3.88	-
784	Pentane	C_5H_{12}	36	500(25)	-49	309	0.63	1-8
800	Petroleum Ether	-	30-60	B	-57	B	B	1-8
1021	Toluene	C_7H_8	111	30(25)	4	536	0.87	1-7
1046	Freon 113	$C_2Cl_3F_3$	47.7	-	A	-	1.56	-
1083	*p*-Xylene	C_8H_{10}	138	10(27)	27	529	0.86	1-7

A -- Non-flammable, however thermal decomposition products are highly toxic.
B -- Properties similar to Pentane.

Flash point -- The lowest temperature at which a flammable vapor-air mixture is present above the surface of the liquid, which will ignite if an ignition source is introduced.
Auto-ignition temperature -- The approximate minimum temperature for self-sustained combustion.
Flammability limits in air % by volume -- The minimum and maximum concentrations of vapor in air that will allow burning to occur.

Control of Toxic Substances

EPA's Office of Research and Development has established an interim procedure for "Toxic Substance Inventory Control". This procedure provides a unified system for controlling the procurement, inventory, and security of non-radioactive toxic substances, especially those substances exhibiting extreme acute toxicity and those having known or suspected carcinogenic, mutagenic, or teratogenic properties. This procedure includes a complete chain of custody from receipt to disposal. The actual usage of these substances in the Laboratory is covered in separately developed procedures or protocols.

Dr. C. S. Hegre has been designated the Toxic Substances Control Officer for the Laboratory, and a SOP implementing the procedures regarding ordering, receipt, storage, and disposal of these materials will be published.

Scuba Diving Safety

All diving at the Laboratory is conducted under the control of the Diving Officer, Bruce H. Reynolds. In order to perform diving operations as part of a laboratory sponsored research project, a diver must be EPA certified. This certification includes a physical examination (conducted at the Laboratory's expense), completion of the EPA sponsored Diving Accident Management Training Course, and a check-out dive with the Diving Officer. No diving operations may be conducted on EPA projects, from EPA property, and/or with EPA owned equipment except within the provisions of this manual and the prior approval of the Diving Officer. Consult the EPA Diving Manual or contact the Diving Officer for further information.

See also SOP I5 regarding Small Boat Use.

Electrical Safety

A. HAZARDS:

Electrical energy can cause death, injury, or fire if it is not properly controlled. When electricity passes through a person's body, it causes muscle spasm and interferes with normal functioning of the nervous system. If the pathway includes the upper torso, the normal action of the heart or lungs may cease. Even if it does not stop these vital organs, muscle contraction may cause secondary injury when a person jerks involuntarily. Another possible injury is burning due to simple heating.

The first thing to do if you see a person receiving an electrical shock is to remove him from the source of power; either pull the plug or use an insulating implement such as a stick or belt to pull him away. Immediate first aid measures can then be applied.

Fire can be caused by either a short circuit or a bad connection. A short circuit is a pathway for electricity to flow which was not intended in the design of the equipment, and which draws excessive power, causing heat. A bad connection may be a corroded plug or a defective switch which is part of the normal circuit but which is presenting an abnormally high resistance to the flow of current. This too, causes heat. Another hazard is ignition of flammable vapors by sparks. All ordinary switches will have internal sparks when switching either on or off; explosion-proof switches simply seal the spark within a non-explosive atmosphere.

B. SAFETY EQUIPMENT:

All live electrical conductors should be inaccessible in normal working areas. Primarily, this is accomplished through insulation covering all conductors. Within our Laboratory, electrical conductors are not only insulated, they are mechanically protected from damage by walls or conduit.

The second line of defense against exposed electrical conductors is GROUNDING of all conducting enclosures. This is accomplished through the "third" pin on electrical plugs, which is connected to the exterior metal parts of the equipment. If the insulation should break down internally, current will flow through this third wire to ground rather than through you to ground. A severe fault will cause enough current to flow to blow a fuse or "trip" a circuit breaker.

A third defense used with most circuits in the Laboratory is the ground-fault interrupter (GFI). This device performs two functions: first, it acts as an ordinary circuit breaker for overloads carried between the two power pins, and secondly, detects very slight imbalances between the current going out and the current returning. Any difference between the two is an undesirable path to ground, perhaps through a person; such an imbalance will immediately trip the GFI.

C. SAFETY PRACTICES:

1 Report any exposed wiring. Report equipment which gives you a shock, no matter how slight. Report any cords or equipment which overheat.

2 Do not use ungrounded equipment or attempt to defeat the grounding system. If you have sensitive analytical equipment and suspect grounding problems are interfering with your signal, consult a qualified person to verify and correct the problem.

3 Do not rely on safety devices to protect you; always minimize the risk by unplugging equipment before working on it. If you are not sure, keep your hands out!

4 Do not use extension cords for permanent installations; request that an outlet be installed where you need it.

5 Do not use equipment with frayed, worn, or damaged cords or plugs.

6 Circuit breakers trip for a reason. Find out why and correct the problem before resetting the breaker. Learn the location of breakers serving your area.

7 Use "lock outs" on circuits being serviced or altered.

D. WET LABORATORY ELECTRICAL SAFETY:

The salt atmosphere in the Wet Lab presents a special hazard. Dust and salty moisture may build up on insulating surfaces in just a few months sufficient to cause a GFI to trip. Keep insulating surfaces free of salty moisture by wiping down frequently with a rag or sponge dampened with fresh water, trying not to get water inside outlets or any equipment. On the other hand, salty atmospheres corrode metal surfaces, leaving an insulating film. Three hazards result from corrosion: 1) The "grounded" case of a unit may have lost its ground connection, thus becoming potentially lethal; 2) The plug or switch may make such poor contact that it becomes a fire hazard, and 3) A wire may be so heavily corroded that it breaks, causing sparks, or it may overheat due to the decreased area for current conduction.

The best procedure to follow in the Wet Lab is to have every electrical installation permanently wired in by an electrician. In this way, conductors will be physically shielded from the corrosive atmosphere. All exposed surfaces should be rubber or plastic, and should be watertight.

Salt water is a good conductor of electricity. If equipment should fall into an aquarium or a quartz heater tube break, ALL aquaria, tanks, pipes, fittings, etc. connected by a continuous water path to that aquarium should be considered to be lethal until the circuit breaker is verified to be OFF. All the heater circuits have GFIs, but play safe and check it at the box and not at the tank with your body!

Safety Stations

The high hazard laboratory area has Safety Stations located in the three main North-South corridors. Green floor tiles mark their location. The Safety Stations are equipped with safety showers, eye wash sinks, first aid cabinets, spill cleanup kits, and fire extinguishers.

SAFETY SHOWERS are to be used for complete body dousing in the case of clothing or body fires, major body contact with acids, caustics, or solvents, etc., which cannot be removed by water from a faucet. They are operated by simply standing beneath the shower head, pulling and holding the chain which hangs from the feed water pipe.

EYE WASH SINKS are to be used to flush any hazardous materials which enter the eyes, including acids, caustics, solvents, detergents, or small particles. Pushing the yellow labeled bar, which runs across the top of the eye wash sink, turns on the flow of cold water to the two upwardly aimed spouts. Flush for fifteen minutes in the case of chemical exposure.

FIRST AID MEDICINE CABINETS contain supplies for attending to a variety of injuries. Their contents and their other locations outside the Safety Stations are described on the following page.

SPILL CLEANUP KITS are available for acid, caustic (alkali), or flammable solvent spills. It is highly recommended that all Laboratory personnel read the accompanying instruction manual located in the bottom of the Spill Kit Cabinet. The manual describes the contents of the kit, proper use of the contents, neutralizing capacities, and cautionary comments. In case of a spill of liquid Mercury, contact Rick Lapan for advice on cleanup procedures and use of the Mercury Spill Kit.

FIRE EXTINGUISHERS are located in all laboratories and other selected locations, as well as the Safety Stations. Two types of extinguisher are available at the Safety Stations. The water type (CLASS A) should only be used on fires involving burning paper, wood, trash, rags, etc. The carbon dioxide extinguishers (CLASS B and C) should be used on oil and solvents (B) or electrical (C) fires. A third type of extinguisher with Halon 1211 or "dry chemical" (Ammonium phosphate) may be found in a few special areas; both will handle all three classes of fire and are therefore suitable for all the above mentioned fuels.

Safety showers and eye wash sinks are also located in each of the high hazard laboratories, room G06, room 171 (dishwashing) and the boiler room (eyewash only). In addition, certain laboratories and the dishwashing room have bulk quantities of spill cleanup materials. Employees should be familiar with the location and correct use of these safety features.

First Aid and Medical Treatment

First aid is the IMMEDIATE and TEMPORARY aid given before professional medical help becomes available. First aid assistance is available in the Laboratory. The following designated individuals are First Aid Certified and should be sought in the event of injury which requires first aid or cardio-pulmonary resuscitation (CPR):

FIRST AID	CPR
Jerry Zaroogian	Wayne Davis
Al Soper	Bruce Reynolds
Don Winslow	Walt Galloway
	Jerry Zaroogian

The FIRST AID ROOM (room 115) is located adjacent to the "ramp" between the "old" and "new" portions of the laboratory. Access to the room is made by contacting the security guard in the lobby or through one of the first aid personnel listed above. Special supplies to be found in the first aid room include:

1 Bed and blankets
2 Canes and crutches
3 Air splints for fractures (training required in their use)
4 Finger splints
5 Sphygmomanometer and stethoscope (to determine blood pressure)
6 Insect sting kits.

The FIRST AID MEDICINE CABINETS are located at each Safety Station (see preceding page), the Northeast corner of the Wet Lab Mezzanine, next to the elevator door on the main floor of the Wet Lab, room G06, and in the shop area of the Facility Support Building.

First aid supplies available at these cabinets include:

1 First aid sprays and bandaids for minor cuts, scrapes, and abrasions;
2 Ace or elastic bandages for sprains;
3 Topper sponges, gauze pads, eye pads, roller gauze, and tape
4 Vaseline gauze and Nu-Gauze (Iodoform);
5 Antiseptic solutions and ointments including; hydrogen peroxide tincture of merthiolate, Neosporin, Bacitracin, and zinc oxide;
6 Aspirin and Tylenol;
7 Ammonia inhalant.

Be certain of the contents and correct usage of any of the supplies in the cabinets; READ THE LABEL. Please notify Jerry Zaroogian if any of the supplies are missing or depleted.

What to do When Injured at Work

(NOTE: Different procedures apply if a problem results from repeated, long-term exposure to a hazard; see the section "In Case of Occupational Illness")

OBTAIN MEDICAL CARE:

If first aid is required, contact one of the designated employees listed on page 26, or call the operator. If further treatment is required, request your supervisor to authorize treatment by use of form CA-16. IN CASE OF AN EMERGENCY, obtain appropriate care immediately and then fill out the forms as soon as practical.

ALL injuries, however slight, should be treated and reported. Sometimes an apparently small injury, if untreated, can develop into a large and expensive medical problem.

REPORT TO YOUR SUPERVISOR:

Every job related injury should be reported as soon as possible to your supervisor. "Injury" includes any illness or disease that is caused or aggravated by the employment, as well as damage to medical braces, artificial limbs, or other prosthetic devices.

FILE WRITTEN NOTICE:

In job related injuries the employee or someone acting on the employee's behalf should complete the employee's portion of form CA-1 (obtainable from the Administrative Office) and give it to the supervisor within TWO working days of the injury. Your supervisor will give you a receipt for the CA-1 which you should retain in your personal records.

Reimbursement for medical expenses and lost time is ultimately decided by the Department of Labor on the basis of CA-1 and other forms and statements. It is important to fill out the forms carefully and provide complete information about the accident; the burden of proof in claims for job-related injury is upon the worker.

IN CASE OF OCCUPATIONAL ILLNESS

If injury or disability develops as a result of repeated exposure to a stress, toxic agent, or other hazard over a period of at least two working days, it is defined as an "occupational illness." As in the case of traumatic injury, the law requires the employee to show that the illness is job-related.

REPORT SUSPECTED HAZARDS TO YOUR SUPERVISOR:

If some change in your work environment seems to be correlated with a negative change in your health or well-being, report it to your supervisor and the Laboratory Health Officer as soon as possible, even if you cannot clearly identify the causative agent or specific symptoms. Keep a record of the events for yourself. There is no official form for reporting unidentified suspected hazards (but see the section entitled "Reporting Unsafe or Unhealthful Working Conditions").

OBTAIN MEDICAL DIAGNOSIS:

If you suspect an occupational illness, you should first go to your supervisor and to the office of the Medical Monitoring Coordinator (Administrative Office) to be scheduled for a visit to the Lab's Health Monitoring Program physician. It is the responsibility of this doctor to make a diagnosis and indicate whether or not the illness is work-related. If you are not satisfied with the diagnosis, You may take a form CA-20 to your physician and ask him to give you a diagnosis. If you select this option, you will have to pay for your own physician (your normal health insurance DOES apply). IN ANY EVENT, start keeping complete records of your dates of exposure, symptoms, expenses incurred, etc. as soon as you suspect a problem. You will need these records for eventual reimbursement if your claim is sustained.

FILE A NOTICE AND CLAIM:

Submit form CA-2 and its associated documentation to the Department of Labor, which will make a determination of whether the illness was caused by your employment. If so, you will be reimbursed for your examinations and medical care, lost time, etc.

REPORTING UNSAFE OR UNHEALTHFUL WORKING CONDITIONS

If you believe that your working environment is unsafe or unhealthful, you should discuss the situation with your supervisor. Most difficulties should be resolved in this way. If you do not feel that your supervisor has responded properly, you may submit EPA form 1440-6 (Rev 6-84) to bring the situation to the attention of management. The laboratory management must give you a reply within 48 hours of receipt of this form.

In case of an accidental release of a toxic agent which renders a particular space potentially or actually hazardous, you should immediately post the area to keep people out, and then request the Safety Designee or a person knowledgeable in the field to take appropriate abatement actions.

The Laboratory Health Officer has a responsibility to be aware of unhealthful working conditions; you should talk to him if you suspect that laboratory personnel are being exposed to harmful agents such as toxic fumes or liquids, pathogens, excess noise or stress in the course of their work.

SAFETY AWARENESS

Every employee must constantly be on guard against hazards in our working environment. Never assume that someone else is looking into the source of that funny smell, or the soundness of that wooden ladder, etc. Don't take for granted that electrical equipment in the wet lab is dry and safe; if anything seems out of the ordinary, think about it and report it to your supervisor if you suspect any problem. Avoid exposing yourself or others to danger. Safety is everyone's job!

Health Monitoring Program

Health Monitoring is a mandatory Laboratory program designed to reduce, as much as possible, the health risks in the laboratory environment. The program is administered by Claire D. Geremia, Director, Administrative and Program Operations and Health Monitoring Coordinator, while services are provided by Rhode Island Hospital in Providence, RI.

The program is intended for laboratory and field workers whose work regularly poses the possibility of exposure to toxic materials. It also meets the needs of other groups of employees whose jobs require preplacement and/or periodic health assessment. Generally, administrative, secretarial, statistical and other support personnel who are exposed to toxic materials indirectly, infrequently, or inconsequentially should not be included. The Laboratory will provide for baseline physical examinations of employees covered under the above guidelines who are on an appointment with an expected duration of one year or greater. Subsequent periodic examinations will be provided annually for employees who may be exposed to toxic materials or hazardous operations. Less frequent physicals may be provided for other laboratory employees. All test results are protected by the Privacy Act and are maintained with strict confidentiality.

Employees are free to participate or not as they choose, with the exception of those few persons whose jobs now require such examinations as a condition of employment.

Health monitoring is an employer responsibility and the Laboratory must bear the entire cost. When a preexisting or non-job related condition is detected, the employee is referred to his private physician for

further evaluation and treatment. The individual must bear these costs and such medical conditions need not be reported to the employer. Conditions determined to have resulted from employment permit the employee to seek compensation and the recovery of medical expenses from the Department of Labor, Office of Workers' Compensation Program.

It is essential that each individual receive a basic panel of blood chemistries to evaluate renal, liver, and endocrine/metabolic function. Workers who are exposed to certain designated materials will require additional special procedures as well as the basic panel of tests. The occupational health physician will determine who is in need of special tests when he reviews the self-administered medical history forms.

Each individual should have routine urinalysis which consists of specific gravity, pH, microscopic examination, protein, acetone, and glucose determinations. A chest X-ray, an electrocardiogram, and pulmonary function testing are included in the baseline examination. Subsequent periodic chest X-rays and electrocardiograms should be obtained only when clinically indicated or when recommended by the examining physician, and not as a routine measure. Pulmonary function testing may be indicated periodically for employees at respiratory system risk, such as those with significant exposure to toxic dusts and irritants.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1985--502-373--20,128

APPENDIX B

ENVIRONMENTAL COMPLIANCE,

HEALTH AND SAFETY PLAN

for

Scope for Growth Determinations
of
Mytilus edulis
in
The NOSC/ERLN Case Study of the Estuarine Ecological Risk
Assessment at the Naval Shipyard Portsmouth
Kittery, Maine

PREPARED BY

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION
27 Tarzwell Drive
Narragansett, RI 02882

FOR

US ENVIRONMENTAL PROTECTION AGENCY
Environmental Research Laboratory
27 Tarzwell Drive
Narragansett, RI 02882

SECTION A

All wet and dry laboratory space must be designated in SECTION A before the Safety Plan is completed and submitted to the ERLN Safety Committee. Wet lab space must be approved by Neal Lackie and dry lab space must be approved by the appropriate Branch Chief.

_____
Designated Dry
Lab Space

_____
Branch Chief

_____
Designated Wet Lab
Space

_____
Neal Lackie
Chair, ERLN Wet
Lab Committee

SECTION B

The signatures required in SECTION B signify ERLN Safety Committee and EPA management approval of this Safety Plan.

_____
Rick Lapan
EPA Health and Safety
Designee

_____
Darryl Keith
Chair, ERLN Safety
Committee

SECTION C

The following signatures required in SECTION C signify SAIC Corporate and local approval of this Safety Plan.

_____
Gary Waggoner
SAIC Environmental Compliance,
Health and Safety Manager

_____
John Scott
SAIC Program Manager

_____
Wayne Munns
SAIC Assistant
Program Manager

_____
Cornelia Mueller
SAIC Local Environmental
Compliance & Health and
Safety Official

_____
SAIC Work Assignment Manager

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SECTION D

PROJECT INTRODUCTION

The physiologial condition of mussels can be quantified using the scope for growth index (SFG). The SFG index represents a measure of the energy that the organism has available for growth and reproduction under the conditions which it was measured. Calculation of the SFG index for mussels requires the measurement of three parameters: clearance rates, respiration rates, and assimilation efficiency. Measurements are completed under ambient conditions of temperature, salinity, and standardized algal concentrations (0.5mg/L).

The SFG index integrates whole animal responses of each individual. Under standardized conditions, mussels with similar physiological conditions exhibit similar SFG values. Differences in SFG are attributed to differences in laboratory or field environmental conditions to which the organism is exposed.

It has been shown that the SFG index is a sensitive and relatively short-term (7 days) indicatior of water quality. In addition, the SFG index can be used to measure the degree of impact and any improvement over time.

PROJECT SCOPE OF WORK

The procedures required to conduct SFG determinations are described in 1.03.013 of Standard Operating Procedures for the Conduct of Marine Environmental Sampling and Analysis.

SECTION E

SAFETY PLAN PURPOSE

Potentially dangerous activities conducted during this project may represent health and safety threats to project personnel, the public, and the environment. This Environmental Compliance, Health and Safety Plan identifies procedures required to ensure human health and environmental compliance, and establishes mandatory guidelined for the safe practices of all personnel involved in the activities associated with this project.

SAFETY PLAN APPLICATION

The provisions of this Health and Safety Plan are mandatory for all SAIC personnel participating in this project. All personnel shall be familiar with this plan and comply with its requirements. If any activities are modified after the issue date of this plan, the hazards associated with these modifications must be reassessed and the affected provisions of this Plan must be modified.

SAFETY RESPONSIBILITIES

The SAIC Work Assignment Manager (WAM) shall oversee all project activities and has the primary responsibility for his or her prospective personnel in regard to:

- assuring that appropriate personnel protective equipment is available and properly utilized by all personnel potentially exposed to contaminants,
- assuring that personnel are aware of the provisions of this Plan and are instructed in the work practices necessary to ensure safety and in procedures for emergencies,
- assuring that personnel are aware of potential hazards associated with project activities,
- monitoring performance of all SAIC personnel to ensure that the required work practices are employed and directing corrective action as necessary,
- correcting any work practices or conditions that may result in injury or exposure to hazardous conditions or substances,
- preparing any accident/incident reports as necessary,
- informing the SAIC Local Environmental Compliance & Health and Safety Official and Program Management of any safety incidences or deviations from this Plan,
- assuring that personnel who may have been exposed to a hazardous substance or condition seek medical attention,
- and assuring that personnel have recieved the required training and medical

monitoring.

Work Assignment personnel are responsible for:

- taking all responsible precautions to prevent injury to themselves and to their fellow workers,
- implementing the Health and Safety Plan,
- reporting to the WAM any deviations from the anticipated conditions described in the Plan,
- performing only those tasks that have been addressed in the Plan,
- and immediately reporting any accidents or unsafe conditions to the WAM.

MEDICAL SURVEILLANCE

All SAIC personnel are required to participate in a medical baseline and termination examination which includes:

- a physician's evaluation,
- complete medical history,
- interval history,
- physical examination,
- complete blood count hematology profile,
- differential,
- sedimentation rate,
- blood chemistry profile,
- urinalysis,
- pap test for female employees (optional),
- resting electrocardiogram,
- audiometry,
- pulmonary function,
- chest X-ray, and
- spirometry.

All SAIC personnel are required to participate in a biennual examinations which include:

- an interim medical review,
- occupational history review,
- screening physical examination,
- physician's evaluation,
- urinalysis,
- blood counts,
- and blood chemistry.

SAFE PRACTICES

Procedures for all emergency incidents (any threat to human or environmental health) including fire, explosion, poisoning, injury, illness, spill, leak, etc.:

- pull fire alarm,
- dial 9, then 911 for rescue,
- call 6000 (front desk) to report location of incident and other relevant information,
- attempt procedures to eliminate emergency if possible,
- and evacuate the area if necessary.

Routine procedures:

- personnel will wear protective eyeglasses in designated areas,
- will wear cloth lab coats in designated areas,
- will wear Tyvek lab coats in designated areas,
- will be familiar with all ERLN Safety SOPs,
- will be familiar with the ERLN Safety Orientation Manual,
- will not eat,drink or smoke in the laboratory,
- will be familiar with all SAIC Corporate Safety Policies,

- will report discrepencies in the maintenance of local fire extinguishers,
- will be familiar with location and use of fire extinguishers,
- will be familiar with the location of all exits,
- will wear proper boots in designated areas,
- will wear proper clothing,
- will wear goggles for designated activities,
- will wear face shields for designated activities,
- will report any obstructed exits or pathways to exits,
- will report discrepencies in the maintenance of local spill kits,
- will be familiar with the location and use of local emergency eyewash equipment,
- will flush local eyewash stations weekly for 3 minutes,
- will be familiar with the names and extensions of in-house first aid and CPR providers,
- will be familiar with the location of local emergency showers,
- will report discrepencies in maintenance of emergency showers,
- will be familiar with the location of all local first aid stations,
- will report discrepencies in maintenance of local first aid stations,
- and will be familiar with the location of all fire alarms.

SECTION F

Please complete SECTION F for each project activity (laboratory, field, construction, maintenance, etc.) requiring guidelines for environmental compliance, public health and safety, personnel health and safety, and protection of property and environment. Additional forms may be required.

GENERAL INFORMATION

Activity: The collection of mussels for deployments, and the transport of caged mussels to and from UNH-JEL require the operation of a motor vehicle. Individuals participating in this activity will follow the requirements established in EPA order 1440.6 on the mandatory use of motor vehicle safety belts or other occupant restraint systems (EPA order 1440.6 in Volume II of the SAIC Safety Manual).

Location of activity: Mussels will be collected on Cape Cod and transported to ERLN for preparation for field deployments. Mussels will be transported from ERLN to UNH-JEL for deployment and from UNH-JEL to ERLN for analyses.

Duration of activity: Three days.

HUMAN HEALTH RISKS (INJURY OR ILLNESS)

Human health risks: See EPA order 1440.6.

Short-term: N/A.

Long-term: N/A.

Procedures for proper and safe conduct (to minimize human health risks): See EPA order 1440.6.

Emergency procedures (for human health risks): N/A.

ENVIRONMENTAL RISKS (INCLUDING PROPERTY)

Environmental risks: N/A.

Procedures for proper and safe conduct (to minimize environmental risks): N/A.

Emergency procedures (for environmental risks): N/A.

SECTION G

Please complete SECTION G for each sample (ordered, synthesized or collected) requiring guidelines for environmental compliance, public health and safety, personnel health and safety, and protection of property and environment. Additional forms may be required.

GENERAL INFORMATION

Sample name: Mussels will be collected from five stations in the Piscataqua River. While this study has been initiated to determine whether or not chemical pollutants are present in the "River" and whether or not they have affected "River" ecology, it is safest to assume that these retrieved mussels have been contaminated with unknown water-borne toxicants emanating from various land-based sources and "River" activities. From previous environmental studies, typical "worst case" pollutants have included PCBs, PAHs (benzpyrene), pesticides (DDT) and metals (mercury). Material Safety Data Sheets (MSDSs) for these contaminants are provided in Appendices a,b,c, and d. The information provided in the MSDSs is based on pure chemical concentrations and not on the diluted concentrations which are of potential harm in an enviromental situation.

CAS no. for sample: See Appendices a,b,c, and d.

Synonyms for sample: See Appendices a,b,c, and d.

Sample source: Unknown land-based sources on the Piscataqua River.

Date sample ordered, synthesized or collected: Potentially contaminated mussels will be collected from the Piscataqua River on October 22, 1991.

Quantity of sample ordered, collected or synthesized: Mussels will be collected from five stations. There will be four replicate baskets at each station with 25 mussels per basket.

Sample use: Retrieved mussels will be used to conduct scope for growth analyses.

Period of sample use: Arrival at ERLN to completion of analyses requires approximately 16-24 hours.

Location of sample use: Mussels will be removed from baskets in dry table and placed in small beakers inside flow through tables located in the old wet laboratory (Room 174). Remaining mussels will be distributed and packaged for chemical analyses at another facility. Mussels are transferred to clearance rate chambers in Skip's room in flow through tables for physiological analyses (clearance rates, respiration rates, length measurements, volume, and dry weights).

Procedures for proper storage of sample: No storage is required.

Location of storage: N/A.

HUMAN HEALTH RISKS (INJURY OR ILLNESS)

Human health risks:

Short-term:

INHALATION: See Appendices a,b,c, and d.

INGESTION: See Appendices a,b,c, and d.

ABSORPTION: See Appendices a,b,c, and d.

INOCULATION: See Appendices a,b,c, and d.

Long-term: See Appendices a,b,c, and d.

Procedures for proper and safe handling (to minimize human health risks):

INHALALTION: See Appendices a,b,c, and d.

INGESTION: No eating or drinking will be allowed in any laboratory area. Hands will be washed after glove contact with mussels.

ABSORPTION: Chemical splash goggles will be worn and eye baths will be available when the potential for eye contact is significant. Tyvek disposable lab coats and chemical resistant gloves will be worn to prevent skin contact.

INOCULATION: N/A.

Emergency procedures (for human health risks):

INHALATION: See Appendices a,b,c, and d.

INGESTION: See Appendices a,b,c, and d. Call the Poison Center at 8-401-277-5727.

ABSORPTION: See Appendices a,b,c, and d.

INOCULATION: N/A.

ENVIRONMENTAL RISKS (INCLUDING PROPERTY)

Environmental risks (physical properties which include flammability, pH, reactivity, etc.): N/A.

Procedures for proper and safe handling (to minimize environmental risks): N/A.

Emergency procedures (for environmental risks such as spills, environmental contamination, etc.): N/A.

MONITORING PROCEDURES

Personnel monitoring procedures (radiation badges, individual air quality detector tubes, etc.): N/A.

Monitoring procedures for environmental contamination (wipe tests, air monitoring, etc.): N/A.

DECONTAMINATION

Decontamination procedures (for exposure area and stationary equipment): Wet tables will be thoroughly rinsed with seawater.

Decontamination procedures (for non-disposable dishware): Dishware will be cleaned according to ERLN dishroom SOPs for the decontamination of glassware.

DISPOSAL

Sample disposal procedures: Mussels will be placed in ziploc bags and disposed of at a public facility.

Disposal procedures for secondary products such as contaminated tissue samples, effluents, reference sediments or animals: Mussel cages will be placed in plastic bags and disposed at a public facility.

Disposal procedures for contaminated protective clothing and disposable products: Disposable protective clothing will disposed at a public facility.

SECTION H

Please read the attached approved Health and Safety Plan, then sign and date SECTION H to indicate that you have read, understood and agree to follow the procedures described.

Name _____ Date _____

Name _____ Date _____

Name _____ Date _____

Name _____ Date _____

Name _____ Date _____

Name _____ Date _____

Name _____ Date _____

Name _____ Date _____

Name _____ Date _____

Name _____ Date _____

APPENDIX a

5700, 5701, 5702, 5703, 5704, 5705, 5706, 5707, 5708

Monsanto MATERIAL SAFETY DATA

MONSANTO PRODUCT NAME

Polychlorinated Biphenyls (PCBs)

MONSANTO COMPANY
800 N. LINDBERGH BLVD.
ST. LOUIS, MO 63167

Emergency Phone No.
(Call Collect)
314-694-1000

Date: 10/88

PRODUCT IDENTIFICATION

Synonyms:

PCBs
Chlorodiphenyl (___% Cl)
Chlorinated biphenyl
Polychlorinated biphenyl
Chlorinated biphenyls
(approx. ___% Cl)

Trade Names/ Common Names:

Aroclor®[1] Series 1016, 1221, 1232, 1242, 1248, 1254, 1260
Therminol®[1] FR Series

PYRANOL®[2] and INERTEEN®[3] are trademarks for commonly used dielectric fluids that may have contained varying amounts of PCBs as well as other components including chlorinated benzenes.

ASKAREL - Generic name for a broad class of fire-resistant synthetic chlorinated hydrocarbons and mixtures used as dielectric fluids that commonly contained about 30-70% PCBs. Some ASKAREL fluids contained 99% or greater PCBs and some contained no PCBs.

This list of trade names is representative of several commonly used Monsanto products (or products formulated with Monsanto products). Other trademarked PCB products were marketed by Monsanto and other manufacturers. PCBs were also manufactured and sold by several European and Japanese companies. Contact the manufacturer of the trademarked product, if not in this listing, to determine if the formulation contained PCBs.

[1] Registered trademark of Monsanto Company
[2] Registered trademark of General Electric Company
[3] Registered trademark of Westinghouse Electric Corporation

CAS No.'s: 001336363, 053469219, 021672296, 01109769, 011096825 and others

WARNING STATEMENTS

Federal regulations under the Toxic Substances Control Act require PCBs, PCB items, storage areas, transformer vaults, and transport vehicles to be marked. (check regulations, 40 CFR 761, for details)

CAUTION
CONTAINS
PCBs
(Polychlorinated Biphenyls)

A toxic environmental contaminant requiring special handling and disposal in accordance with U.S. Environmental Protection Agency Regulations 40 CFR 761. For Disposal Information contact the nearest U.S. E.P.A. Office.

In case of accident or spill call toll free the U.S. Coast Guard National Response Center 800 424-8802

Also Contact _____
Tel. No. _____

CAUTION —
CONTAINS
PCBs
(Polychlorinated Biphenyls)
FOR PROPER DISPOSAL INFORMATION CONTACT U.S. ENVIRONMENTAL PROTECTION AGENCY

PRECAUTIONARY MEASURES

Care should be taken to prevent entry into the environment through spills, leakage, use, vaporization, or disposal of liquid or containers. Avoid prolonged breathing of vapors or mists. Avoid contact with eyes or prolonged contact with skin. If skin contact occurs, remove by washing with soap and water. Following eye contact, flush with water. In case of spillage onto clothing, the clothing should be removed as soon as practical, skin washed, and clothing laundered. Comply with all federal, state, and local regulations.

EMERGENCY AND FIRST AID PROCEDURES

Ingestion: Consult a physician. Do not induce vomiting or give any oily laxatives. NOTE TO PHYSICIAN—If large amounts are ingested, gastric lavage is suggested.

Skin: If liquid or solid PCBs are splashed or spilled on skin, contaminated clothing should be removed and the skin washed thoroughly with soap and water. NOTE TO PHYSICIAN—Hot PCBs may cause thermal burns.

Eyes: Eyes should be irrigated immediately with copious quantities of running water for at least 15 minutes if liquid or solid PCBs get into them. A petrolatum-based opthalmic ointment may be applied to the eye to relieve the irritating effects of PCBs.

Inhalation: Remove to fresh air. If skin rash or respiratory irritation persists, consult a physician. NOTE TO PHYSICIAN—If electrical equipment arcs over, PCBs or other chlorinated hydrocarbon dielectric fluids may decompose to produce HCl, hydrochloric acid, a respiratory irritant.

OCCUPATIONAL CONTROL PROCEDURES

Eye Protection: Wear chemical splash goggles and have eye baths available where there is significant potential for eye contact.

Skin Protection: Wear appropriate protective clothing and chemical resistant gloves to prevent skin contact. Consult glove manufacturer to determine appropriate type glove for given application. Wear chemical goggles, face shield, and chemical resistant clothing such as a rubber apron when splashing is likely. Wash immediately if skin is contaminated. Remove contaminated clothing promptly and launder before reuse. Clean protective equipment before reuse. Provide a safety shower at any location where skin contact can occur. Wash thoroughly after handling.

ATTENTION! Repeated or prolonged contact may cause chloracne in some people.

Respiratory Protection: Avoid breathing vapor or mist. Use NIOSH/MSHA approved equipment when airborne exposure limits are exceeded. Full facepiece equipment is recommended and, if used, replaces need for face shield and/or chemical splash goggles. Consult respirator manufacturer to determine the type of equipment for a given application. The respirator use limitations specified by NIOSH/MSHA or the manufacturer must be observed. High airborne concentrations may require use of self-contained breathing apparatus or supplied air respirator. Respiratory protection programs must be in compliance with 29 CFR Part 1910.134.

Ventilation: Provide natural or mechanical ventilation to control exposure levels below airborne exposure limits (see below). If practical, use local mechanical exhaust ventilation at sources of air contamination such as open process equipment.

Airborne Exposure Limits: Chlorinated biphenyl (approximately 42% chlorine)

OSHA PEL: 1 mg/m³ 8-hour time-weighted average - Skin*
ACGIH TLV: 1 mg/m³ 8-hour time-weighted average - Skin*
2 mg/m³ short-term exposure limit - Skin*

**Skin notation means that skin absorption of this material may add to the overall exposure. Avoid skin contact.*

(OCCUPATIONAL CONTROL PROCEDURES continued on page 3)

OCCUPATIONAL CONTROL PROCEDURES *(continued)*

Airborne Exposure Limits (Continued): Chlorinated biphenyl (approximately 54% chlorine)

OSHA PEL: 0.5 mg/m³ 8-hour time-weighted average - Skin*
ACGIH TLV: 0.5 mg/m³ 8-hour time-weighted average - Skin*
1 mg/m³ short-term exposure limit - Skin*

**Skin notation means that skin absorption of this material may add to the overall exposure. Avoid skin contact.*

FIRE PROTECTION INFORMATION

Fire and Explosion: PCBs are fire-resistant compounds. They may decompose to form CO, CO_2, HCl, phenolics, aldehydes and other toxic combustion products under severe conditions such as exposure to flame or hot surfaces.

At temperatures in the range of 600-650°C in the presence of excess of oxygen PCBs may form polychlorinated dibenzofurans (PCDFs). Laboratory studies under similar conditions have demonstrated that PCBs do not produce polychlorinated dibenzo-p-dioxins (PCDDs).

PCBs in electrical equipment have been reported to produce both chlorinated dioxins (PCDDs) and furans (PCDFs) during fire situations. These combustion products may result all, or in part, from non-PCB components of the dielectric fluids or other combusted materials. Consult the equipment manufacturer for information regarding composition of the dielectric fluids in electrical apparatus.

Standard fire fighting wearing apparel and self-contained breathing apparatus should be worn when fighting fires that involve possible exposure to chemical combustion products. Fire fighting equipment should be thoroughly cleaned and decontaminated after use.

Federal regulations require all PCB transformers to be registered with fire response personnel.

If a PCB transformer is involved in a fire-related incident, the owner of the transformer may be required to report the incident. Consult and follow appropriate federal, state, and local regulations.

REACTIVITY DATA

PCBs are very stable, fire-resistant compounds.

HEALTH EFFECTS SUMMARY

Skin Contact: PCBs can be absorbed through intact skin. Local action on skin is similar to that of common organic solvents where contact leads to removal of natural fats and oils with subsequent drying and cracking of the skin. A potential exists for contracting chloracne.

Eye Contact: The liquid products and their vapors are moderately irritating to eye tissues.

Ingestion: The acute oral toxicities of the undiluted compounds are: LD_{50} rats—8.65 gm/kg for 42% chlorinated, and 11.9 gm/kg for 54% chlorinated—"slightly toxic."

Inhalation: Animal experiments of varying duration and at different air concentrations show that for similar exposure conditions, the 54% chlorinated material produces more liver injury than the 42% chlorinated material.

(HEALTH EFFECTS SUMMARY continued on page 4)

HEALTH EFFECTS SUMMARY *(continued)*

Other: There are literature reports that PCBs can impair reproductive functions in monkeys. The National Cancer Institute performed a study in 1977 using Aroclor 1254 with both sexes of rats. NCI stated that the PCB, Aroclor 1254, was not carcinogenic under the conditions of their bioassay. There is sufficient evidence in the scientific literature to conclude that Aroclor 1260 can cause liver cancer when fed to rodents at high doses. Similar experiments with less chlorinated PCB products have produced negative or equivocal results.

The consistent finding in animal studies is that PCBs produce liver injury following prolonged and repeated exposure by any route, if the exposure is of sufficient degree and duration. Liver injury is produced first, and by exposures that are less than those reported to cause cancer in rodents. Therefore, exposure by all routes should be kept sufficiently low to prevent liver injury.

Numerous epidemiological studies of humans, both occupationally exposed and non-worker environmentally exposed populations, have not demonstrated any causal relationship between PCB exposures and chronic human illnesses such as cancer or neurological or cardiovascular effects. PCBs can cause dermatological symptoms; however, these are reversible upon removal of exposure source.

PCBs are identified as hazardous chemicals under criteria of the OSHA Hazard Communication Standard (29 CFR Part 1910.1200). PCBs have been listed in the International Agency for Research on Cancer (IARC) Monographs (1987)-Group 2A and in the National Toxicology Program (NTP) Annual Report on Carcinogens (Fourth).

PHYSICAL DATA

PROPERTIES OF SELECTED AROCLORS®

PROPERTY	1016	1221	1232	1242	1248	1254	1260
Color (APHA)	40	100	100	100	100	100	150
Physical state	mobile oil	mobile oil	mobile oil	mobile oil	mobile oil	viscous liquid	sticky resin
Stability	inert	inert	inert	inert	inert	inert	inert
Density (lb/gal 25°C)	11.40	9.85	10.55	11.50	12.04	12.82	13.50
Specific gravity x/15.5°C	1.36-1.37 x-25°	1.18-1.19 x-25°	1.27-1.28 x-25°	1.30-1.39 x-25°	1.40-1.41 x-65°	1.49-1.50 x-65°	1.55-1.56 x-90°
Distillation range (°C)	323-356	275-320	290-325	325-366	340-375	365-390	385-420
Acidity mg KOH/g, maximum	.010	.014	.014	.015	.010	.010	.014
Fire point (°C)	none to boiling point	176	238	none to boiling point	none to boiling point	none to boiling point	none to boiling point
Flash point (°C)	170	141-150	152-154	176-180	193-196	none	none
Vapor pressure (mm Hg @ 100°F)	NA	NA	0.005	0.001	0.00037	0.00006	NA
Viscosity (Saybolt Univ. Sec. @ 100°F) (centistokes)	71-81 13-16	38-41 3.6-4.6	44-51 5.5-7.7	82-92 16-19	185-240 42-52	1800-2500 390-540	— —

NA—Not Available

SPILL, LEAK & DISPOSAL INFORMATION

Cleanup and disposal of liquid PCBs and other PCB items are strictly regulated by the federal government. The regulations are found at 40 CFR Part 761. Consult these regulations as well as applicable state and local regulations prior to any disposal of PCBs, PCB items, or PCB-contaminated items.

If PCBs leak or are spilled, the following steps should be taken immediately:

All non-essential personnel should leave the leak or spill area.

The area should be adequately ventilated to prevent the accumulation of vapors.

The spill/leak should be contained. Loss to sewer systems, navigable waterways and streams should be prevented. Spills/leaks should be removed promptly by means of absorptive material, such as sawdust, vermiculite, dry sand, clay, dirt or other similar materials, or trapped and removed by pumping or other suitable means (traps, drip-pans, trays, etc.).

Personnel entering the spill or leak area should be furnished with appropriate personal protective equipment and clothing as needed. See Occupational Control Procedures section of this MSDS.

Personnel trained in the emergency procedures and protected against the attendant hazards should shut off sources of PCBs, clean up spills, control and repair leaks and fight fires in PCB areas.

All wastes and residues containing PCBs (e.g., wiping cloths, absorbent material, used disposable protective gloves, clothing, etc.) should be collected, placed in proper containers, marked and disposed of in the manner prescribed by EPA regulations (40 CFR Part 761) and applicable state and local regulations.

Various federal, state and local regulations may require immediate reporting of PCB spills and may also define spill clean-up levels. Consult your attorney or appropriate regulatory officials for information relating to spill reporting and spill clean-up.

ENVIRONMENTAL INFORMATION

Care should be taken to prevent entry of PCBs into the environment through spills, leakage, use, vaporization or disposal of liquids or solids. PCBs can accumulate in the environment and can adversely affect some animals and aquatic life. In general, PCBs have low solubility in water, are strongly bound to soils and sediments, and are slowly degraded by natural processes in the environment.

ADDITIONAL COMMENTS

Polychlorinated Biphenyls

For regulatory purposes, under the Toxic Substances Control Act the term "PCBs" refers to a chemical substance limited to the biphenyl molecule that has been chlorinated to varying degrees or any combination of substances which contain such substance (40 CFR Part 761).

Chemically, commercial PCBs are defined as a series of technical mixtures, consisting of many isomers and compounds that vary from mobile oily liquids to white crystalline solids and hard non-crystalline resins. Technical products vary in composition, in the degree of chlorination and possibly according to batch.

The mixtures generally used contain an average of 3 atoms of chlorine per molecule (42% chlorine) to 5 atoms of chlorine per molecule (54% chlorine). They are used as components of dielectric fluids in transformers and capacitors. Prior to 1972, PCB applications included heat transfer media, hydraulic and other industrial fluids, plasticizers, carbonless paper, paints, inks and adhesives.

In 1972 Monsanto restricted sales of PCBs to applications involving only closed electrical systems (transformers and capacitors). In 1977 all manufacturing and sales were voluntarily terminated. In 1979 EPA restricted the manufacture, processing, use, and distribution of PCBs to specifically exempted and authorized activities.

FOR ADDITIONAL NON-EMERGENCY INFORMATION, CONTACT:

John H. Craddock
Product & Environmental Safety Director

Paul R. Michael
Product & Environmental Safety Manager

Environmental Policy Staff
Monsanto Company
800 North Lindbergh Boulevard
St. Louis, Missouri 63167
(314) 694-4764

APPENDIX b

Amersham Corporation
2636 South Clearbrook Drive
Arlington Heights, Illinois 60005-4692
(312) 593-6300

Amersham Canada Ltd.
505 Iroquois Shore Road
Oakville, ON L6H 2R3
(416) 842-2720

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MATERIAL SAFETY DATA SHEET

Amersham

PRODUCT: TRK662 DATE ISSUED: 08/19/85 DATE REVISED: 09/10/87
DESCRIPTION: (G-3H)BENZO(A)PYRENE
SYNONYM: 3,4-BENZPYRENE FORMULA: C20 H12

-----PHYSICAL DATA OF SOLUTION-----

BOILING PT: 111°C SPECIFIC GRAVITY: 0.9 (H2O=1)
VAPOR PRESSURE: 29MBAR @ 20°C PERCENT VOLATILE: 100
VAPOR DENSITY: 3.2 (AIR=1) SOLUBILITY IN WATER: INSOLUBLE
APPEARANCE AND ODOR: COLORLESS LIQUID WITH CHARACTERISTIC ODOR

-----HAZARDOUS INGREDIENTS > 1 % (OR 0.1% IF CARCINOGENIC)-----

SECTION FORMAT: MATERIAL | CAS# | TOXICITY DATA | TLV

TOLUENE|108-88-3|ORAL RAT LD50=5000MG/KG|100 PPM
BENZO(A)PYRENE|50-32-8|SCU RAT LD50=50MG/KG|2PPM

-----FIRE AND EXPLOSION HAZARD DATA-----

FLASH POINT: 40°F TCC FLAMMABLE LIMITS IN AIR - LEL 1% UEL 7%
EXTINGUISHING MEDIA:
CO2, DRY CHEMICAL, FOAM, HALONS
SPECIAL FIREFIGHTING PROCEDURES/UNUSUAL FIRE HAZARDS:
VAPOR FORMS EXPLOSIVE MIXTURE WITH AIR BETWEEN LOWER EXPLOSIVE LIMIT (LEL) AND UPPER EXPLOSIVE LIMIT (UEL). VAPOR IS HEAVIER THAN AIR AND MAY TRAVEL ALONG THE GROUND; DISTANT IGNITION POSSIBLE.

-----HEALTH HAZARD DATA-----

ACUTE EFFECTS OF OVEREXPOSURE:
SKIN/EYE CONTACT: REDNESS, PAIN. INHALATION: HEADACHE, NAUSEA, DIZZINESS. INGESTION: SORE THROAT, ABDOMINAL PAIN.
INGESTION: SORE THROAT, ABDOMINAL PAIN.
CHRONIC EFFECTS OF OVEREXPOSURE:
CARCINOGEN
LIVER INJURY MAY OCCUR
MAY AFFECT THE NERVOUS SYSTEM
EMERGENCY AND FIRST AID PROCEDURE:
SKIN OR EYE CONTACT: WASH WITH COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MINUTES. REMOVE CONTAMINATED CLOTHING. CALL A PHYSICIAN. INHALATION: REMOVE TO FRESH AIR. CALL A PHYSICIAN IF NECESSARY. INGESTION: RINSE MOUTH. DO NOT INDUCE VOMITING, GIVE COPIOUS AMOUNTS OF WATER TO DRINK. TRANSPORT TO A PHYSICIAN IMMEDIATELY.

-----REACTIVITY DATA -----

STABILITY:
STABLE

Amersham Corporation
2636 South Clearbrook Drive
Arlington Heights, Illinois 60005-4692
(312) 593-6300

Amersham Canada Ltd.
505 Iroquois Shore Road
Oakville, ON L6H 2R3
(416) 842-2720

Amersham

PRODUCT: TRK662 DATE ISSUED: 08/19/85 DATE REVISED: 09/10/87

INCOMPATIBILITIES:
KEEP AWAY FROM HEAT, SPARKS, IGNITION SOURCES AND OPEN FLAMES.
KEEP AWAY FROM STRONG ACIDS.

HAZARDOUS POLYMERIZATION:
WILL NOT OCCUR

HAZARDOUS DECOMPOSITION PRODUCTS:
NOT ESTABLISHED

-----SPILL OR LEAK PROCEDURES-----

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED:
TREAT AS RADIOACTIVE SPILL. DISPOSE SPILLED MATERIAL AS RADIOACTIVE WASTE.
TAKE PROPER PRECAUTIONS FOR A CARCINOGEN SPILL.

WASTE DISPOSAL METHOD:
CONSULT LOCAL, STATE AND FEDERAL REGULATIONS ON DISPOSAL OF RADIOACTIVE WASTE.

-----SPECIAL PROTECTION INFORMATION-----

RESPIRATORY PROTECTION:
SELF-CONTAINED BREATHING APPARATUS FOR FIRES AND SPILLS.

VENTILATION:
USE WITH LOCAL EXHAUST OR BREATHING PROTECTION.

PROTECTIVE GLOVES NEEDED:
NITRILE.
PVA.

EYE PROTECTION NEEDED:
SAFETY GLASSES/GOGGLES

OTHER PROTECTIVE EQUIPMENT:
LAB COAT.

-----SPECIAL PRECAUTIONS-----

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE:
USE ONLY WITH ADEQUATE VENTILATION.
AVOID CONTACT WITH EYES, SKIN OR CLOTHING.
AVOID BREATHING VAPOR/DUST.
STORE IN A COOL, DRY PLACE AWAY FROM IGNITION SOURCES.

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Amersham

PRODUCT: TRK662 DATE ISSUED: 08/19/85 DATE REVISED: 09/10/87

MATERIAL SAFETY DATA SHEET
STANDARD FORM DISCLAIMER

THE ABOVE INFORMATION IS BASED ON DATA AVAILABLE TO US AND IS BELIEVED TO BE CORRECT, BUT DOES NOT INTEND TO BE ALL-INCLUSIVE AND SHALL BE USED ONLY AS A GUIDE. SINCE THE INFORMATION CONTAINED HEREIN MAY BE APPLIED UNDER CONDITIONS BEYOND OUR CONTROL AND WITH WHICH WE MAY BE UNFAMILIAR, WE DO NOT ASSUME ANY RESPONSIBILITY FOR THE RESULTS OF ITS USE.

APPENDIX c

HANDBOOK OF TOXIC AND HAZARDOUS CHEMICALS AND CARCINOGENS

Second Edition

by

Marshall Sittig

Princeton University

np NOYES PUBLICATIONS
Park Ridge, New Jersey, U.S.A.

Library of Congress Catalog Card Number: 84-22755
ISBN: 0-8155-1009-8
Printed in the United States

Published in the United States of America by
Noyes Publications
Mill Road, Park Ridge, New Jersey 07656

10 9 8 7 6 5 4 3 2 1

Library of Congress Cataloging in Publication Data

Sittig, Marshall.
Handbook of toxic and hazardous chemicals and carcinogens.

Bibliography: p.
Includes index.
1. Poisons--Dictionaries. 2. Hazardous substances--Dictionaries. 3. Carcinogens--Dictionaries. I. Title.
RA1193.S58 1985 615.9'02 84-22755
ISBN 0-8155-1009-8

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5-30-85 Rec. # 3166

chemical contacts the skin, wash with soap promptly. If a person breathes in large amounts of this chemical, move the exposed person to fresh air at once and perform artificial respiration. When this chemical has been swallowed, get medical attention. Give large quantities of water and induce vomiting. Do not make an unconscious person vomit.

Personal Protective Methods: Wear appropriate clothing to prevent repeated or prolonged skin contact. Wear eye protection to prevent any reasonable probability of eye contact. Employees should wash promptly when skin is wet or contaminated. Work clothing should be changed daily if clothing is contaminated. Remove nonimpervious clothing promptly if wet or contaminated.

Respirator Selection:

100 mg/m^3: CCROVDPest/SA/SCBA
500 mg/m^3: CCROVFDPest/DMOVDMPest/SAF/SA:PD,PP,CF/SCBAF
Escape: GMOVPPest/SCBA

Disposal Method Suggested: Incineration of phenoxys is effective in one second at 1800°F using a straight combustion process or at 900°F using catalytic combustion. Over 99% decomposition was reported when small amounts of 2,4-D were burned in a polyethylene bag (A-32).

References

(1) U.S. Environmental Protection Agency, *2,4-Dichlorophenoxy Acetic Acid,* Health and Environmental Effects Profile No. 77, Washington, DC, Office of Solid Waste (April 30, 1980).
(2) See Reference (A-61).
(3) United Nations Environment Programme, *IRPTC Legal File 1983,* Vol. I, pp VII/8-11, Geneva, Switzerland, International Register of Potentially Toxic Chemicals (1984).

DDT

- Carcinogen (Animal suspected, IARC) (4) (Potential, EPA) (A-40). (Negative, NCI) (5)
- Hazardous substance (EPA)
- Hazardous waste (EPA)
- Priority toxic pollutant (EPA)

Description: $ClC_6H_4\overset{\overset{CCl_3}{|}}{C}HC_6H_4Cl$ is a waxy solid of indefinite melting point with a weak, chemical odor.

Code Numbers: CAS 50-29-3 RTECS KJ3325000 UN (NA 2761)

DOT Designation: ORM-A

Synonyms: p,p'-DDT, 2,2-bis(p-chlorophenyl)-1,1,1-trichloroethane, dichlorodiphenyltrichloroethane, ENT 1506, dicophane, chlorophenothane, Gesarol®, Guesarol® and Neocid®.

Potential Exposure: DDT is a low-cost broad-spectrum insecticide. However, following an extensive review of health and environmental hazards of the use of DDT, U.S. EPA decided to ban further use of DDT in December 1972. This decision was based on several properties of DDT that had been well evidenced: (1) DDT and its metabolites are toxicants with long-term persistence in soil

and water; (2) it is widely dispersed by erosion, runoff and volatilization; and (3) the low-water solubility and high lipophilicity of DDT result in concentrated accumulation of DDT in the fat of wildlife and humans which may be hazardous.

Human exposure to DDT is primarily by ingestion of contaminated food. Air and water intake is negligible and amounts to probably less than 0.01 mg/yr. Therefore, by EPA estimate total intake of DDT/yr for the average U.S. resident will be less than 3 mg/yr.

The entire population of the U.S. thus has some low level exposure to dietary contaminants. Minimal exposure from air and water sources, however, may be more important in previously heavily sprayed agricultural areas, where large amounts of residues may still be present. Groups at special risk are workmen in manufacturing plants and formulating plants and applicators, handlers and sprayers.

During such times as when exceptions are granted by the U.S. EPA for crop usage or during use for public health measures, those involved in handling or applying DDT may have considerable exposure.

Estimating the number of individuals at high risk due to occupational exposure is difficult. It is estimated that 8,700 workers are involved in formulating or manufacturing all pesticides. Since DDT constitutes much less than 10% of the total, the maximal number of exposed workers would be ~500. Since usage of DDT is severely limited, persons exposed by application would probably be fewer.

Incompatibilities: Strong oxidizers.

Permissible Exposure Limits in Air: The Federal limit and the 1983/84 ACGIH TWA value is 1 mg/m^3. The STEL value is 3 mg/m^3. The IDLH level has not been set.

Determination in Air: Collection on a filter, workup with isooctane, analysis by gas chromatography. See NIOSH Methods, Set S. See also reference (A-10).

Permissible Concentration in Water: To protect freshwater aquatic life—0.0010 μg/ℓ as a 24 hr average; never to exceed 1.1 μg/ℓ. To protect saltwater aquatic life—0.0010 μg/ℓ as a 24 hr average; never to exceed 0.13 μg/ℓ. To protect human health—preferably zero. An additional lifetime cancer risk of 1 in 100,000 is imposed by a level of 0.24 ng/ℓ (0.00024 μg/ℓ).

Determination in Water: Gas chromatography (EPA Method 608) or gas chromatography plus mass spectrometry (EPA Method 625).

Routes of Entry: Inhalation, skin absorption, ingestion, eye and skin contact.

Harmful Effects and Symptoms: DDT is of moderate acute toxicity to man and most other organisms. However, its extremely low solubility in water (0.0012 ppm) and high solubility in fat (100,000 ppm) result in great bioconcentration. Its principal breakdown product, DDE (3), has very similar properties. Both compounds are also highly persistent in living organisms, so the major concern about DDT toxicity is related to its chronic effects (A-3).

Symptoms include paresthesia of tongue, lips and face; tremors; apprehension, dizziness, confusion, malaise, headaches; convulsions; paresis of the hands; vomiting; irritation of eyes and skin.

Points of Attack: Central nervous system, liver, kidneys, skin, peripheral nervous system.

Medical Surveillance: Consider the points of attack in preplacement and periodic physical examinations.

First Aid: If this chemical gets into the eyes, irrigate immediately. If this chemical contacts the skin, wash with soap promptly. If a person breathes in large amounts of this chemical, move the exposed person to fresh air at once and perform artificial respiration. When this chemical has been swallowed, get medical attention. Give large quantities of water and induce vomiting. Do not make an unconscious person vomit.

Personal Protective Methods: Wear appropriate clothing to prevent repeated or prolonged skin contact. Wear eye protection to prevent any reasonable probability of eye contact. Employees should wash promptly when skin is wet or contaminated. Work clothing should be changed daily if it is possible that clothing is contaminated. Remove nonimpervious clothing promptly if wet or contaminated.

Respirator Selection:

10 mg/m^3: CCROVDMPest/SA/SCBA
50 mg/m^3: CCROVFDMPest/GMOVDMPest/SAF/SCBAF
500 mg/m^3: CCROVHiEPest/SA:PD,PP,CF

Disposal Method Suggested: Incineration has been successfully used on a large scale for several years and huge incinerator equipment with scrubbers to catch HCl, a combustion product, are in use at several facilities such as Hooker Chemical, Dow Chemical and other producers of chlorinated hydrocarbon products. One incinerator operates at 900° to 1400°C with air and steam added which precludes formation of Cl_2. A few companies also construct incinerator-scrubber combinations of smaller size, e.g., a system built by Garver-Davis, Inc., of Cleveland, Ohio, for the Canadian government can handle 200 to 500 lb DDT/day as a kerosene solution (A-32).

References

(1) U.S. Environmental Protection Agency, *DDT: Ambient Water Quality Criteria,* Washington, DC (1980).
(2) U.S. Environmental Protection Agency, *DDT* Health and Environmental Effects Profile No. 60, Washington, DC, Office of Solid Waste (April 30, 1980).
(3) U.S. Environmental Protection Agency, *DDE* Health and Environmental Effects Profile No. 59, Washington, DC, Office of Solid Waste (April 30, 1980).
(4) International Agency for Research on Cancer, *IARC Monographs on the Carcinogenic Risks of Chemicals to Humans,* Lyon, France, 5, 83 (1974).
(5) National Cancer Institute *Bioassay of DDT, TDE and DDE for Possible Carcinogenicity,* Technical Report Series No. 131, Bethesda, MD (1978).
(6) World Health Organization, *DDT and Derivatives,* Environmental Health Criteria No. 9, Geneva, Switzerland (1979).
(7) Sax, N.I., Ed., *Dangerous Properties of Industrial Materials Report, 1,* No. 3, 51-54, New York, Van Nostrand Reinhold Co. (1981).
(8) Parmeggiani, L., Ed., *Encyclopedia of Occupational Health & Safety,* Third Edition, Vol. 1, pp 592-93, Geneva, International Labour Office (1983).
(9) United Nations Environment Programme, *IRPTC Legal File 1983,* Vol. I, pp VII/328-31, Geneva, Switzerland, International Register of Potentially Toxic Chemicals (1984).

DECABORANE

Description: $B_{10}H_{14}$ is a colorless solid with a pungent odor. It melts at 100°C.

Code Numbers: CAS 17702-41-9 RTECS HD1400000 UN 1868

OSHA Designation: Flammable Solid and Poison

APPENDIX d

Material Safety Data Sheet

From Genium's Reference Collection
Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
(518) 377-8855

GENIUM PUBLISHING CORP.

No. 26

MERCURY
(Revision C)
Issued: September 1981
Revised: August 1988

SECTION 1. MATERIAL IDENTIFICATION 26

Material Name: MERCURY

Description (Origin/Uses): Used in barometers, thermometers, hydrometers, and pyrometers; in mercury arc lamps producing ultraviolet rays; in switches and fluorescent lamps; as a catalyst in oxidations of organic compounds; in alloys; in explosives; and for extracting gold and silver from ore.

Other Designations: Colloidal Mercury; Metallic Mercury; Quicksilver; Hg; Hydrargyrum; CAS No. 7439-97-6

Manufacturer: Contact your supplier or distributor. Consult the latest edition of the *Chemicalweek Buyers' Guide* (Genium ref. 73) for a list of suppliers.

Comments: Inorganic and organic mercury compounds are highly toxic, as is pure mercury.

Genium

HMIS			
H	3	R	1
F	0	I	4
R	0	S	1
PPG*		K	0

*See sect. 8

SECTION 2. INGREDIENTS AND HAZARDS / EXPOSURE LIMITS

Ingredients	%	Exposure Limits
Mercury, CAS No. 7439-97-6	Ca 100	**OSHA PEL** Ceiling: 1 mg per 10 m³ **ACGIH TLV (Skin*), 1987-88** TLV-TWA: 0.05 mg/m³ as Hg (Mercury Vapor) **Toxicity Data**** Rabbit, Inhalation, LC_{Lo}: 29 mg/m³ (30 Hrs)

*Mercury can be absorbed through intact skin, which contributes to overall exposure.

**See NIOSH, *RTECS* (OV4550000), for additional data with references to reproductive, mutagenic, and tumorigenic effects.

SECTION 3. PHYSICAL DATA

Boiling Point: 673°F (357°C)
Specific Gravity (H_2O = 1): 13.546 at 68°F (20°C)
Vapor Pressure: 0.0018 Torr at 77°F (25°C)
Water Solubility (%): Insoluble
Molecular Weight: 201 Grams/Mole
Melting Point: -37.93°F (-38.85°C)

Appearance and Odor: A silver, heavy liquid; odorless. **Danger:** Mercury vapor has no warning properties.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temperature	Flammability Limits in Air % by Volume	LOWER	UPPER
*	*		*	*

Extinguishing Media: *Mercury does not burn. Use extinguishing agents that will put out the surrounding fire.

Unusual Fire or Explosion Hazards: When exposed to the high temperatures that occur during a fire, mercury can vaporize to form extremely toxic fumes.

Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

SECTION 5. REACTIVITY DATA

Mercury is stable in closed containers at room temperature under normal storage and handling conditions. It cannot undergo hazardous polymerization.

Chemical Incompatibilities: Hazardous reactions involving mercury and acetylene, ammonia, boron phosphodiiodide, chlorine, chlorine dioxide, methyl azide, sodium carbide, nitric acid, oleum, and sulfuric acid are reported (Genium ref. 84).

Conditions to Avoid: Do not expose mercury to incompatible chemicals.

Hazardous Products of Decomposition: Extremely toxic mercury metal fumes are likely to be produced during fires.

SECTION 6. HEALTH HAZARD INFORMATION

Mercury is not listed as a carcinogen by the NTP, IARC, or OSHA.

Summary of Risks: Mercury is very toxic due to its liquid and fat solubility, lack of charge, and membrane permeability. It is a slowly cumulative poison that concentrates in the brain, kidneys, and liver. It is very hazardous when spilled or heated. Mercury and its vapor are rapidly absorbed by the membranes lining the respiratory tract, the gastrointestinal (GI) tract, and the skin. Mercury is a teratogen (causes physical defects in embryos). **Medical Conditions Aggravated by Long-Term Exposure:** Preexisting problems of the target organs can be worsened. Provide preplacement and periodic medical exams emphasizing the target organs. **Target Organs:** Skin, eyes, respiratory system, central nervous system (CNS), kidneys. **Primary Entry:** Skin absorption/contact, inhalation. **Acute Effects:** Erosion of the respiratory/GI tracts, nausea, vomiting, bloody diarrhea, shock, headache, metallic taste. Inhalation of high concentrations for short periods can cause pneumonitis, chest pain, dyspnea, coughing, stomatitis, gingivitis, and salivation. **Chronic Effects:** Tremors, emotional problems, loss of concentration, depression, drowsiness, fatigue, insomnia, loss of memory, kidney problems, eye lesions, vision disturbances, sore mouth and throat, problems with the sense of taste or smell, nosebleeds, nasal inflammation, loss of weight or appetite, poor hand-eye coordination, awkwardness, and unsteadiness, as well as dermatitis. **FIRST AID: Eyes.** Immediately flush eyes, including under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes. **Skin.** Immediately wash the affected area with soap and water because of the increased exposure from skin absorption. **Inhalation.** Remove exposed person to fresh air; restore and/or support his or her breathing as needed. Have medical personnel administer oxygen to treat the chemical pneumonitis that may develop. **Ingestion.** Never give anything by mouth to someone who is unconscious or convulsing. Note to physician: If indicated by degree of ingestion, saline cathartics and charcoal should be used. Chelation therapy with d-penicillamine may also be indicated.

GET MEDICAL HELP (IN PLANT, PARAMEDIC, COMMUNITY) FOR ALL EXPOSURES. Seek prompt medical assistance for further treatment, observation, and support after first aid. Treatment of chronic mercury poisoning requires expert medical care. At the first signs, immediately remove the exposed person from further exposure and have him or her examined and treated by a physician trained in occupational mercury poisoning.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Notify safety personnel, restrict access to the spill area to necessary personnel, and provide adequate ventilation. Clean up spills promptly. Specialized equipment and/or techniques may be required to safely deal with large mercury spills; if large quantities of mercury are used in the workplace, detailed, prior spill-management planning is recommended. Collect spilled mercury by using a suction pump and an aspirator bottle with a long capillary tube. For finely divided mercury in inaccessible cracks, corners, etc., treatment with calcium polysulfide and excess sulfur is recommended to convert the mercury globules into mercury sulfide. Vacuum cleaners may be used if they are equipped with specially designed mercury-absorbent exhaust filters. Collect the mercury into tightly sealed containers for later disposal or reclamation. Cleanup personnel must use the recommended personal protective equipment (see sect. 8).

Waste Disposal: Consider reclamation, recycling, or destruction rather than disposal in a landfill. Do not pour mercury down a drain. Mercury is very harmful to the environment. Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations.

OSHA Designations

Air Contaminant (29 CFR 19010.1000 Subpart Z)

EPA Designations (40 CFR 302.4)

RCRA Hazardous Waste No. U151

CERCLA Hazardous Substance, Reportable Quantity: 1 lb (0.454 kg)*

*Per the Clean Water Act, § 407 (a); Clean Air Act, § 112; and Resource Conservation and Recovery Act, § 3001.

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Where splashing of mercury may occur, wear a full face shield or splash guard. Follow OSHA eye- and face-protection regulations (29 CFR 1910.133).

Respirator: Use a NIOSH-approved respirator per the *NIOSH Pocket Guide to Chemical Hazards* for the maximum-use concentrations and/or the exposure limits cited in section 2. Follow OSHA respirator regulations (29 CFR 1910.134). **Other:** Wear impervious gloves, boots, aprons, gauntlets, etc., to prevent any contact with mercury and the skin.

Ventilation: Install and operate general and local ventilation systems powerful enough to continuously maintain airborne levels of mercury below the OSHA PEL standard cited in section 2.

Safety Stations: Make emergency eyewash stations, washing facilities, and safety/quick-drench showers available in work areas.

Contaminated Equipment: Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them. Do *not* wear contact lenses in any work area. Remove contaminated clothing and launder it before wearing it again; clean mercury from shoes and equipment. Separate work and street clothes; store work clothes in special lockers and always shower before changing to street clothes.

Comments: Practice good personal hygiene; always wash thoroughly after using this material. Keep it off of your clothing and equipment. Avoid transferring it from your hands to your mouth while eating, drinking, or smoking. Do *not* eat, drink, or smoke in any work area.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage/Segregation: Store mercury in a cool, dry, well-ventilated area in tightly closed unbreakable polyethylene containers. Protect these containers from physical damage.

Special Handling/Storage: Construct storage areas to have smooth, hard, nonporous floors with no cracks or spaces so that spilled mercury globules do not form in inaccessible areas.

Comments: Mercury evaporates slowly, but if it is spilled it can form many tiny globules that evaporate much faster than a single pool of it will. In an unventilated area, significant concentration of mercury vapor can develop from this enhanced evaporation effect. This poisonous vapor is particularly hazardous if breathed over a long period of time, so spills or releases of mercury require very meticulous cleaning procedures.

Transportation Data (49 CFR 172.101-2)

DOT Shipping Name: Mercury, Metal
DOT Hazard Class: ORM-B

DOT Label: None
DOT ID No. NA2809

IMO Class: 8
IMO Label: Corrosive

References: 1, 2, 8, 26, 38, 84-94, 100.

Prepared by PJ Igoe, BS

Industrial Hygiene Review: DJ Wilson, CIH

Medical Review: MJ Hardies, MD

APPENDIX C

LABORATORY PROCESSING OF FIELD COLLECTED *AMPELISCA*

Field collected *Ampelisca abdita* are sieved out of their tubes and sediment in order to be sized and counted. The amphipods are then held in press sieved collection site sediment for at least 48 hrs before being used in toxicity test. Ambient temperature seawater is used throughout this process so as to assimilate field collection temperature and reduce any stresses associated with temperature differences.

1.0 Assemble all materials for sieving:

large (32" diameter) 0.5 mm sieve
large (32" diameter) 2.0 mm sieve
sizing sieves (12" diameter):
1.7 mm, 1.0 mm, .71 mm, .50 mm
two aquarium fish nets
four large Carolina (or similar) dishes
small specimen cups, one for each holding jar
squeeze bottle containing seawater
two wide bore pipettes with bulbs
holding jars

2.0 Seiving out field collected *Ampelisca*

2.1 Rinse and half-fill Carolina dishes with ambient temperature seawater.

2.2 Spray ambient temperature seawater into field collection bucket to loosen the amphipods from the sediment.

2.3 Pour half of a bucket's contents (tubes and sediment) onto large 2.0 mm sieve which is inserted into the large 0.5 mm sieve. (Sieves are set up over a settling bin to catch sediment)

2.4 Spray the material on the sieve with moderate force by pinching the end of the hose to loosen the amphipods from the tubes and sediment.

2.5 Remove the 2.0 mm sieve when all the material has been sprayed thoroughly.

2.6 Vigorously shake and slap the 0.5 mm sieve up and down (works best with 2 people) .

2.7 Gently lower the 0.5 mm sieve into the water without completely submerging it so that amphipods float. Skim the amphipods from the surface of the water within the sieve using an aquarium net and transfer the amphipods to a Carolina dish. Repeat the shaking and skimming process until only a few amphipods remain in the sieve.

2.8 Pour more material into the sieve from the field bucket and repeat the above process; occasionally cleaning debris and tubes out from the 2.0 mm sieve.

3.0 Sizing *Ampelisca*

3.1 Rinse and half-fill three Carolina dishes. Label them S, M, and L.

3.2 Stack the sieves in ascending order (0.5 mm on bottom, .71 mm , 1.0mm, and 1.7 mm on top).

3.3 Pour collected amphipods slowly onto the 1.7 mm sieve

3.4 Thoroughly, but gently, rinse the amphipods through the stacked sieves to separate them by size.

3.5 Using a squeeze bottle, rinse each sieve into the appropriate Carolina dish.

4.0 Counting out *Ampelisca.*

4.1 Take out as many specimen cups as you have holding jars.

4.2 Rinse and half-fill specimen cups with seawater.

4.3 Randomly pipette 10 medium size amphipods (those from the 1.0 mm sieve) into each specimen cup until each cup contains a maximum of 350 amphipods. If there are not enough medium size amphipods, use the small (0.71 mm) amphipods. These amphipods can be added until 350 is reached.

4.4 Record the number of animals/holding jar on the Field / Holding Data sheet, along with the sizes used.

5.0 Adding the amphipods to the holding jars (see SOP # AMP-02 for setting up holding jars).

5.1 Turn off the air leading to the holding jars and gently remove approximately 150 ml of water from each jar.

5.2 Empty one specimen cup of amphipods into each holding jar; swirling cup to break up any clumps of amphipods. Push amphipods stuck on the air-water interface down with fingers.

5.3 Wait a few minutes for the amphipods to swim down to the sediment surface then turn the air to the jars back on.

6.0 Clean all equipment with fresh water.

HOLDING OF *AMPELISCA* PRIOR TO TESTING (STATIC-RENEWAL)

Field collected *Ampelisca abdita* are held under static conditions. They should be held in 4 liter holding jars for at least 48 hrs (but no longer than 10 days) under test temperature and salinity conditions before being used for toxicity testing. Seawater is renewed (approximately 75%) and animals fed each weekday. No renewal or feeding is done on the weekends.

1.0 Holding jars should be set up 24 hours before animals are collected. They are placed in a controlled temperature culture box or waterbath, and aerated. The initial temperature of the seawater in the holding jars is no more than 3 degrees C higher than the field temperature.

2.0 Place approximately 4 cm of Collection site sediment into holding jar. Rinse down sides with seawater from squeeze bottle or low pressure seawater line to remove excess sediment from the sides.

3.0 Add amphipods to the holding jars (see SOP # AMP-01 sect. 5.0).

4.0 Place airline with attached pipet into holding jar so that it is approximately 6 cm below the water surface. Use gentle aeration.

5.0 Seawater renewal and feeding (seawater renewal should take place in the morning and feeding in the afternoon)

- 5.1 Remove airlines.
- 5.2 Check for any emerged amphipods, if any gently prod down to encourage burrowing.
- 5.3 Siphon off approximately 75% of water volume.
- 5.4 Refill with clean seawater (for renewal) or 1 liter of diatom culture, *Phaeodactylum,* and clean seawater (for feeding), using a turbidity reducer so as not to disturb tubes or sediment.
- 5.5 Replace airlines.
- 5.6 Cover Holding jars to simulate night time conditions and enhance feeding conditions.... IMPORTANT : Cover to enhance feeding...

5.0 Monitor temperature daily and record on Holding/Field data sheet. If amphipods require temperature acclimation to 20 C, the temperature is increased or decreased by 3 C per day and recorded on Holding data sheet.

6.0 Temperature can be increased no more than 3 C per day and animals should be maintained at 20 C for at least 48 hr prior to use in test.

PRESS SIEVING SEDIMENT FOR TOXICITY TESTS

Sediment samples are press sieved through a 2.0 mm sieve in order to remove large debris or predators. If a sample contains amphipods, the sample is press sieved first through a 2.0 mm and then a 1.0 mm sieve in an attempt to remove the resident amphipods.

1.0 Materials needed:
- 12", 2.0 mm sieve
- 12", 1.0 mm sieve
- round plastic bin
- Plexiglas paddle
- nylon spoon and spatula
- seawater for rinsing sieves, bin, etc.

2.0 Wear appropriate safety gloves, lab coat and eye protection.

3.0 Pour, or scoop with nylon spoon, entire contents of sample container into sieve. **DO NOT ADD ANY WATER!**

4.0 Push sediment through 2.0 sieve with Plexiglass paddle or nylon spoon. NOTE: If sample contains resident amphipods stack the 2.0 mm sieve on top of the 1.0 mm sieve and press sediment through both sieves.

5.0 Rinse out sample container with seawater.

6.0 Homogenize sieved sediment by stirring and return to original container or add to test chambers.

7.0 Label sample container "PRESS SIEVED" , and date of sieving.

8.0 Between each sample, rinse all equipment into settling tank using seawater. After the last sample has been sieved rinse all equipment with tap water and then with DI water. Follow "Glassware" SOP for final clean-up.

PREPARING TEST CHAMBERS FOR AMPELISCA TOXICITY TESTS

Test chambers are quart-size canning jars with metric markings. A small glass dish with a hole drilled for an air line is used as a lid. Test chambers are prepared the day before sediments are added.

1.0 Assemble materials needed:
- seawater (not more than 48 hrs old)
- test chambers and lids
- labeling tape
- waterproof marker
- randomization sheet

2.0 Fill out randomization sheet by picking numbers (1 through N, where N = the total number of jars for the test series) out of container. Sign and photocopy randomization sheet and place original in appropriate test folder.

3.0 Label test chambers and lids with colored tape and waterproof marker. (Number 1 through N). On the lids circle the numbers that correspond to the first two replicates of each group. These two replicates will be used for physical data measurements.

4.0 One other person must check the randomization sheet and sign to assure that no numbers are duplicated.

5.0 Fill test chambers with seawater and cover. Allow to soak overnight.

ADDING SEDIMENTS TO AMPELISCA TEST CHAMBERS

1.0 Sediments are added to test chambers the day before the animals are added. Wear appropriate safety gloves, lab coat and eye protection.

2.0 Materials needed:
- sediment sample(s)
- control sediment
- turbulence reducer(s) (a device used to keep sediment from mixing into the water column)
- plastic spoons and spatulas
- sponge
- squeeze bottle filled with seawater
- randomization sheet
- modified funnels (cut off at neck)
- electric drill and Teflon coated paddle

3.0 Homogenize previously press sieved sediment sample using an electric drill and a Teflon coated paddle. (Not all samples will have been previously press sieved. See SOP # AMP-03 for this procedure.)

4.0 For each sediment sample check the randomization sheet and select the appropriately numbered jars for that sample. Record the necessary information on the randomization sheet (ie. sample # description)

5.0 Pour or scoop ca. 200 ml of homogenized sediment through a modified funnel into each test chamber using the metric markings already on the quart jars for measuring. Gently tap test chamber or smooth sediment surface with a spatula to eliminate air pockets.

6.0 Rinse all mud from sides of test chamber using a squeeze bottle filled with seawater at 30 ppt.

7.0 Using a turbulence reducer, slowly add ca. 600 ml of seawater to test chamber and place cover on chamber.

8.0 Transfer test jars to waterbath table.
- 8.1 Place test chambers in table in numerical order, in groups of five (to make air tubes easier to connect).
- 8.2 Put pipettes in test chambers so that the tip of the pipette is approximately half way down the water column (between the 400 and 600 ml mark).
- 8.3 Attach air lines to pipettes and turn on air pump.
- 8.4 Check all test chambers to make sure air is bubbling through pipettes.
- 8.5 Adjust 'gang' valves for gentle aeration, if necessary.

SIEVING *AMPELISCA* FROM HOLDING JARS

Although animals are kept at ETC, the holding jars are sieved at the "ARK" because flowing seawater with pressure is required for this task. This task is done the morning that the amphipods are scheduled to go into the test to begin the 10 day sediment toxicity test.

1.0 Material needed for sieving.
- two, 12" 0.5 mm sieves
- two, aquarium fish nets
- two, large Carolina dishes
- same number of transfer containers (plastic dishes) as holding jars
- same number of specimen cups as holding jars
- large plastic tray with drains
- squeeze bottles filled with seawater (30 ppt salinity)
- large round settling bin

2.0 Place large plastic tray onto the cinder blocks in round bin.

3.0 Fill Carolina dishes half full with seawater.

4.0 Carefully pour off a small amount of water before bringing holding jar to bin.

5.0 Over the large plastic tray, pour contents of holding jar into 0.5 mm sieve and sieve as usual (see SOP AMP-01 sect.2.4). NOTE: Try to spray all tubes individually, so that very few animals remain in tubes.
- 5.1 Repeat process until no amphipods come out.
- 5.2 Rinse down tubes and place into specimen cup. DO NOT CAP.
- 5.3 Pour pods from dish into transfer container. DO NOT CAP.
- 5.4 Rinse net into sieve to ensure all animals have been retrieved.

6.0 Repeat Step 5 for each holding jar and be sure that the animals from each are kept in separate transfer containers (to keep track of any mortality).

7.0 Rinse all equipment with deionized water. This includes holding jars and buckets.

8.0 Return all equipment to appropriate storage area.

9.0 Cap all transfer containers and specimen cups for transport to ETC for use.

10.0 At ETC pour contents of jars into separate, labelled Carolina dishes and aerate.

COUNTING *AMPELISCA* INTO TEST CHAMBERS

Under normal testing procedures, 20 animals are placed into each test chamber. These amphipods are randomly distributed to all specimen cups before being transferred to test chambers.

1.0 Assemble materials needed:
Ampelisca from holding jars (See SOP #AMP-06)
pipettes with bulbs
one specimen cup for each test chamber and reference toxicant replicate
clean seawater (30 ppt; 20 C)
"specimen cup" sieve
squeeze bottle with seawater
Carolina (or similar) dish for each holding jar

2.0 Count out the number of specimen cups needed; one for each test chamber, one for each reference toxicant replicate, one for later sizing of the animals, and a few extra for dead and gravid animals. Fill each cup approximately half full of seawater.

3.0 Determine initial amphipod mortality in holding jars, for each jar used.
- 3.1 Remove all suspected dead amphipods. Determine condition under a stereomicroscope.
- 3.2 Record only the number of dead, if greater than 5% mortality animals from that jar should not be used for testing.

4.0 Adding animals to specimen cups:
- 4.1 20 animals are added into each specimen cup in a random fashion.
- 4.2 Determine the number of animals that can be used from each holding jar by dividing 20 by the number of holding jars. (The amphipods from each holding jar are now contained in a carolina dish; one for each holding jar. See SOP# AMP-06, sect. 10.0)
- 4.3 Using a pipette select healthy looking, non-gravid amphipods two or three at a time, and place into specimen cups.
- 4.4 Switch Carolina dishes and add 2-3 more amphipods to each cup.
- 4.5 Continue switching dishes until each cup contains 10 amphipods. Separate the number of cups needed for the reference test.
- 4.6 Continue to switch dishes until all remaining cups contain 20 animals. (If there are not enough animals the test may be performed with as few as 15 animals if the client agrees; check with lab manager)

5.0 Adding animals to test chambers.
- 5.1 Gently pour contents of specimen cup into a screened bottom transfer cup.
- 5.2 Verify amphipod count and check again for gravid females and remove, add additional amphipods from Carolina dishes if needed.

5.3 After count has been verified pour the amphipods from the screened bottom transfer cup into the test chamber using a squeeze bottle filled with 30 ppt , 20 C seawater. Squirt sides of transfer cup and assure that all amphipods were transferred to test chamber.

5.4 Using the squeeze bottle again, squirt down the sides of the test chamber making sure all amphipods are in the water column.

5.5 Gently prod any floating amphipods with pipette so that the amphipods will swim down and bury into the sediment.

5.6 Check test chamber carefully for any amphipods stuck on sides of chamber or floating on surface.

5.7 After waiting approximately 1 hr after adding amphipods to test chambers, check all chambers for any " floaters'' or any amphipods that have not buried into sediment and replace these.

5.8 Record any replacements made on the Day 0 Data sheet for that test.

DAILY OBSERVATIONS OF AMPELISCA TOXICITY TEST

Daily observations are made on each test container to check for emerged or dead amphipods and the presence of any molts, Salinity, pH and dissolved oxygen are recorded twice during the test; once on day one and again near the end of the test (preferably on day nine).

1.0 Make sure lab coats,latex gloves, and safety glasses are worn while checking test.

2.0 Check temperature recorder and note any irregularities. Read regular thermometer and record temperature.

3.0 Check test jars for emerged amphipods and molts.

- 3.1 Remove aeration pipette and lid from test chamber.
- 3.2 Rinse inside edge of chamber with seawater from squeeze bottle.
- 3.3 Look into chamber for emerged amphipods or molts and remove with a clean pipette.
- 3.4 Place amphipods/molts into petri dish and examine under dissecting microscope.
- 3.5 Emerged amphipods should be classified as one of the following:
  Dead--usually exhibit the following: not curled up; body is soft; gut is empty; may be desintegrating; when gently touched with probe, the legs and antennae do not move; and there is no neuromuscular twitch.
  Neuromuscular twitch (NMT)--appears dead, but when gently touched with probe near the legs or midsection, one or two legs may kick spasmodically.
  Emerged--any live amphipod not burrowed in the sediment, i.e. floating, swimming, or lying on the surface of sediment.
  Molt--usually exhibits the following: transparent; no eyes; no gut; and appears hollow.
- 3.6 Return emerged and NMT animals to test chambers; dispose of molts and dead animals. Record data on daily data sheets.
- 3.7 Replace lid and pipette on chamber.
- 3.8 Between each test chamber, rinse sampling pipette inside and out with seawater. When all chambers have been checked, rinse probes, pipettes, etc. with deionized water and let air dry on a paper towel. Wipe down microscope and turn off light.

4.0 On days one and nine check dissolved oxygen concentration, pH and salinity in all pre-selected jars. See separate SOP's for each of these measurements.

5.0 End test on day 10: Check test as usual except emerged and NMT animals are placed into corresponding vials (instead of being returned to jars) and indicated on breakdown sheet. Rinse tools used to check test and place in dirty dish bin.

SIEVING AMPELISCA FOR TEST BREAKDOWN

When ending the 10 day sediment toxicity test, sediment in the individual test chambers must be sieved and the contents of the sieve must be picked through in order to count surviving amphipods.

1.0 Wear appropriate safety gloves, lab coat and eye protection.

2.0 Assemble all materials in sieving area (one/ sieving station):
- 0.5 mm sieve
- plastic grate
- plastic bin/basin
- bucket with drainage hole
- large Carolina dish
- seawater squeeze bottle
- pipette
- forceps
- one medium size carolina dish (labelled the same as corresponding test chamber.)

3.0 Select a test chamber and corresponding medium Carolina dish. Sieve out reps 1-3 first. This is done so that these samples are sieved and picked first and if preserving of samples is necessary, reps 4 and 5 of each sediment sample will be preserved and picked later.

4.0 Empty test chamber into sieve over the bucket.

5.0 Rinse the sediment through sieve using a moderate force tap water spray, then rinse the remaining material in sieve with seawater squeeze bottle.

6.0 Place the labeled medium Carolina dish inside the large Carolina dish. Use the seawater squeeze bottle to rinse the material from the sieve into the medium Carolina dish. Check the large Carolina dish for any spillage, and pipette or pour into medium Carolina dish.

7.0 Gently submerge the sieve to make sure no pods or tubes remain on the sieve. Use a pipette to transfer amphipods to the Carolina dish, use forceps for the tubes. Repeat until all amphiods have been removed.

PICKING AMPELISCA AT END-OF-TEST

1.0 Put on lab coat, latex or vinyl gloves, and safety glasses.

2.0 Materials needed:
- Dissecting microscope
- wide bore pipette
- dissecting utensils
- forceps

3.0 Select a seived sample of sediment in medium sized Carolina dish.

4.0 Look for amphipods:
- 4.1 Look into Carolina dish for any floating amphipods.
- 4.2 Agitate sediment and water to get any loose amphipods up to surface.
- 4.3 Pour out excess water into another Carolina dish, making sure no amphipods escape.
- 4.4 Look for tubes.
- 4.5 Pick through sediment and tubes using a stereomicroscope, a small portion at a time, removing amphipods, putting them into a separate petri dish. Put this sediment into the Carolina dish used in section 3.3.
- 4.6 Continue picking through sediment until all of sediment is gone.
- 4.7 Place all live amphipods into the appropriate scintillation vial with the minimum amount of seawater using a pipette. Dead amphipods are discarded.
- 4.8 Carefully record the following data on Breakdown sheet before continuing to another sample:
  - a. <u>Picker's initial and time completed picking</u>
  - b. <u>Jar number</u>- corresponds to dish number and vial number
  - c. <u>Number of dead amphipods during test</u>- cumulative dead on day 10
  - d. <u>Number recovered</u>- total number of amphipods found (# live + # dead)
  - e. <u>Number of amphipods unaccounted for</u>- number of amphipods not found
  - f. <u>Total number of amphipods dead</u>- # amphipods dead during test + # dead found during picking + # unaccounted for.
- 4.9 Return sediment to original labeled Carolina dish.
- 4.10 Any sample with more than ten percent (> 2 amphipods) unaccounted for should be placed in the QA, re-pick pile.

5.0 Quality Control/Quality Assurance re-pick of replicates with more than 10% of amphipods unaccounted for: (This can be done on same day as breakdown or the

next day)

5.1 Choose sample that you did not pick originally.
5.2 Look for amphipods as above.
5.3 Place live animals in scintillation vial
5.4 Write down data about repick of sample on breakdown data sheet.
   a. Number repicked- total number of amphipods found during repicking.
   b. Count of vial- this will be done once all samples have been picked and QA'd. (see step 6.0)
   c. Number unaccounted for- number of amphipods not found, this is done after the vial is counted
   d. Final number dead-- # amphipods dead during test + # found dead during picking and repicking, + # unaccounted for. This is done after the vial is counted

6.0 Count of Vial:
Once all samples are picked and QA'd, add either tap water or alcohol to the vials containing pods. Use tap if the vials can be counted within one hour, if not use alcohol. Record the # of amphipods in the vial, # unaccounted for, and final # dead.

7.0 Clean up picking space.
7.1 Make sure light of microscope is turned off.
7.2 Put picking tools and dishes into dirty dish bin.
7.3 Wipe down spilled water and sediment.
7.4 Clean off microscope and light.
7.5 Put away safety clothing into appropriate places.

Picking Preserved Samples at End-Of-Test

Samples are preserved at the end of the 10 day sediment toxicity test, when time is not available for picking live. These samples are preserved with buffered 10% formalin with Rose-Bengal used as a live stain. Live amphipods should stain bright fuschia/pink.

1.0 Put on lab coat, latex or vinyl gloves, and safety glasses.

2.0 Materials needed:
- Fume guard
- Dissecting microscope
- wide bore pipette
- dissecting utensils
- forceps
- "formalin only" 0.5 mm sieve
- formalin waste bin
- formalin disposal cannister
- plastic caolina dishes forholding sieved sample
- Breakdown Data Sheet
- Squeeze bottle

3.0 Select a preserved sediment sample jar.

4.0 Check Breakdown Data Sheet to assure that it has not been picked already.

5.0 Sieve formalin sample out to remove excess formalin:
- 5.1 Turn hood on.
- 5.2 Sieve sample through the "formalin only" 0.5 mm sieve over blue formalin waste bin.
- 5.3 Rinse sieve thoroughly with tap water hose over sink, using gentle pressure, being careful to retain all material on sieve. BE CAREFUL NOT TO SPLASH ANY MATERIAL.
- 5.4 Using a squeeze bottle filled with seawater spray the material on the sieve into plastic carolina dish.
- 5.5 Rinse sieve again to be sure all material has been transferred from the sieve to the carolina "picking" dish.

6.0 Bring carolina dish containing the sieved sample to the picking station, where fume guard is located.

7.0 Look for amphipods: Amphipods should be bright fuschia/pink colored:
- 7.1 Look into Carolina dish for any floating amphipods.

7.2 Agitate sediment and water to get any loose amphipods up to surface.
7.3 Pour out excess water into another Carolina dish, making sure no amphipods escape.
7.4 Look for tubes.

7.5 Pick through sediment and tubes using a stereomicroscope, a small portion at a time, removing amphipods, putting them into a separate petri dish. Put this sediment into the Carolina dish used in section 7.3.
7.6 Continue picking through sediment until all of sediment is gone.
7.7 Place all amphipods into the appropriate scintillation vial with the minimum amount of seawater using a pipette.
7.8 Carefully record the following data on Breakdown sheet before continuing to another sample:
   a. Picker's initial and time completed picking
   b. Jar number- corresponds to dish number and vial number
   c. Number of dead amphipods during test- cumulative dead on day 10
   d. Number recovered- total number of amphipods found
   e. Number of amphipods unaccounted for- number of amphipods not found or accounted for during test.
   f. Total number of amphipods dead- # amphipods dead during test + # dead found during picking + # unaccounted for.

7.9 Return sediment to original labeled sample jar.
7.10 Any sample with more than ten percent (> 2 amphipods) unaccounted for should be marked in the QA, and will be repicked by someone else.

8.0 Quality Control/Quality Assurance re-pick of replicates with more than 10% of amphipods unaccounted for:
8.1 Choose sample that you did not pick originally.
8.2 Look for amphipods as above.
8.3 Place live animals in scintillation vial
8.4 Write down data about repick of sample on breakdown data sheet.
   a. Number repicked- total number of amphipods found during repicking.
   b. Count of vial- this will be done once all samples have been picked and QA'd. (see step 9.0)

   c. Number unaccounted for- number of amphipods not found, this is done after the vial is counted

   d. Final number dead-- # amphipods dead during test + # found dead during picking and repicking, + # unaccounted for. This is done after the vial is counted

9.0 Count of Vial:

9.1 Once all samples are picked and QA'd, add formalin to the vials containing pods.

9.2 Record the # of amphipods in the vial, # unaccounted for, and final # dead.

10.0 Clean up picking space.

10.1 Make sure light of microscope is turned off.

10.2 Turn off fume guard.

10.3 Wipe down spilled water and sediment.

10.4 Clean off microscope and light.

10.5 Put away safety clothing into appropriate places.

11.0 Put formalin in sample jar filling jar with an amount equal to the amount of sample in jar.
(Do this in hood).

Sieving "Hurricane" Sediments

This SOP applies only to *Ampelisca* test 910806, the test that was broken down early in the morning that Hurricane Bob hit Rhode Island. The samples were not sieved before being preserved with formalin. We need to gradually sieve them all out, being very careful to minimize the amount of sediment and formalin that goes down the drain.

NOTE:

The sediment removed from these samples does NOT go in the BLUE BARRELS.

Do not use the 12 inch sieves, buckets or other equipment that we usually use to breakdown live tests.

Personal Protective Equipment:
long sleeved, ties-in-back labcoat
latex gloves covered with silver shields covered with nitrile gloves
safety glasses
face shield

All sieving must be done in the prep room hood and all samples must be picked in the fume guards.

1 Set up the usual equipment for sieving preserved samples: small 8 inch sieve marked formalin, plastic grid set on blue bin (blue plastic wash tub labelled formalin)

2 Decant the formalin overlying the sample through the sieve. Leave about 1" of liquid over the mud.

3 Swirl the jar to slurry the sediment and release it from the walls of the jar. Do this with the jar well under the hood and don't slop formalin around.

o Pour the sediment onto the sieve, using very small rinses from a wash bottle or the hose on the faucet until all the sediment has been transfered to the screen.

4 Allow formalin to drip through the sieve for a few moments, then rinse the sediment on the sieve with several more small rinses collected in the blue bin. At this point, virtually all the formalin should be removed from the sample, but no more liquid should be transfered to the blue bin than necessary.

5 Place the pink bucket marked formalin (with overflow spout) in the hood sink. Set the grid and sieve over it and rinse the balance of the sediment through the sieve. Rinse the sample to the edge of the sieve as usual and use a wash bottle to transfer it to a labelled carolina dish for sorting.

Clean up: When the blue bin gets about half full, decant the liquid into the white 15 gallon drum labelled formalin. The sediment that has settled to the bottom of the blue bin or pink bucket should be transfered to special DOT approved five gallon white buckets labelled "formalin contaminated sediment". A minimum amount of liquid should be transfered with the sediment.

Only a few samples per day from this test should be sieved to assure that any traces of formalin which remain in the sediments after rinsing over the blue bin are well diluted in the sewer lines.

Leave the hood clean and dry when you have finished.

I acknowledge this training session:_____
Date_____

APPENDIX D

POINT OF CONTACT:

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I. OBJECTIVE

This method measures the toxicity of effluent and receiving waters to the gametes of the sea urchin, *Arbacia punctulata*, during a 1 h and 20 min exposure. The purpose of the sperm cell toxicity test is to determine the concentration of a test substance that reduces fertilization of exposed gametes relative to that of the control.

II. NECESSARY MATERIALS AND EQUIPMENT

- Facilities for holding and acclimating test organisms.
- Laboratory sea urchin culture unit -- See SOP on Culture. To test effluent or receiving water toxicity, sufficient eggs and sperm must be available.
- Environmental chamber or equivalent facility with temperature control ($20 \pm 1^{o}C$) for controlling temperature during exposure.
- Water purification system -- Millipore Super-Q, Deionized water (DI) or equivalent.
- Balance -- Analytical, capable of accurately weighing to 0.0001 g.
- Reference weights, Class S -- for checking performance of balance.
- Air pump -- for supplying air.
- Air lines, and air stones -- for aerating water containing adults.
- Vacuum suction device -- for washing eggs.
- pH and DO meters -- for routine physical and chemical measurements. Unless the test is being conducted to specifically measure the effect of one of these two parameters, portable, field-grade instruments are acceptable.
- Transformer, 10-12 Volt, with steel electrodes -- for stimulating release of eggs and sperm.
- Centrifuge, bench-top, slant-head, variable speed -- for washing eggs.
- Fume hood -- to protect the analyst from formaldehyde fumes.
- Dissecting microscope -- for counting diluted egg stock.
- Compound microscope -- for examining and counting sperm cells and fertilized eggs.
- Sedgwick-Rafter counting chamber -- for counting egg stock.

- Hemacytometer, Neubauer -- for counting sperm.
- Count register, 2-place -- for recording sperm and egg counts.
- Refractometer -- for determining salinity.
- Thermometers, glass or electronic, laboratory grade -- for measuring water temperatures.
- Thermometers, bulb-thermograph or electronic-chart type -- for continuously recording temperature.
- Ice bucket, covered -- for maintaining live sperm.
- Centrifuge tubes, conical, 15 mL -- for washing eggs.
- Cylindrical glass vessel, 8-cm diameter -- for maintaining dispersed egg suspension.
- Beakers -- six Class A, borosilicate glass or non-toxic plasticware, 1000 mL for making test solutions.
- Glass dishes, flat bottomed, 20-cm diameter -- to hold adults during gamete collection.
- Wash bottles -- for deionized water, for rinsing small glassware and instrument electrodes and probes.
- Volumetric flasks and graduated cylinders -- Class A, borosilicate glass or non-toxic plastic labware, 10-1000 mL for making test solutions.
- Syringes, 1-mL, and 10-mL, with 18 gauge, blunt-tipped needles (tips cut off) -- for collecting sperm and eggs.
- Pipets, volumetric -- Class A, 1-100 mL.
- Pipets, automatic -- adjustable, 1-100 mL.
- Pipets, serological -- 1-10 mL, graduated.
- Pipet bulbs and fillers -- PROPIPET^{R}, or equivalent.
- Tape, colored -- for labelling tubes.
- Markers, water-proof -- for marking containers, etc.
- Sea Urchins (approximately 12 of each sex).
- Scintillation vials, 20 mL, disposable -- to prepare test concentrations.
- Parafilm -- to cover tubes and vessels containing test materials.
- Gloves, lab coat, disposable -- for personal protection from contamination.
- Safety glasses
- Data sheets (one set per test) -- for data recording (Figure 1).
- Acetic acid, 10%, reagent grade, in sea water -- for preparing killed sperm dilutions.
- Formalin, 10% in seawater -- for preserving eggs.
- pH buffers 4, 7, and 10 (or as per instructions of instrument manufacturer) for standards and calibration check.
- Membranes and filling solutions for dissolved oxygen probe or reagents for modified Winkler analysis.
- Laboratory quality assurance samples and standards for the above methods.
- Reagent water -- defined as distilled or deionized water that does not contain substances which are toxic to the test organisms.
- Effluent, surface water, and dilution water.
- Saline test and dilution water -- The salinity of the test water must be 30 ^{o}/oo. The salinity should vary by no more than $\pm$ 2 ^{o}/oo among the replicates.

III. METHODS

A. Test Solutions

1. Samples are used directly as collected when sample salinity is between 28 and 32 ppt. If samples do not require salinity adjustment, natural seawater is used in all washing and diluting steps and as control water. Local water from an uncontaminated area may be used as an additional control.

2. If salinity adjustment is required, prepare 3 L of control water at 30 °/oo using hypersaline brine (see SOP on Preparation of Brine). This water is used in all washing and diluting steps and as control water in the test. Natural sea water and uncontaminated local waters may be used as additional controls.

3. Effluent/receiving water samples are adjusted to salinity of 30 °/oo using hypersaline brine as necessary.

4. The selection of the effluent test concentrations should be based on the objectives of the study. A dilution factor of 0.5 is used with this procedure, starting with a high concentration of 70% effluent (for freshwater effluents). If the effluent is known or suspected to be highly toxic, a lower range of effluent concentrations should be used.

5. Three replicates are prepared for each test concentration, using 5 mL of solution in disposable liquid scintillation vials. A 50% (0.5) concentration series can be prepared by serially diluting test concentrations with control water.

6. All test samples are equilibrated at 20 $\pm$ 1°C before addition of sperm.

B. Collection and Preparation of Gametes for the Test

1. Select four females and place in shallow bowls, barely covering the shell with seawater. Stimulate the release of eggs by touching the test with electrodes from the transformer. Collect about 3 mL of eggs from each female using a 10 cc syringe with a blunted needle. Remove the needle from the syringe before adding the eggs to a 15 mL conical centrifuge tube. Pool the eggs. The egg stock may be held at room temperature for several hours before use. Note: The egg suspension may be prepared during the 1-h sperm exposure.

2. Select four males and place in shallow bowls, barely covering the animals with seawater. Stimulate the release of sperm by touching the shell with steel electrodes connected to a 10 - 12 V transformer (about 30 seconds each time). Collect the sperm (about 0.25 mL) from each male, using a 1 mL disposable syringe fitted with an 18-gauge, blunt-tipped needle. Maintain the syringe containing pooled sperm sample on ice. The sperm must be used in a toxicity test within 1 h of collection.

3. Using control water, dilute the pooled sperm sample to a concentration of about 5 X 10^7 sperm/mL (SPM). Estimate the sperm concentration as described below:.

a. Make a sperm dilutions of 1:50, 1:100, 1:200, and 1:400, using 30°/oo seawater, as follows:

1. Add 400 uL of collected sperm to 20 mL of sea water in Vial A. Cap Vial A and mix by inversion.

2. Add 10 mL of sperm suspension from Vial A to 10 mL of seawater in Vial B. Cap Vial B and mix by inversion.

3. Add 10 mL of sperm suspension from Vial B to 10 mL of seawater in Vial C. Cap Vial C and mix by inversion.

4. Add 10 mL of sperm suspension from Vial C to 10 mL of seawater in Vial D. Cap Vial D and mix by inversion.

5. Discard 10 mL from Vial D. (The volume of all suspensions is 10 mL).

b. Make a 1:2000 killed sperm suspension and determine the SPM.

1. Add 10 mL 10% acetic acid in seawater to Vial C. Cap Vial C and mix by inversion.

2. Add 1 mL of killed sperm from Vial C to 4 mL of seawater in Vial E. Mix by gentle pipetting with a 4-mL pipetter.

3. Add sperm from Vial E to both sides of the Neubauer hemacytometer. Let the sperm settle 15 min.

4. Count the number of sperm in the central 400 squares on both sides of the hemacytometer using a compound microscope (400X). Average the counts from the two sides.

5. SPM in Vial E = 10^4 x average count.

c. Calculate the SPM in all other suspensions using the SPM in Vial E above:

SPM in Vial A = 40 x SPM in Vial E
SPM in Vial B = 20 x SPM in Vial E
SPM in Vial D = 5 x SPM in Vial E
SPM in original sperm sample = 2000 x SPM in Vial E

d. Dilute the sperm suspension with a sperm concentration greater than 5×10^7 SPM to 5×10^7 SPM.

Actual SPM/(5×10^7) = dilution factor (DF)

[(DF) x 10] - 10 = mL of seawater to add to vial.

e. Confirm the sperm count by sampling from the test stock. Add 0.1 mL

of test stock to 9.9 mL of 10% acetic acid in seawater, and count with the hemacytometer. The count should average 50 ± 5.

4. Wash the pooled eggs three times using control water with gentle centrifugation (500xg or lowest possible setting) for 3 min using a tabletop centrifuge. If the wash water becomes red, the eggs have lysed and must be discarded.

a. Dilute the egg stock, using control water, to 2000 ± 200 eggs/mL.

1. Remove the final wash water and transfer (by filling the centrifuge tube with control water and repeatedly inverting to resuspend the eggs) the washed eggs to a beaker containing a small volume (about 50 mL) of control water. Add more control water to bring the eggs to a volume of 200 mL ("egg stock").

2. Mix the egg stock using gentle aeration. Cut the point from a pipet tip, then transfer 1 mL of eggs from the egg stock to a vial containing 9 mL of control water. (This vial contains an egg suspension diluted 1:10 from egg stock).

3. Mix the contents of the vial using gentle pipetting. Cut the point from a pipet tip, then transfer 1 mL of eggs from the vial to a Sedgwick-Rafter counting chamber. Count all eggs in the chamber using a dissecting microscope ("egg count").

4. Calculate the concentration of eggs in the stock. Eggs/mL = 10x (egg count). Dilute the egg stock to 2000 eggs mL by the formula below.

b. If the egg count is equal to or greater than 200:

(egg count) - 200 = volume (mL) of control water to add to egg stock

c. If the egg count is less than 200, allow the eggs to settle and remove enough control water to concentrate the eggs to greater than 200, repeat the count, and dilute the egg stock as above.
NOTE: It requires 18 mL of a egg stock solution for each test with a control and five exposure concentrations (three replicates).

d. Transfer 1 mL of the diluted egg stock to a vial containing 9 mL of control water. Mix well, then transfer 1 mL from the vial to a Sedgwick-Rafter counting chamber. Count all eggs using a dissecting microscope. Confirm that the final egg count = 200 ± 20 per mL.

B. Start of the Test

1. Within 1 h of collection add 100 uL of appropriately diluted sperm to each test vial. Record the time of sperm addition.

2. Incubate all test vials at 20 $\pm$ 1°C for 1 h.

3. Mix the diluted egg suspension (2000 eggs/mL), using gentle bubbling. Add 1 mL of diluted egg suspension to each test vial using a wide mouth pipet tip. Incubate 20 min at 20 $\pm$ 1°C.

C. Termination of the Test

1. Terminate the test and preserve the samples by adding 2 mL of 10% formalin in seawater to each vial.

2. Vials may be evaluated immediately or capped and stored for as long as one week before being evaluated.

3. To determine fertilization, transfer about 1 mL eggs from the bottom of a test vial to a Sedgwick-Rafter counting chamber. Observe the eggs using a compound microscope (100 X). Count about 100 eggs/sample. Record the number counted and the number unfertilized. Fertilization is indicated by the presence of a fertilization membrane surrounding the egg. Adjustment of the microscope to obtain proper contrast may be required to observe the fertilization membrane.
NOTE: Because samples are fixed in formalin, a ventilation hood is set-up surrounding the microscope to protect the analyst from prolonged exposure to formaldehyde fumes.

D. Acceptability of Test Results

1. The sperm:egg ratio routinely employed should result in fertilization of at least 50% of the eggs in the control chambers.

IV. TROUBLE SHOOTING

1. Toxic substances may be introduced by contaminants in dilution water, glassware, sample hardware, and testing equipment.

V. STATISTICAL ANALYSIS AND DATA USAGE

1. Tabulate and summarize the data. Calculate the percent of unfertilized eggs for each replicate.

2. The endpoints of toxicity tests using the sea urchin are based on the reduction in percent of eggs fertilized. An estimate of the effluent concentration which would cause a 50% reduction in egg fertilization (EC50) is calculated using Trimmed Spearman-Karber analysis (Hamilton, Russo, and Thurston, 1977). Dunnett's Procedure (Dunnett, 1955) is used to estimate no effect and least effect concentrations (NOEC and LOEC values).

3. Data are used along with other toxicity tests in assessing the toxicity of an effluent or receiving water.

VI. REFERENCES

Dunnett, C.W. 1955. A multiple comparisons procedure for comparing several treatments with a control. JASA 50:1096-1101.

Hamilton, M.A., R.C. Russo, and R.V. Thurston. 1977. Trimmed Spearman-Karber method for estimating median lethal concentrations in toxicity bioassays. Environ. Sci. Technol. 11(7):714-719.

US EPA. 1988. Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms. Weber, C.I., et al (eds). EPA Office of Research and Development EPA-600/4-87/028 (May 1988).

APPENDIX E

Employee Orientation

What we need to address:

1. OSHA plans to insure employee safety
2. EPA and other plans to ensure proper handling of materials.

Why are we telling you this:

1. Legal requirement
2. Corporate policy "Reduce risk to employee and environment."
3. Environmental Testing Center Policy - Learn good work habits here that you will take with you throughout your career.
4. Citizen suits are a legal possibility.

We can expect to be held to a very high standard because we work for the EPA.

How we will convey this information:

Provide material for your safety notebooks. (You may take notes.)
General outlines for lab and field operation
Specific plans as required by law
Safety measures included in SOPs

You will be required to sign, acknowledging each training session.
It is your responsibility to follow these instructions once they are conveyed.

Disciplinary measures may be required by law and/or by SAIC for certain infractions of safety laws and policies.

Right to Know Requirements

I. It is the employers responsibility to convey to you your **Right to Know:**

1. Identification of workplace hazards
2. Safe handling of hazardous materials
3. Proper disposal of wastes
4. What to do in an emergency
5. Access to documents

If you don't believe that this is being done properly, it is your right to contact state and/or federal authorities; the phone numbers are in the blue pages of the Providence telephone directory.

It is your right to have a private meeting with government inspectors.

It is also your right to request that a supervisor be present at such a meeting.

There are also provisions in the statutes that protect the jobs of "whistleblowers".

Emergency Action Plan

What type of emergencies do we need to anticipate here?

1. Fire
2. Injuries or other medical emergencies
3. Weather emergencies
4. Bomb threats
5. Hazardous material spills

General Emergency Procedures

Rhode Island is part of the **911 emergency telephone system.** In case of fire or medical emergencies **CALL 911.** Tell them:

The nature of the emergency
Your name and the location
165 Dean Knauss Drive
Narragansett
Stay on the line if possible.

There is a card by every telephone listing this information. Do not remove or obscure these cards.

The following persons have had at least some Red Cross First Aid Training:

Anne Kuhn, Laboratory Manager
Diane MacBride, Safety Officer
Glen Thursby, Laboratory Director

Any emergencies are to be reported to your supervisor, Glen Thursby and the Safety Officer, Diane MacBride, who are required to file written reports detailing causes and remedies of certain types of incidents.

If you have any questions regarding any of the information in this or other communicatons regarding emergencies, workplace safety, safe handling of materials or proper disposal of waste contact Diane MacBride.

ETC = 165 Dean Knauss Drive
Narragansett. S. Ferry Indust. Park

In case of EMERGENCY

Emergency Telephone	Dial "911" or 911 (insert telephone number)
Fire	1. Evacuate immediate area. 2. Dial emergency number. 3. Attempt to control fire if safe to do so. 4. Meet at path at end of street.
Medical	1. Do not move victim (except for safety reasons). 2. Dial emergency number
Hazardous Material Spill	1. Evacuate immediate area. 2. Dial emergency number

EVACUATION SIGNAL Alarm or Voice (identify signal, such as voice, fire alarm, or broadcast over public address system)

Date: 12/90

What to do in case of Fire:

a. Vocalize "Fire" and pull fire alarm. Ours are **local** alarms, the fire department still must be called.

b. Use a fire extinguisher **if** it appears that the blaze can be quickly and safely extinguished. Our extinguishers are ABC type, suitable for **trash\paper\wood**
grease and oils
electrical fires

Fire extinguishers are located by the back (east) door in the wet lab and by the front (west) door in the EMAP\culture room.

TO USE OUR FIRE EXTINGUISHERS --
PULL OUT THE PIN
AIM THE HOSE AT THE BASE OF THE FLAMES
SQUEEZE THE HANDLE

c. If the fire cannot be safely and quickly extinguished, the area or building must evacuated. A map of the facility, with evacuation routes is attached to this plan and is posted in each room.

d. Shut down the hood, rest room fan, and close doors before leaving your area. If the area is smoky, drop to the ground and crawl for the exits, the smoke may thinner down along the floor.

e. Stay clear of areas where flammables may be stored: There will be 1-4 liters of ethanol and/or methanol stored under the hood and may be some small cans of paint or thinner stored in the EMAP/culture area.

f. Employees who are required to stay at their equipment until specifically evacuated: None.

g. Call the fire department **CALL 911** if it can be done safely before leaving the building. Tell them: The nature of the emergency
Your name and the location
165 Dean Knauss Drive
Narragansett
Stay on the line if possible; evacuate if necessary.

h. If it isn't possible to call **911** before leaving the building, go to Paglia Construction, Forty Fathom Lobster Company, or Rocky Brook to use the phone. Try to make sure that someone knows that you have gone to phone.

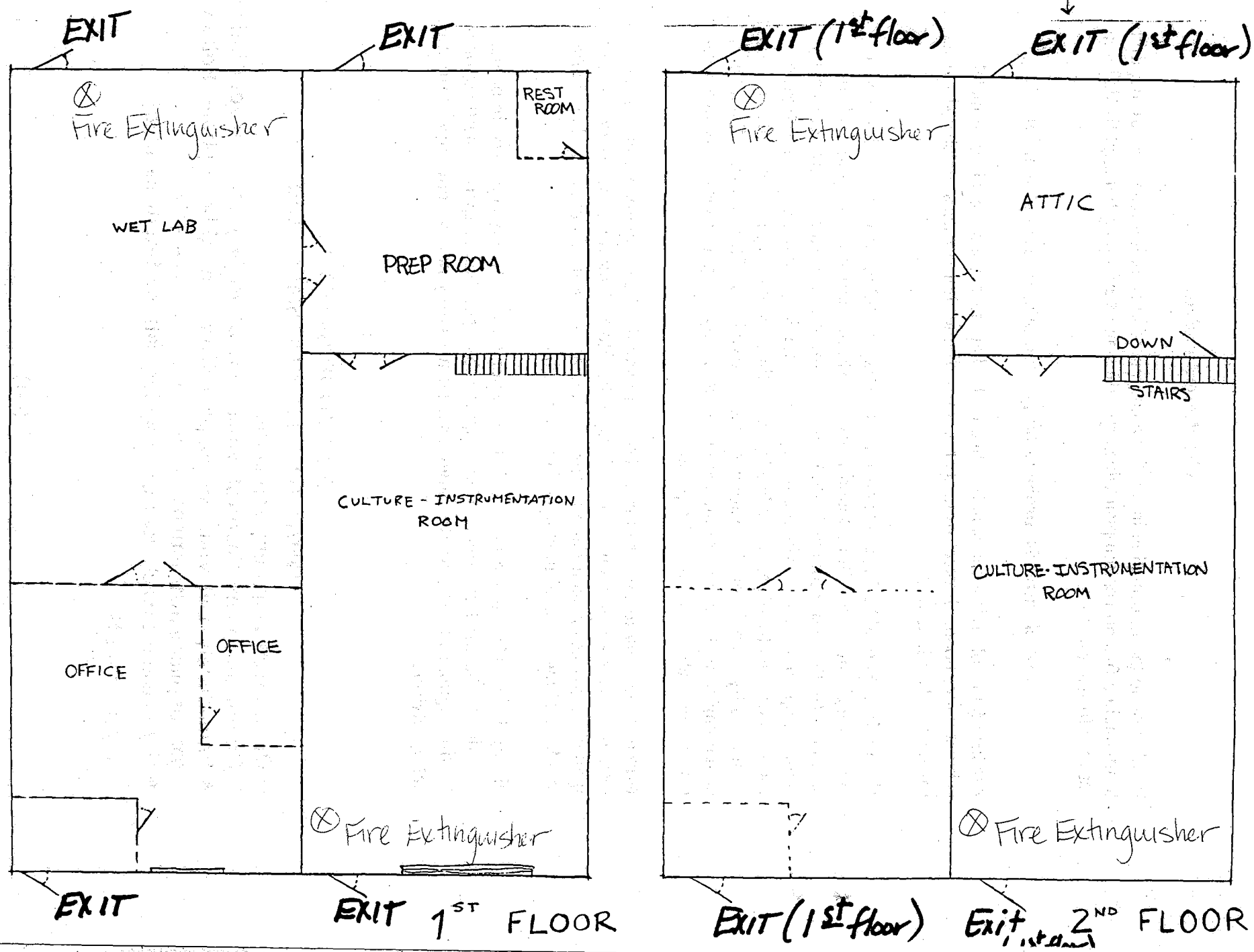
i. If it is necessary to evacuate, get away from the building; do not congregate by or block doors. Go to the following prearranged meeting place so that you may be accounted for.

MEET AT THE TURNAROUND AT THE END OF OUR STREET (DEAN KNAUSS DRIVE)

You may be instructed to go to a different location if blowing smoke presents a hazard, but report to the designated meeting place first. Do not return until the all clear is given (verbal signal).

j. We are required to have one fire marshall per 20 employees. The designated fire marshall for the facility is Diane MacBride. In her absence, Glen Thursby and/or Anne Kuhn are designated to make sure that all employees are accounted for.

EVACUATION PLAN



Fire PreventionPlan

In addition to the information in the fire emergency/ evacuation plan, we are required to maintain a fire prevention plan which specifies an overlapping but slightly different set of information.

List of hazards, proper storage methods, sources of ignition

Alcohol (ethanol and/or methanol) . Should be kept in capped container in metal cabinet under hood. Protect from sparks, open flame, hot surfaces, electrical wiring, oxidizers. Use in hood.

Formalin . Should be kept in capped containers, including squeeze bottles, under hood. Small amounts will be found in capped sample jars containing animals or sediment (in the prep room and attic). A pink mixture of formalin with rose bengal stain is kept in a carboy within a plastic pan (secondary containment) in the prep room. Formaldehyde gas in the headspace of these containers is flammable and could be ignited by open flame, hot surfaces, sparks, oxidizers. Use in hood. Samples containing formalin can be examined microscopically in open dishes only in activated carbon fume absorbers in the prep room.

Miscellaneous paint and thinner. There are small cans of household paints and cleaning solvents stored on metal shelves in the EMAP/culture area. They could be ignited by sparks or open flames. Even if they are to be used outdoors, there is **no smoking** allowed when these materials are nearby.

Natural gas. Used in the furnace and hot water heater. Safely conveyed in piping installed by licensed pipefitter. Can be ignited by open flame, sparks, malfunctioning heating equipment. **If you ever smell gas, immediately notify your supervisor and safety officer.**

FOR YOUR SAFETY
WHAT TO DO IF YOU SMELL GAS

- Do not try to light any appliance.
- Do not touch any electrical switch; do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions. PHONE #_____ ',
- If you cannot reach your gas supplier, call the fire department.

CALL GLEN _____

Gas and Electrical Shutdown Procedure

Gas The gas meters are outdoors, between the back doors to the wet lab and the prep room. At present, ours is the only one that is hooked up. Just above the meter is a silver valve that can be turned 90 degrees with a wrench (any standard adjustable wrench). A crescent wrench hangs from a wire on the fire alarm beside the back door to the wet lab for this purpose. Prov. GAS CO. 1-272-3330

Electrical There is presently no main shut off on the electrical panel, which is beside the hood in the prep room . To shut off the power, flip all circuit breakers to the "off" position.

Fire Fighting Equipment

Fire Extinguishers: Our extinguishers are ABC type
suitable for **trash\paper\wood**
grease and oils
electrical fires

Fire extinguishers are located by the back (east) door in the wet lab and by the front (west) door in the EMAP\culture room.

TO USE OUR FIRE EXTINGUISHERS --
PULL OUT THE PIN
AIM THE HOSE AT THE BASE OF THE FLAMES,SQUEEZE THE HANDLE

Safety shower - installed in the prep room. Stand below shower head and pull down on triangular metal handle.

Names of person(s) assigned to maintain fire fighting equipment: Diane MacBride

Names of person(s) responsible for fuel sources: Diane MacBride

Name of person(s) with a copy of the full Fire Prevention Plan: Diane MacBride

Housekeeping Procedures to Reduce Fire Hazards

- There is absolutely **No Smoking** anywhere in this facility.
- Flammable solvents should be stored in the metal cabinets under the hood. Flammables and oxidizers must not be stored in the same cabinet.
- Any oily rags generated during painting or clean up should go directly to the dumpster; they should not stored in the building.
- Combustibles such as cardboard or wood should not be stored within several feet of the gas hot water heater upstairs.
- Household or two-prong extension cords cannot be used in this facility. Extension cords are only suitable for temporary applications and must be heavy three-prong models.
- Don't use any electrical equipment that smells hot or has a frayed cord.
- The small ceramic heaters should not be run unattended and should be shut down overnight.

- Coffee pots should be unplugged overnight. The heater/cooler on the water dispenser should be unplugged for the weekend if the water level is very low.

- Combustibles such as paper and cardboard should not be allowed to pile up in untidy heaps. (We will have to balance this with our requirement to recycle.) They must be kept dry to avoid spontaneous combustion.

- Exits, fire fighting equipment and electrical panels must be kept clear . Do not leave carts in the aisles.

- The safety shower and eyewash must always be accessible.

cc: Division Manager(s)
Division Supervisor(s)
EH&S Manager

APPENDIX A

MONTHLY SAFETY INSPECTION

AREA: _____ DATE: _____

SUPERVISOR(S): _____

_____

INSPECTOR: _____ NOTE: Check off all items.

(Yes) Acceptable
(No) Requires Correction
(NA) Not Applicable

SECTION I. GENERAL HOUSEKEEPING	Yes	No	NA	Corrective Action/Date Completed
1.1 Area kept clean.				
1.2 Aisleways kept clear (24" wide).				
1.3 Exits marked and not blocked.				
1.4 Floor condition (slippery, cracked, tripping hazards, etc.).				
1.5 Tables, cabinets and shelves stable and secure.				
1.6 Electrical panels kept clear and accessible. (Minimum 36" clearance)				
1.7 Sharp edges, splinters or burrs exposed on furniture or equipment.				
1.8 Materials that could cause injury kept off tops of cabinets, files, etc.				
1.9 Lighting adequate.				

APPENDIX A

MONTHLY SAFETY INSPECTION (con't)

SECTION I. GENERAL HOUSEKEEPING (con't)	Yes	No	NA	Corrective Action/Date Completed
1.10 Equipment stored safely.				
1.11 Shelving not overloaded or overcrowded.				
1.12 Glass bottles stored at or below eye level.				
1.13 Proper labeling and storage of chemicals.				
1.14 Outdated or updated chemicals.				
1.15 Special containers for broken glass in use.				
1.16 Cutting blades disposed of properly.				

SECTION II. MECHANICAL SAFETY EQUIPMENT	Yes	No	NA	Corrective Action/Date Completed
2.1 Machine safety guards in place (belts, pulleys, grinders, blades, gears, rollers, pinchpoints, etc.				
2.2 Defective tools/equipment (taped handles, broken ladders, etc.).				
2.3 Gas cylinders secured.				
2.4 Compressed air for cleaning shall not exceed 30 psi.				
2.5 Properly guarded fan blades (maximum 1/2" opening)				
2.6 Laboratory hoods operational (current certification, not used for storage).				

APPENDIX A

MONTHLY SAFETY INSPECTION (con't)

SECTION III. SAFETY EQUIPMENT & PRACTICES	Yes	No	NA	Corrective Action/Date Completed
3.1 Safety goggles or glasses in use.				
3.2 Hearing protectors in use.				
3.3 Shower/eye wash station kept clear and inspection tag current.				
3.4 Proper footwear in use.				
3.5 Protective clothing and gloves in use or available.				
3.6 Required hazard signs posted.				
3.7 Long hair restrained where required.				
3.8 Respirators in use where required.				
3.9 Proper lifting practices observed.				
3.10 Food not stored or heated in units prohibited for such use.				
3.12 Spill control center stocked.				
3.13 Emergency telephone number card posted.				

APPENDIX A

MONTHLY SAFETY INSPECTION (con't)

SECTION IV. FIRE SAFETY	Yes	No	NA	Corrective Action/Date Completed
4.1 "No Smoking" areas complied with.				
4.2. Proper containers for flammables in use.				
4.3 Fire extinguishers kept clear and in place.				
4.4 Proper storage of gas cylinders (away from heat source, fuel and oxygen cylinders separated by 20' or by a partition unless on welding cart).				
4.5 Combustibles not stored within 30" of gas waterheater upstairs				
4.6 Storage kept at least 36" away from lighting fixtures.				

SECTION V. ELECTRICAL SAFETY	Yes	No	NA	Corrective Action/Date Completed
5.1 Ungrounded equipment.				
5.2 Equipment in use is U.L. approved.				
5.3 Electrical cords free of splices.				
5.4 Cover plates in place.				
5.5 Panels covered.				
5.6 No exposed wiring.				
5.7 Two-pronged household extension cords not used.				

Bomb Threat

A. An employee should take down the items itemized below if he or she receives a bomb threat.

1. Attempt to obtain as much of the following information as possible:
   a. Location of the bomb (building, area, room, other details)
   b. Time that the bomb is set to go off
   c. What it looks like (whether it is concealed or in the open)
   d. How it got into the building

2. Attempt to identify the caller's sex, knowledge of the building and accent.

3. Attempt to identify background noise

4. Notify your supervisor when the call ends. Do not talk to anyone else about the call, except as instructed by your supervisor.

5. The supervisor, working in conjunction with local authorities, will determine whether to evacuate the building.

Weather Emergencies

(Hurricanes, Blizzards, Tornados, Floods)

A copy of the SAIC bad weather policy is attached. In the case of forecast hurricanes or blizzards, staffing will be drastically reduced. We will to notify you in advance that you are not to come to work. **For this reason, every employee should be sure that we have her/his current telephone number on file.**

Tornados are much more difficult to forecast, and are infrequent (although possible) in Rhode Island. During thunderstorms, the safety officer will designate an employee to monitor a local radio station (WPRO 92 kilocycles FM). If a tornado is sighted, a decison will be made at that time whether to stay here or to try to get to a more substantial building such as the EPA lab.

Floods are very unlikely at this location because we are high above the bay and well away from rivers. For this reason, we submit no detailed flood plan.

* Don't use Telephones
Stay away from windows

Medical Emergencies

In case of a medical emergency, it may be necessary to **call 911 for an ambulance:**

Tell them: The nature of the emergency
Your name and the location
165 Dean Knauss Drive
Narragansett
Stay on the line if possible.

When: If the victim is unconscious, bleeding badly, stops breathing, or is confused/disoriented.

Do not move the victim unless he/she is in a hazardous area.

The following persons have at least some first aid training:

Anne Kuhn
Diane MacBride
Glen Thursby

The most likely injury in this facilty is probably a glass cut. **In case of a cut:**

1. The victim may faint and injure himself further. Make the victim sit or lie down. If **you** are cut, cooperate.

2. If the cut was from contaminated glassware, rinse it (onto the floor if neceassary) with deionized water. This step is optional. If the cut is very bad or the victim is woozy, skip it.

3. If possible, raise the cut above the level of the heart.

4. Use direct pressure on the wound if possible. Put a compress, or even a paper towel on the wound and squeeze it closed.

5. A tournicate is to be use only if a limb wound is life-threatening. Place a belt or piece of rubber tubing around the limb between the wound and the heart, tie it snuggly, but not as tight as possible. Leave in place until the ambulance arrives. This is to be used as a last resort only. Tell the EMT's when they arrive that there is a tournicate in place. - Pin a Note onto victim or/and "T" onto forehead

Other possible injuries here would be **falls** - do not move the victim.

If someone is **overcome by chemical fumes** move them outdoors if possible. Call an ambulance if the victim is unconscious or confused/disoriented.

Medical Emergencies - continued

Chemical or sample splash in eyes: Move victim quickly to eyewash near the restroom. Lower face between spouts and depress the handle on the right side of the basin. Continue to irrigate eyes for 15 minutes.

Exposure: During winter field work, if one of the team members begins to shiver uncontrolably or begins to act disoriented return to the lab immediately. If necessary, take an unconscious victim immediately to South County Hospital. at the lab, remove any wet clothing and give the victim warm drinks to warm the body core. Do not rub cold limbs if there is any possibility that the tissue has been damaged by frostbite.

Frostbite: During winter fieldwork, watch each other to see that exposed facial skin isn't turning white. Return to the lab immediately if this happens.

Heatstroke: If the victim feels warm but clammy, remove him/her to a cool, or at least shaded spot and give fluids. Do not give salt. Return to the lab. Untreated heat exhaustion leads to heatstroke. If the victim is disoriented and semiconscious or unconscious and has hot dry skin, remove him/ her to the hospital immediately. Do not try to administer fluids to an unconscious person.

If you're wearing gloves - Wear glasses

Spills of Hazardous Materials

Spill/Release Prevention

- We are working with small amounts of hazardous and presumed hazardous material, so there should not be any release of hazardous materials to the outside. Don't place any chemical or sediment waste in the dumpsters except sediment which has been analysed by an independant laboratory and been documented to be nontoxic enough to landfill. Don't allow sediments to dry on surfaces (to avoid dust).

- Don't dump any chemicals down the drains, with the following exceptions:

  1. Cadmium reference toxicants at the 0.13 and 0.36 ppm (mg/L) level may currently go down the drains. This is subject to revision. Cadmium reference toxicants in excess of 0.4 ppm must go in the appropriately labelled carboy along the east wall. Use secondary containment when emptying test jars. Work in the hood to protect yourself from aerosols.
  2. Sodium dodecyl sulfate solutions may go down the drain.

- Water samples can be put down the drains. Whenever possible, samples should handled in the hood. Secondary containment with a dish bin is recommended when renewing the water in exposure containers. Water should not be allowed to dry on counters or containers awaiting wash. (To avoid liberating sediments.)

- Formalin, Ethanol and hydrochloric acid should only be used in the hood to avoid release of fumes into the room. Working 12 inches back from the edge will avoid release of liquid into the room.

- If secondary containment pans are being used for a reagent or waste, be sure to return the reagent container to the pan.

- Notify the safety officer whenever there has been a spill or a new waste is being produced.

Employee Responsibilities for Handling Wastes

1. Notify the Local EC&HS Official of all spent or excess hazardous material and hazardous waste.
2. Do not store ANY incompatible wastes in the same container. The following is a partial list of waste streams that must not be stored in the same container because of incompatibilities and/or disposal/recycling requirements:
   - Oils (vacuum pump)
   - Flammable liquids (isopropyl alcohol, ethanol, kerosene, methyl ethyl ketone, acetone)
   - Halogenated solvents (methylene chloride, 1,1,1-tricholoroethane)
   - Oxidizers (>40% nitric acid, potassium nitrate, ammonium nitrate)
   - Poisons (phenol, mercury)
   - Organic acids (acetic acid, formic acid)
   - Inorganic acids (hydrochloric acid, sulfuric acid, hydrofluoric acid).

     NOTE: Further segregation within the above waste streams may be required because of chemical incompatibilities. If uncertain as to container and storage requirements, contact your Local EC&HS Official.
3. Label containers with the following information:
   - The words "Hazardous Waste"
   - Contents (i.e., isopropyl alcohol solution)
   - Accumulation start date (i.e., date waste is first added to the container)
   - Physical/health hazards (i.e., flammable/reactive).

     NOTE: Labels are obtained from the Local EC&HS Official.
4. Ensure that all containers are nonleaking, nonreactive and properly sealed.
5. Leave 3 inches of head space in any hazardous waste drum containing liquid.

Spill Control Measures
(Wear Gloves)

Lab coat
eye protection etc.

Hydrochloric Acid: Small spills of diluted hydrochloric acid can be mopped up with paper towels. Put the towels in a bucket in the hood, sprinkle with baking soda and gently run water into the bucket. Add a little more soda. Neutralization is complete when there are no more bubbles. The towels can be squeezed out and placed in the trash and the water in the bucket can go down the drain. Spills of concentrated HCL on the floor of the hood can be neutralized with a little baking soda then mopped or rinsed into the sink. Calcium carbonate may also be used for acid neutralization.

✓ marble chips

Ethanol/methanol: Small spills: wipe with paper towels, place in hood. Large spills (ie 200 ml) use spill control mats, follow directions on the package. to contain spill

Cadmium: Use spill control mats and immediately place in plastic bags. Cadmium solutions must not be allowed to dry out to release carcinogenic particles.

small spills wipe down counters with water & paper towels and put into plastic ziplock bag

Sediment: Don't allow sediment to dry out. — Secondary containment
Wipe up very small spills (a few ml) with paper towels and take them to the dumpster before they dry out. For larger spills, scoop up as much material as possible and put it in the designated sediment waste drum. Wipe with a minimum number of paper towels and put them in the drum.
Bent Pan in enclosure

Water samples: Wipe up with paper towels and put them immediately in the dumpster. Large spills should be contained with spill mats.

Notify the safety officer whenever there has been a spill or a new waste has been produced.

Notification of Hazards Associated with Work in this Facility

- **Polluted sediments and water.** All samples are to be regarded as hazardous. Any one of them could contain pesticides, heavy metals, industrial pollutants and/or infectious agents. Wear latex (and additional) gloves, tyvek lab coat and eye protection at all times. Operations which liberate pollutants and natually occurring cyanide and sulfide fumes (press sieving, jar filling, subsampling, salinity adjustment) should be done in the hood or on carts in front of the hood. Don't allow samples to dry out on surfaces. This would liberate **particles.**

- To avoid ingestion of samples or chemicals, there is no eating, drinking, or allowed in the lab.

- **Chemicals.** Specific hazards will be conveyed in the Chemical Hygiene Plan. Protection detailed above for samples should also be used for chemicals. In addition, chemical wastes should never be mixed in the same containers.

- **Glassware.** Cuts from glass can be minimized by using nonbreakable containers for any operations that do not specifically require glass. All chipped or broken glassware should be discarded immediately upon discovery. Put it in the designated broken glass container. Handle glass very carefully at all times, but especially when wearing gloves, and when reaching into dishbins full of soapy water and glassware. Always wear shoes and socks (no sandals) to protect your feet from flying pieces of glass that has been dropped.

- Injuries due to **improper lifting.** This job requires lifting large carboys of seawater, boxes of glassware, coolers full of sediments, canoes, and other heavy gear. Whenever necessary, ask for help with lifting. Always lift with the back straight, allowing the muscles of the legs to do most of the work. Never lift and twist in the same motion.

- **Exposure/sunburn.** Wear adequate clothing during fieldwork, including sunglasses. For winter, wear multiple layers. Wool is preferable to cotton (ie jeans) or down because wool is warm even when wet. Cotton wicks moisture to other clothing, resulting in a larger wetted surface area. Bring a hat and gloves, in addition to the rubber gloves provided by the company. Bring a thermos along in the canoe with warm nonalcoholic drinks. For summer, carry drinking water to avoid dehydration. Have a longsleeved shirt and sunscreen available to protect against sunburn.

Notification of Hazards Associated with Work in this Facility
continued

- **Hearing loss** - exposure to the noise from fume hoods can result in a cumulative loss of hearing. If the hood is running for long periods of time, use the disposible earplugs stored under the center cabinet in the prep room.

- **Drowning** - There is no horseplay no swimming allowed when canoeing. Do not stand up in the boat. Do not wear waders when canoeing across the river channel, put them on after reaching shallowwater. Life jackets must be worn at all times in the canoe and while sieving (because of the possibility of stepping into a deep hole while weighted down with waders).

Accident Reporting Procedure

An accident is defined as an incident or event occurring at work or while on company business that **caused or could have caused** injury to personnel and/or damage to equipment or facilities.

OSHA and company policies require filing of written reports when certain injuries and damage occur.

Person to whom accidents and unsafe situations should be reported: Diane MacBride

To protect yourself, and insure that you would be eligible for Workers Compensation if complications develop from a seemingly minor injury, **report all injuries.**

Employers are required by law to report all serious injuries that might involve Workers Comp to the appropriate agencies within 24 hours of first knowledge of the accident.

Attached is a copy of of an OSHA accident reporting form that must be filed for certain types of injuries. Notice that it is necessary to report unsafe acts on the part of the employee as well as unsafe conditions.

It is the responsibility of the employee not to engage in unsafe acts.

Exhibit 4-1. Supervisor's Accident Investigation Report Instructions

Part III-Accident Causes. Use the following lists in determining the cause(s) of the accident.

Selected Unsafe Acts-Personal Factors

Making safety devices inoperable

Failure to use guards provided

Using defective equipment

Servicing equipment in motion

Failure to use proper tools or equipment

Operating machinery or equipment at unsafe speed

Failure to use personal protective equipment

Operating without authority

Lack of skill or knowledge

Unsafe loading or placing

Improper lifting, lowering, or carrying

Taking unsafe position

Unnecessary haste

Influence of alcohol or drugs

Physical limitation or mental attitude

Unaware of hazards

Unsafe act of other

Selected Unsafe Conditions

Inadequate guards or protection

Defective tools or equipment

Unsafe condition of machine

Congested work area

Poor housekeeping

Unsafe floors, ramps, stairways, platforms

Improper material storage

Inadequate warning system

Fire or explosion hazards

Hazardous atmosphere: gases, dust, fumes, vapors

Hazardous substances

Inadequate ventilation

Radiation exposures

Excessive noise

Inadequate illumination

Exhibit 4-1. Supervisor's Accident Investigation Report

Instructions for Parts III and IV are given on the following page. If more space is needed in completing the report, use additional pages. Complete and return this report to the Local EC&HS Official no later than the next working day after the accident.

Location: _____

Part I- General Information

Name of Injured: _____ Division: _____

Date of Accident: _____ Hour: _____am/pm Exact Location:_____

Name of Witness: _____ Division: _____

Part II-Description of Accident (Summarize the accident, providing specific detail.)

_____

_____

_____

_____

_____

_____

_____

_____

Part III-Causes of Accident (Determine the cause by analyzing all involved factors, including those listed in the instructions.)

A. Describe Any **Unsafe** Acts:_____

_____

_____

Exhibit 4-1. Supervisor's Accident Investigation Report (continued)

B. Describe Any Unsafe Conditions: _____

_____

_____

_____

_____

_____

_____

Part IV-Corrective Action Taken *(Summarize actions taken and recommendations made to prevent a similar accident or recurrence of the same accident. Before completing this section, study the steps identified in the instructions.)*

_____

_____

_____

_____

_____

_____

_____

If no actions have been taken, give the reason(s _____

_____

_____

_____

_____

_____

Signatures: _____ _____

Supervisor Local EC&HS Official

Date Report Prepared: _____

WRITTEN HAZARD COMMUNICATION PROGRAM

PURPOSE

TO ENSURE THAT THE HAZARDS OF ALL CHEMICALS ARE EVALUATED AND INFORMATION CONCERNING POTENTIAL HEALTH AND PHYSICAL HAZARDS IS PASSED ON FROM CHEMICAL MANUFACTURERS, IMPORTERS AND DISTRIBUTORS TO EMPLOYERS AND THEIR EMPLOYEES.

INFORMATION REQUIREMENTS

EMPLOYERS MUST INFORM EMPLOYEES OF:

- REQUIREMENTS OF THE HAZARD COMMUNICATION STANDARD.
- OPERATIONS IN THE WORK AREA WHERE HAZARDOUS SUBSTANCES ARE PRESENT.
- LOCATION AND AVAILABILITY OF THE WRITTEN HAZARD COMMUNICATION PROGRAM.
- RIGHT TO PERSONALLY RECEIVE INFORMATION REGARDING HAZARDOUS SUBSTANCES TO WHICH THEY MAY BE EXPOSED.
- RIGHT FOR THEIR PHYSICIAN OR BARGAINING AGENT TO RECEIVE INFORMATION REGARDING HAZARDOUS SUBSTANCES TO WHICH THE EMPLOYEE MAY BE EXPOSED.
- RIGHT AGAINST DISCHARGE OR OTHER DISCRIMINATION DUE TO THE EXERCISE OF THEIR RIGHTS.

PROGRAM

EMPLOYERS MUST HAVE A WRITTEN PROGRAM WHICH CONTAINS:

1) SYSTEM OF LABELS OR OTHER FORMS OF WARNING
2) MATERIAL SAFETY DATA SHEET PROGRAM MSDS
3) EMPLOYEE TRAINING PROGRAM
4) LIST OF HAZARDOUS SUBSTANCES IN THE WORKPLACE
5) METHODS TO INFORM EMPLOYEES OF THE HAZARDS OF NON-ROUTINE TASKS
6) METHODS TO INFORM CONTRACTORS OF HAZARDOUS SUBSTANCES TO WHICH THEY MAY BE EXPOSED.

TRAINING REQUIREMENTS

EMPLOYEES MUST BE TRAINED IN:

- EXPLANATION OF WHAT A MATERIAL SAFETY DATA SHEET IS.
- CONTENTS OF THE MSDS FOR ANY HAZARDOUS SUBSTANCE TO WHICH THEY MAY BE EXPOSED. Chem/ phys.
- ANY PHYSICAL OR HEALTH HAZARDS ASSOCIATED WITH THE USE OF A HAZARDOUS SUBSTANCE.
- PROPER HANDLING PRECAUTIONS.
- NECESSARY PERSONAL PROTECTIVE EQUIPMENT.
- PRECAUTIONS TO MINIMIZE EXPOSURE TO HAZARDOUS SUBSTANCES.
- EMERGENCY PROCEDURES FOR FIRES, SPILLS.
- PROPER DISPOSAL PROCEDURES.

- FIRST AID PROCEDURES.
- METHODS AND OBSERVATIONS THAT MAY BE USED TO DETECT THE PRESENCE OR RELEASE OF A HAZARDOUS SUBSTANCE IN THE WORK AREA.
- DETAILS OF THE HAZARD COMMUNICATION PROGRAM FOR YOUR FACILITY.

EXCEPTIONS

MATERIAL EXCEPTIONS

- EPA REGULATED HAZARDOUS WASTE
- TOBACCO OR TOBACCO PRODUCTS
- WOOD OR WOOD PRODUCTS
- ARTICLES THAT DO NOT RELEASE A HAZARDOUS CHEMICAL UNDER NORMAL CONDITIONS OF USE (I.E., NUTS, BOLTS, ETC.)
- FOOD, DRUGS, COSMETICS AND ALCOHOL
- CONSUMER PRODUCTS AND (DURATION AND FREQUENCY OF EXPOSURE MUST BE GREATER THAN THAT EXPERIENCED BY CONSUMERS)

LABELING EXCEPTIONS

- FIFRA PESTICIDES
- DISTILLED SPIRITS REGULATED BY ATF
- CONSUMER PRODUCTS REGULATED BY CPSC
- ~~FDA~~ FDA REGULATED FOOD, DRUGS & COSMETICS

DEFINITIONS

Toxic oral LD50 < 500 mg/kg

Extremely Toxic LD50 < 50 mg/kg

HEALTH HAZARD - A CHEMICAL FOR WHICH THERE IS STATISTICALLY SIGNIFICANT EVIDENCE FROM AT LEAST ONE SCIENTIFIC STUDY DEMONSTRATING THAT ACUTE OR CHRONIC EFFECTS MAY OCCUR IN EXPOSED EMPLOYEES. INCLUDES: 1) CARCINOGENS, 2) TOXIC/HIGHLY TOXIC AGENTS, 3) REPRODUCTIVE TOXINS, 4) IRRITANTS, 5) CORROSIVES, 6) SENSITIZERS, 7) HEPATOTOXINS, 8) NEPHROTOXINS, 9) NEURONTOXINS, 10) HEMATO POEITIC AGENTS.

PHYSICAL HAZARD - CHEMICAL THAT IS A 1) COMBUSTIBLE LIQUID, 2) COMPRESSED GAS, 3) EXPLOSIVE 4) FLAMMABLE, 5) AN ORGANIC PEROXIDE, 6) OXIDIZER, 7) PYROPHORIC, 8) UNSTABLE (REACTIVE) OR 9) WATER-REACTIVE.

TEMPERATURE

IN GENERAL, MATERIALS THAT ARE HEATED ARE MORE HAZARDOUS.

HOT ACIDS AND CAUSTICS WILL CAUSE MORE SKIN DAMAGE OR BURNS THAN IF THEY WERE COOL.

LIQUIDS GIVE OFF MORE VAPORS AT HIGHER TEMPERATURES.

FLAMMABLES ARE MORE LIKELY TO CATCH FIRE OR EXPLODE AS THE TEMPERATURE IS RAISED.

KEY POINT

MORE CARE AND CONTROL MUST BE USED WHEN WORKING WITH OR AROUND HOT SUBSTANCES.

any degree ...

(ii) "*Gas, flammable*" means:

(A) A gas that, at ambient temperature and pressure, forms a flammable mixture with air at a concentration of 13 percent by volume or less; or

(B) A gas that, at ambient temperature and pressure, forms a range of flammable mixtures with air wider than 12 percent by volume, regardless of the lower limit.

(iii) "*Liquid, flammable*" means any liquid having a flashpoint below 100 °F (37.8 °C), except any mixture having components with flashpoints of 100 °F (37.8 °C) or higher, the total of which make up 99 percent or more of the total volume of the mixture.

(iv) "*Solid, flammable*" means a solid, other than a blasting agent or explosive as defined in § 1910.109(a), that is liable to cause fire through friction, absorption of moisture, spontaneous chemical change, or retained heat from manufacturing or processing, or which can be ignited readily and when ignited burns so vigorously and persistently as to create a serious hazard. A chemical shall be considered to be a flammable solid if, when tested by the method described in 16 CFR 1500.44, it ignites and burns with a self-sustained flame at a rate greater than one-tenth of an inch per second along its major axis.

"*Flashpoint*" means the minimum temperature at which a liquid gives off a vapor in sufficient concentration to ignite when tested as follows:

(i) Tagliabue Closed Tester (See American National Standard Method of Test for Flash Point by Tag Closed Tester, Z11.24–1979 (ASTM D 56–79))-for liquids with a viscosity of less than 45 Saybolt Universal Seconds (SUS) at 100 °F (37.8 °C), that do not contain suspended solids and do not have a tendency to form a surface film under test; or

(ii) Pensky-Martens Closed Tester (see American National Standard Method of Test for Flash Point by Pensky-Martens Closed Tester, Z11.7–1979 (ASTM D 93–79))-for liquids with a viscosity equal to or greater than 45 SUS at 100 °F (37.8 °C), or that contain suspended solids or have a tendency to form a surface film under test.

"*Combustible liquid*" means any liquid having a flashpoint at or above 100 °F (37.8 °C), but below 200 °F (93.3 °C), except any mixture having components with flashpoints of 200 °F (93.3 °C), or higher, the total volume of which make up 99 percent or more of the total volume of the mixture.

"*Compressed gas*" means:

(i) A gas or mixture of gases having, in a container, an absolute pressure exceeding 40 psi at 70 °F (21.1 °C); or

(ii) 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

(iii) A liquid having a vapor pressure exceeding 40 psi at 100 °F (37.8 °C) as determined by ASTM D–323–72.

"*Designated area*" means an area which may be used for work with "select carcinogens," reproductive toxins or substances which have a high degree of acute toxicity. A designated area may be the entire laboratory, an area of a laboratory or a device such as a laboratory hood.

"*Emergency*" means any occurrence such as, but not limited to, equipment failure, rupture of containers or failure of control equipment which results in an uncontrolled release of a hazardous chemical into the workplace.

"*Employee*" means an individual employed in a laboratory workplace who may be exposed to hazardous chemicals in the course of his or her assignments.

"*Explosive*" means a chemical that causes a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature.

"*Flammable*" means a chemical that falls into one of the following categories:

(i) "*Aerosol, flammable*" means an aerosol that, when tested by the method described in 16 CFR 1500.45, yields a

FLAMMABLES

FIRE TRIANGLE:

CONTROL THE HAZARD BY:

A. LIMITING AMOUNT OF FUEL IN AREA
- LIMIT STORAGE OF FLAMMABLES TO THE SMALLEST AMOUNT NEEDED.
- USE SAFETY CANS AND SAFETY CABINETS.
- USE SAFETY CANS OR COVERED WASTE CANS.

B. LIMITING SOURCES OF IGNITION
- DO NOT SMOKE IN AREAS WHERE FLAMMABLES ARE USED OR STORED.
- AVOID CREATING SPARKS OR STATIC ELECTRICITY (ALWAYS GROUND AND BOND CONTAINERS USED TO TRANSFER FLAMMABLES).
- USE NON-SPARKING TOOLS.
- DO NOT USE ELECTRICAL EQUIPMENT WHICH IS NOT EXPLOSION-PROOF AROUND FLAMMABLES.

NEVER ENTER A FLAMMABLE VAPOR ATMOSPHERE.
KNOW ABOUT SPILL CONTROL METHODS AND EMERGENCY PLANS.

CORROSIVES

STRONG ACIDS AND BASES WILL CAUSE SERIOUS SKIN AND EYE BURNS IN LESS THAN ONE MINUTE. USE OF PROPER PROTECTION; GLOVES, GOGGLES, SPLASH SHIELDS, APRONS, BOOTS, ETC. IS ESSENTIAL

WHEN USING CORROSIVES, A SAFETY SHOWER AND EYEWASH MUST BE NEARBY, KNOW WHERE THIS EQUIPMENT IS AND KEEP ACCESS TO IT CLEAR AT ALL TIMES.

IF IT GETS ON YOUR SKIN, FLUSH IT WITH LARGE QUANTITIES OF CLEAN WATER FOR SEVERAL MINUTES. REMOVE CONTAMINATED CLOTHING AND SHOES.

IF IT GETS IN YOUR EYES, FLUSH THEM IMMEDIATELY WITH CLEAN WATER FOR AT LEAST 15 MINUTES.

REPORT ALL CONTACTS WITH CORROSIVES TO YOUR SUPERVISOR AND/OR NURSE.

KEY POINT

USE ALL PROTECTIVE EQUIPMENT TO PREVENT EXPOSURE TO CORROSIVES.

"*Organic peroxide*" means an organic compound that contains the bivalent —O—O— structure and which may be considered to be a structural derivative of hydrogen peroxide where one or both of the hydrogen atoms has been replaced by an organic radical.

"*Oxidizer*" means a chemical other than a blasting agent or explosive as defined in § 1910.109(a), that initiates or promotes combustion in other materials, thereby causing fire either of itself or through the release of oxygen or other gases.

"*Physical hazard*" means a chemical for which there is scientifically valid evidence that it is a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable (reactive) or water-reactive.

"*Protective laboratory practices and equipment*" means those laboratory procedures, practices and equipment accepted by laboratory health and safety experts as effective, or that the employer can show to be effective, in minimizing the potential for employee exposure to hazardous chemicals.

"*Reproductive toxins*" means chemicals which affect the reproductive capabilities including chromosomal damage (mutations) and effects on fetuses (teratogenesis).

"*Select carcinogen*" means any substance which meets one of the following criteria:

(i) It is regulated by OSHA as a carcinogen; or

(ii) It is listed under the category, "known to be carcinogens," in the Annual Report on Carcinogens published by the National Toxicology Program (NTP) (latest edition); or

(iii) It is listed under Group 1 ("carcinogenic to humans") by the International Agency for Research on Cancer Monographs (IARC) (latest editions); or

(iv) It is listed in either Group 2A or 2B by IARC or under the category, "reasonably anticipated to be carcinogens" by NTP, and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:

(A) After inhalation exposure of 6–7 hours per day, 5 days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m^3;

(B) After repeated skin application of less than 300 (mg/kg of body weight) per week; or

(C) After oral dosages of less than 50 mg/kg of body weight per day.

"*Unstable (reactive)*" means a chemical which is the pure state, or as produced or transported, will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shocks, pressure or temperature.

"*Water-reactive*" means a chemical that reacts with water to release a gas that is either flammable or presents a health hazard.

(c) *Permissible exposure limits.* For laboratory uses of OSHA regulated substances, the employer shall assure that laboratory employees' exposures to such substances do not exceed the permissible exposure limits specified in 29 CFR part 1910, subpart Z.

TOXIC CHEMICALS

KEY POINTS:

EXPOSURE TO TOXIC MATERIALS CAN OCCUR THROUGH ALL ROUTES IN THE BODY.

MATERIALS THAT ARE TOXIC MAY ALSO HAVE OTHER HAZARDOUS PROPERTIES, SUCH AS CORROSIVE, FLAMMABLE OR EXPLOSIVE.

THE MORE TOXIC THE CHEMICAL OR MATERIAL, THE BETTER THE PROTECTION MUST BE.

HOW EXPOSURES OCCUR

(ROUTES OF EXPOSURE)

INHALATION
(BREATHING)

BREATHING DUSTS, GASES AND VAPORS CAN BE LESSENED BY USING EXHAUST VENTILATION, SUCH AS FUME HOODS; OR BY VACCUUMING DUSTS AND POWDERS OR USING A DAMP MOP OR CLOTH FOR CLEANING UP POWDERS.

INGESTION
(EATING)

NEVER EAT, DRINK SMOKE OR APPLY MAKE-UP IN AREAS WHERE HAZARDOUS OR TOXIC MATERIALS ARE USED.

SKIN ABSORPTION

MANY GASES, LIQUIDS AND MOST POWDERS CAN BE TAKEN INTO THE BODY THROUGH UNBROKEN SKIN. WEAR GLOVES, APRONS, LAB COATS AND OTHER

TOXICITY
VS.
HAZARD

TOXICITY - REFERS TO THE ABILITY OF MATERIAL TO PRODUCE HARM.

HAZARD - IS THE CHANCE THAT A MATERIAL WILL CAUSE INJURY OR HARM IF YOU ARE EXPOSED TO IT.

EXAMPLE

A SHEET OF ASBESTOS HAS NO HAZARD UNLESS THE SHEET IS SAWED OR BROKEN UP THEREBY RELEASING ASBESTOS FIBER AND DUST.

KEY POINT

REDUCE OR ELIMINATE THE HAZARD BY USING PROTECTIVE EQUIPMENT, EXHAUST VENTILATION OR OTHER MEANS OF CONTROL. ALSO PLAN AND PREPARE FOR EMERGENCIES AND SPILLS IN ADVANCE.

COMPRESSED GASES

none currently except in EMAP

KEY POINTS:

ALWAYS CHAIN FULL AND EMPTY CYLINDERS.

STORE AWAY FROM SOURCES OF HEAT

WHEN OPENING VALVE, DO NOT STAND IN FRONT OF THE GAUGES hearing hazzard too

OXYGEN AND FUEL GAS CYLINDERS MUST BE STORED SEPARATELY

ALWAYS LEAVE THE CAP ON THE GAS CYLINDER WHEN ITS NOT IN USE

DO NOT MOVE CYLINDERS UNLESS THEY ARE CHAINED TO THE CART

US

Hazard Communication Plan
Labelling

Person Designated to label chemicals in house and assure that any material being shipped from here is labelled : Diane MacBride

Description of our Labelling system:

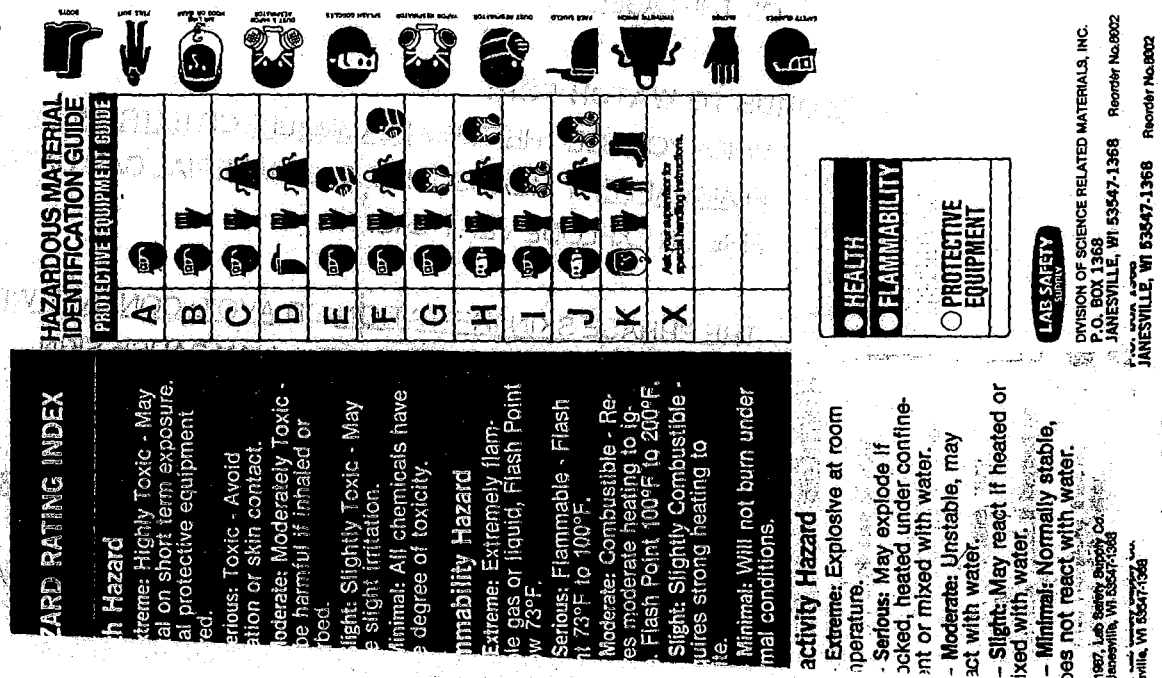
We will be using stick-on labels with pictorials to designate hazards and personal protective equipment. All chemicals, whether purchased, prepared here, or purchased alsewhere and carried into this facility, must be labelled as follows:

1. One the top line, write the name of the chemical as it is designated on the MSDS.
2. With a waterproof marker, fill in the numerical rating for health, flammability, and reactivity. This information can be found on the MSDS or on the label of the original container, in the case of material being repackaged.
3. The same sources should be consulted for specific hazards and for personal protective gear. Small symbols can be found on the R.T.K. pictorial pad to stick in the boxes on the bottom of the label. If there is no symbol available, write the item (lab coat, fume hood) in the box with a waterproof marker.

Alternative methods for labelling:

Samples may be numerically labelled using tape. They will not have the hazard information on each test chamber or jar, but all samples are to be regarded as hazardous and can only be handled according to posted personal protective measures.

Chemicals which are purchased and have text (paragraph form) labels need not be relabelled with the numerical/pictorial system, as long as the hazards are stated on the label.



LABELS AND OTHER FORMS OF WARNING

EACH CONTAINER OF HAZARDOUS SUBSTANCES IN THE WORKPLACE MUST BE TAGGED OR MARKED WITH:

A) THE IDENTITY OF THE HAZARDOUS SUBSTANCES IN THE CONTAINER AND

B) APPROPRIATE HAZARD WARNINGS

HAZARD WARNING - ANY WORDS, PICTURES, SYMBOLS OR COMBINATION WHICH CONVEYS THE HEALTH AND PHYSICAL HAZARDS OF THE CONTENTS OF THE CONTAINER.

LABELING

KEY POINTS:

ALWAYS LABEL THE BEAKER, FLASK OR SAFETY CAN, ETC., WHICH YOU ARE WORKING WITH.

DON'T THINK THAT A CHEMICAL IS SAFE JUST BECAUSE THERE ARE NO WARNINGS OR STATEMENTS OF HAZARD ON THE LABEL.

WORDS TO WATCH FOR:

WHEN YOU SEE THE TERM FLAMMABLE OR EXTREMELY FLAMMABLE, IT MEANS THAT THE MATERIAL CAN CATCH FIRE OR EXPLODE VERY EASILY.

THE PHRASE SKIN IRRITATION OR AVOID CONTACT WITH SKIN MEANS THAT THE MATERIAL MAY CAUSE SKIN DAMAGE.

THE PHRASE CAUSES BURNS OR CAUSES SEVERE BURNS OR CAUSES SEVERE IRRITATION MEANS THAT THE CHEMICALS IF TOUCHED TO YOUR SKIN, WILL CAUSE A RASH OR DESTROY THE TISSUE.

THE WORD OXIDANT OR THE WORDS OXIDIZING AGENT USUALLY MEANS THAT THE CHEMICAL READILY REACTS WITH OTHER MATERIALS. WHEN AN OXIDIZING AGENT COMES IN CONTACT WITH COMBUSTIBLE MATERIALS, THESE MATERIALS MAY BURN OR EXPLODE, SOMETIMES EVEN WITHOUT A SOURCE OF IGNITION.

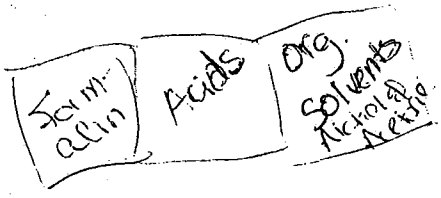
THE PHRASE HARMFUL IF INHALED OR DO NOT BREATHE VAPOR MEANS THAT YOU SHOULD NOT BREATHE THE GAS, VAPOR OR DUST.

THE PHRASE KEEP AWAY FROM HEAT AND OPEN FLAME MEANS THAT YOU SHOULD NOT USE THIS CHEMICAL WITHIN 25 FEET OF SOURCES OF IGNITION.

THE PHRASE KEEP CONTAINER CLOSED USUALLY MEANS THAT THE CHEMICAL WILL QUICKLY VAPORIZE. IT COULD CAUSE HIGH CONCENTRATIONS OF VAPOR IN THE AIR AND THE AIR WOULD BE EXPLOSIVE, FLAMMABLE OR POISONOUS.

STORAGE

STORAGE



ISOLATE INCOMPATIBLE CHEMICALS
(SEE ATTACHED GUIDELINE FOR INCOMPATIBLES)

USE STRONG, WELL CONSTRUCTED SHELVING FOR CHEMICALS (SPILL TRAYS FOR LIQUIDS). USE SPECIAL SAFETY CABINETS FOR FLAMMABLES, CORROSIVES AND OXIDIZERS.

DISPOSE OF OFF-SPEC, OUT-OF-DATE OR NO LONGER USED CHEMICALS.

ENSURE ALL CONTAINERS ARE PROPERLY LABELED.

Other Measures to Minimize Exposure to Hazardous Materials

- Lab coats, gloves and other protective gear are not to be worn in the offices or restroom.

- No food or beverages are to be stored in the refrigerators designated for samples, and no samples or chemicals are to be stored in the refrigerator in the front office designated for food.

- No dishwashing in the lab sinks.

- Red-taped equipment such as pens, pencils, scissors, may not leave the lab areas. Any clean office equipment which is accidentally carried into the lab may not be returned to the office. It must be marked with red tape and used henceforth only in the lab.

- Gloves, labcoat and eye protection, at a minimum, must be worn for all lab operations in this building, and should also be worn for any operations in the main lab which involve handling any sediments, including work with reference and holding sediments.

- Always wash your hands with soap and water before leaving the lab.

_____

_____

_____

_____

_____

Employee Responsibilities for Handling Wastes

1. Notify the Local EC&HS Official of all spent or excess hazardous material and hazardous waste.
2. Do not store incompatible wastes in the same container. The following is a partial list of waste streams that must not be stored in the same container because of incompatibilities and/or disposal/recycling requirements:
   - Oils (vacuum pump)
   - Flammable liquids (isopropyl alcohol, ethanol, kerosene, methyl ethyl ketone, acetone)
   - Halogenated solvents (methylene chloride, 1,1,1-tricholoroethane)
   - Oxidizers (>40% nitric acid, potassium nitrate, ammonium nitrate)
   - Poisons (phenol, mercury)
   - Organic acids (acetic acid, formic acid)
   - Inorganic acids (hydrochloric acid, sulfuric acid, hydrofluoric acid).

     NOTE: Further segregation within the above waste streams may be required because of chemical incompatibilities. If uncertain as to container and storage requirements, contact your Local EC&HS Official.
3. Label containers with the following information:
   - The words "Hazardous Waste"
   - Contents (i.e., isopropyl alcohol solution)
   - Accumulation start date (i.e., date waste is first added to the container)
   - Physical/health hazards (i.e., flammable/reactive).

     NOTE: Labels are obtained from the Local EC&HS Official.
4. Ensure that all containers are nonleaking and properly sealed.
5. Leave 3 inches of head space in any hazardous waste drum containing liquid.

Each addition of waste must be signed into the appropriate hazardous waste log provided by the safety officer. Write the date, the amount of material (in the appropriate units, usually milliliters for chemicals, liters for sediment and water samples) and then sign your name.

"CHEMICAL HYGIENE PLAN" REQUIRES:

1. A COMPREHENSIVE PLAN TO IMPLEMENT PRACTICES THAT WILL MINIMIZE EXPOSURES TO HAZARDOUS CHEMICALS.

2. EMPLOYEE EXPOSURE TO OSHA REGULATED SUBSTANCES TO NOT EXCEED THE PELS, 29 CFR 1910, SUBPART Z.

3. EMPLOYERS TO DETERMINE THE CHEMICAL EXPOSURE LEVELS TO THEIR EMPLOYEES.

   (A) MONITOR EXPOSURES TO REGULATED SUBSTANCE STANDARDS, IF THERE IS A REASON TO BELIEVE EXPOSURE LEVELS ROUTINELY EXCEED THE ACTION LEVEL OR PEL.

   (B) EXCEEDING THE ACTION LEVEL OR PEL MUST RESULT WITH MONITORING AND MEDICAL SURVEILLANCE AS PRESCRIBED IN THE RELEVANT STANDARD UNTIL EXPOSURE LEVELS ARE REDUCED TO OR BELOW THE STANDARD OR THE HAZARDOUS MATERIAL IS NO LONGER USED IN THE SAME PROCEDURE.

   (C) EMPLOYEES MUST BE NOTIFIED OF THE MONITORING RESULTS WITHIN FIFTEEN (15) DAYS AFTER RECEIPT OF THE INFORMATION. INFORMATION MAY BE INDIVIDUALLY GIVEN TO THE EMPLOYEE OR POSTED.

4. EMPLOYEES MUST BE GIVEN INFORMATION AND TRAINING FOR THESE NEW GUIDELINES. ALSO, WHEN:

   (A) INITIALLY ASSIGNED TO A WORK AREA.

   (B) PRIOR TO ASSIGNMENT INVOLVING NEW EXPOSURES.

5. EMPLOYEE INFORMATION AND TRAINING MUST INCLUDE:

   (A) THE CONTENTS OF THE "LABORATORY STANDARD" AND APPENDICES.

   (B) THE LOCATION AND AVAILABILITY OF THE "CHEMICAL HYGIENE PLAN". MUST INCLUDE COMPANY LABORATORY SAFETY POLICIES.

(C) THE PELS FOR OSHA REGULATED SUBSTANCES OR RECOMMENDED EXPOSURE LIMITS FOR OTHER HAZARDOUS CHEMICALS, IF NOT IN OSHA STANDARD.

(D) THE SIGNS AND SYMPTOMS ASSOCIATED WITH THEIR HAZARDOUS MATERIAL EXPOSURES.

(E) THE LOCATION OF MSDS AND OTHER REFERENCE MATERIAL FOR THE SAFE HANDLING, STORAGE, AND DISPOSAL OF HAZARDOUS MATERIAL.

(F) METHODS TO DETECT THE PRESENCE OR RELEASE OF HAZARDOUS MATERIALS.

(G) PHYSICAL AND HEALTH HAZARDS FOR HAZARDOUS MATERIALS.

(H) MEASURES EMPLOYEES MAY USE TO PROTECT THEMSELVES FROM HAZARDOUS MATERIALS. MAY INCLUDE:

(1) WORK PRACTICES
(2) EMERGENCY PROCEDURES
(3) PPE Personal Protective Equipment

6. EMPLOYERS TO PROVIDE EMPLOYEES WITH MEDICAL ATTENTION AND EXAMINATIONS, AS WELL AS FOLLOW-UP EXAMINATIONS AS DETERMINED BY THE TREATING PHYSICIAN, WHEN:

(A) AN EMPLOYEE HAS SIGNS OR SYMPTOMS ASSOCIATED WITH A HAZARDOUS MATERIAL EXPOSURE.

(B) MONITORING EXPOSURE LEVEL ROUTINELY EXCEEDS THE ACTION LEVEL (PEL) FOR AN OSHA REGULATED SUBSTANCE WHICH HAS MEDICAL SURVEILLANCE REQUIREMENTS.

(C) AN ACCIDENT OCCURS WHICH MAY HAVE RESULTED WITH HAZARDOUS MATERIAL EXPOSURE.

7. MEDICAL EXAMINATION/CONSULTATIONS MUST BE:

   (A) PERFORMED BY OR UNDER THE DIRECTION OF A LICENSED PHYSICIAN.

   (B) PROVIDED WITHOUT EMPLOYEE COST, LOSS OF PAY, AND AT A REASONABLE TIME AND LOCATION.

8. INFORMATION GIVEN TO THE TREATING PHYSICIAN FOR A POSSIBLE EMPLOYEE EXPOSURE SHOULD INCLUDE:

   (A) IDENTITY OF HAZARDOUS MATERIALS.

   (B) CONDITION DESCRIPTION DURING EXPOSURE.

   (C) EMPLOYEE SIGNS/SYMPTOMS DESCRIPTION.

(A) MSDS ARE MAINTAINED AND READILY AVAILABLE TO EMPLOYEES.

(B) HAZARDOUS MATERIAL LABELS ARE INTACT FOR INCOMING CONTAINERS.

(C) EMPLOYEES RECEIVE INFORMATION AND TRAINING FOR HAZARDOUS MATERIAL PRODUCED IN-HOUSE.

(D) HAZARDOUS MATERIALS PRODUCED AND USED IN THE LABORATORY FOLLOW THIS STANDARD.

(E) HAZARDOUS MATERIALS PRODUCED AND USED OUTSIDE THE LABORATORY MUST COMPLY WITH HCS.

(F) HAZARDOUS MATERIAL BY-PRODUCTS WITH UNKNOWN COMPOSITION SHOULD BE ASSUMED HAZARDOUS AND FOLLOW THE CHP.

12. PPE

(A) PROVIDED AT NO COST TO THE EMPLOYEE.

(B) COMPLY WITH THE RESPIRATORY PROTECTION STANDARD, 29 CFR 1910.134.

(E) CRITERIA TO REQUIRE PRIOR APPROVAL FOR SPECIFIC TYPES OF OPERATIONS. *

14. EXHAUST HOODS ARE FUNCTIONING PROPERLY.

15. DESIGNATION OF A CHEMICAL HYGIENE OFFICER RESPONSIBLE FOR THE CHP.

16. PROVISIONS FOR ADDITIONAL EMPLOYEE PROTECTION FROM EXTREMELY HAZARDOUS MATERIALS (E.G., SPECIFIC CARCINOGENS, REPRODUCTIVE TOXINS, HIGH DEGREE OF ACUTELY TOXIC SUBSTANCES) BY PROVIDING:

(A) DESIGNATED AREA(S) OF USE.

(B) CONTAINMENT EQUIPMENT (E.G., EXHAUST HOODS, GLOVE BOXES)

(C) PROCEDURES FOR HAZARDOUS MATERIAL WASTE REMOVAL.

(D) DECONTAMINATION PROCEDURES.

* Criteria to require prior approval: Prior approval and written application will be required by the saftety officer any time a new chemical is to be brought into the facility (either by purchase of new materials or hand carrying them from another location). The safety officer must also be notified any time waste is being generated.

Chemical Hygiene Plan

Certain material called for in the Chemical Hygiene plan has been convered in other sections of the employee training. These include, emergency procedures to summon help, spill prevention and management, wastehandling, first aid, personal protection methods.

The person designated to write and convey the Chemical Hygiene plan, as well other employee orientation plans is Diane MacBride. The Chemical Hygiene plan,as well as other employee orientation materials will be kept in the bottom drawer of the filing cabinet by the door between the wet lab and the front office.

Monitoring methods for hazardous chemicals used in this facility: SAIC will provide us with formaldehyde monitoring badges to be used on a day when we are picking preserved samples, since this activity should represent our maximum exposure to formalin.

Exposure to alcohols and hydrochloric acid will be limited by performing operations with these chemical only in the fume hood. These chemicals will therefore only be monitored by odor.

Operations that might result in liberation of Cadmium aerosols (preparing solutions, renewing chambers) will be limited to the fume hood. This material will not be monitored at present, except as below.

Methods to detect the release of hazardous material:

Samples, Cadmium: Visual. Check for puddles around waste drums, exposure chambers and stored sample materials.

Hydrochloric acid, formalin and ethanol all have distinctive odors. If any identifiable or unidentified chemical odor is detected, contact the safety officer immediately.

The PELS for the chemicals that we use have been discussed during training on MSDS and are tabulated below:

Hydrochloric Acid	-- 5 ppm	
Formaldehyde	-- 1 ppm	(a probable carcinogen)
Ethanol	-- _____	
Cadmium	-- 0.2 mg/ cubic meter	(a probable carcinogen)

The physical and health hazards for the chemicals above have been discussed in the course of MSDS training.

Special Hazards Associated with Nonroutine Tasks

Occasionally, we will be asked to do chemical analyses on our samples as part of specific contracts. In these cases, the persons doing the analyses will be trained with written SOP,s (standard operating procedures) which will identify hazards and designate safe methods for handling and disposing of chemicals. Other personel will be alerted as to the location(s) and hazards of the reagents and procedures.

ensuring that their standards are at least as effective as the Federal standard.

The 25 States with their own OSHA-approved occupational safety and health plans must adopt a comparable standard within six months of publication of a final rule. The States are: Alaska, Arizona, California, Connecticut, Hawaii, Indiana, Iowa, Kentucky, Maryland, Michigan, Minnesota, Nevada, New Mexico, New York, North Carolina, Oregon, Puerto Rico, South Carolina, Tennessee, Utah, Vermont, Virginia, Virgin Islands, Washington, Wyoming. For New York and Connecticut, plans cover only state and local government employees. Until such time as a State standard is promulgated, Federal OSHA will provide interim enforcement assistance, as appropriate, in these States.

VIII. Authority and Signature

This document was prepared under the direction of Gerard F. Scannell, Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, 200 Constitution Avenue NW., Washington, DC 20210. Pursuant to sections 6(b) and 8(c) and 8(g)(2) of the Act, OSHA hereby amends 29 CFR part 1910 by adding a new § 1910.1450 as set forth below.

List of Subjects in 29 CFR Part 1910

Laboratories, Occupational safety and health.

Signed at Washington, DC, this 22nd day of January 1990.

Gerard F. Scannell,

Assistant Secretary for Occupational Safety and Health.

Part 1910 of title 29 of the Code of Federal Regulation (CFR) is hereby amended as follows:

PART 1910—OCCUPATIONAL SAFETY AND HEALTH STANDARDS

1. The authority citation for part 1910, subpart Z is amended by adding the following citation at the end. (Citation which precedes asterisk indicates general rulemaking authority.)

Authority: Secs. 6 and 8, Occupational Safety and Health Act, 29 U.S.C. 655, 657; Secretary of Labor's Orders Nos. 12–71 (36 FR 8754), 8–76 (41 FR 25059), or 9–83 (48 FR 35736), as applicable; and 29 CFR part 1911. * * * Section 1910.1450 is also issued under sec. 6(b), 8(c) and 8(g)(2), Pub. L. 91–596, 84 Stat. 1593, 1599, 1600; 29 U.S.C. 655, 657.

2. Section 1910.1450 is added to subpart Z, part 1910 to read as follows:

§ 191.1450 Occupational exposure to hazardous chemicals in laboratories.

(a) *Scope and application.* (1) This section shall apply to all employers engaged in the laboratory use of hazardous chemicals as defined below.

(2) Where this section applies, it shall supersede, for laboratories, the requirements of all other OSHA health standards in 29 CFR part 1910, subpart Z, except as follows:

(i) For any OSHA health standard, only the requirement to limit employee exposure to the specific permissible exposure limit shall apply for laboratories, unless that particular standard states otherwise or unless the conditions of paragraph (a)(2)(iii) of this section apply.

(ii) Prohibition of eye and skin contact where specified by any OSHA health standard shall be observed.

(iii) Where the action level (or in the absence of an action level, the permissible exposure limit) is routinely exceeded for an OSHA regulated substance with exposure monitoring and medical surveillance requirements, paragraphs (d) and (g)(1)(ii) of this section shall apply.

(3) This section shall not apply to:

(i) Uses of hazardous chemicals which do not meet the definition of laboratory use, and in such cases, the employer shall comply with the relevant standard in 29 CFR part 1910, subpart Z, even if such use occurs in a laboratory.

(ii) Laboratory uses of hazardous chemicals which provide no potential for employee exposure. Examples of such conditions might include:

(A) Procedures using chemically-impregnated test media such as Dip-and-Read tests where a reagent strip is dipped into the specimen to be tested and the results are interpreted by comparing the color reaction to a color chart supplied by the manufacturer of the test strip; and

(B) Commercially prepared kits such as those used in performing pregnancy tests in which all of the reagents needed to conduct the test are contained in the kit.

(b) *Definitions*—

"*Action level*" means a concentration designated in 29 CFR part 1910 for a specific substance, calculated as an eight (8)-hour time-weighted average, which initiates certain required activities such as exposure monitoring and medical surveillance.

"*Assistant Secretary*" means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

"*Carcinogen*" (see "select carcinogen").

"*Chemical Hygiene Officer*" means an employee who is designated by the employer, and who is qualified by training or experience, to provide technical guidance in the development and implementation of the provisions of the Chemical Hygiene Plan. This definition is not intended to place limitations on the position description or job classification that the designated indvidual shall hold within the employer's organizational structure.

"*Chemical Hygiene Plan*" means a written program developed and implemented by the employer which sets forth procedures, equipment, personal protective equipment and work practices that (i) are capable of protecting employees from the health hazards presented by hazardous chemicals used in that particular workplace and (ii) meets the requirements of paragraph (e) of this section.

"*Combustible liquid*" means any liquid having a flashpoint at or above 100 °F (37.8 °C), but below 200 °F (93.3 °C), except any mixture having components with flashpoints of 200 °F (93.3 °C), or higher, the total volume of which make up 99 percent or more of the total volume of the mixture.

"*Compressed gas*" means:

(i) A gas or mixture of gases having, in a container, an absolute pressure exceeding 40 psi at 70 °F (21.1 °C); or

(ii) 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

(iii) A liquid having a vapor pressure exceeding 40 psi at 100 °F (37.8 °C) as determined by ASTM D–323–72.

"*Designated area*" means an area which may be used for work with "select carcinogens," reproductive toxins or substances which have a high degree of acute toxicity. A designated area may be the entire laboratory, an area of a laboratory or a device such as a laboratory hood.

"*Emergency*" means any occurrence such as, but not limited to, equipment failure, rupture of containers or failure of control equipment which results in an uncontrolled release of a hazardous chemical into the workplace.

"*Employee*" means an individual employed in a laboratory workplace who may be exposed to hazardous chemicals in the course of his or her assignments.

"*Explosive*" means a chemical that causes a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature.

"*Flammable*" means a chemical that falls into one of the following categories:

(i) "*Aerosol, flammable*" means an aerosol that, when tested by the method described in 16 CFR 1500.45, yields a

carcinogens" by NTP, and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:

(A) After inhalation exposure of 6–7 hours per day, 5 days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m³;

(B) After repeated skin application of less than 300 (mg/kg of body weight) per week; or

(C) After oral dosages of less than 50 mg/kg of body weight per day.

"*Unstable (reactive)*" means a chemical which is the pure state, or as produced or transported, will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shocks, pressure or temperature.

"*Water-reactive*" means a chemical that reacts with water to release a gas that is either flammable or presents a health hazard.

(c) *Permissible exposure limits.* For laboratory uses of OSHA regulated substances, the employer shall assure that laboratory employees' exposures to such substances do not exceed the permissible exposure limits specified in 29 CFR part 1910, subpart Z.

(d) *Employee exposure determination*—(1) *Initial monitoring.* The employer shall measure the employee's exposure to any substance regulated by a standard which requires monitoring if there is reason to believe that exposure levels for that substance routinely exceed the action level (or in the absence of an action level, the PEL).

(2) *Periodic monitoring.* If the initial monitoring prescribed by paragraph (d)(1) of this section discloses employee exposure over the action level (or in the absence of an action level, the PEL), the employer shall immediately comply with the exposure monitoring provisions of the relevant standard.

(3) *Termination of monitoring.* Monitoring may be terminated in accordance with the relevant standard.

(4) *Employee notification of monitoring results.* The employer shall, within 15 working days after the receipt of any monitoring results, notify the employee of these results in writing either individually or by posting results in an appropriate location that is accessible to employees.

(e) *Chemical hygiene plan—General.* (Appendix A of this section is non-mandatory but provides guidance to assist employers in the development of the Chemical Hygiene Plan.) (1) Where hazardous chemicals as defined by this standard are used in the workplace, the employer shall develop and carry out the provisions of a written Chemical Hygiene Plan which is:

(i) Capable of protecting employees from health hazards associated with hazardous chemicals in that laboratory and

(ii) Capable of keeping exposures below the limits specified in paragraph (c) of this section.

(2) The Chemical Hygiene Plan shall be readily available to employees, employee representatives and, upon request, to the Assistant Secretary.

(3) The Chemical Hygiene Plan shall include each of the following elements and shall indicate specific measures that the employer will take to ensure laboratory employee protection:

(i) Standard operating procedures relevant to safety and health considerations to be followed when laboratory work involves the use of hazardous chemicals;

(ii) Criteria that the employer will use to determine and implement control measures to reduce employee exposure to hazardous chemicals including engineering controls, the use of personal protective equipment and hygiene practices; particular attention shall be given to the selection of control measures for chemicals that are known to be extremely hazardous;

(iii) A requirement that fume hoods and other protective equipment are functioning properly and specific measures that shall be taken to ensure proper and adequate performance of such equipment;

(iv) Provisions for employee information and training as prescribed in paragraph (f) of this section;

(v) The circumstances under which a particular laboratory operation, procedure or activity shall require prior approval from the employer or the employer's designee before implementation;

(vi) Provisions for medical consultation and medical examinations in accordance with paragraph (g) of this section;

(vii) Designation of personnel responsible for implementation of the Chemical Hygiene Plan including the assignment of a Chemical Hygiene Officer and, if appropriate, establishment of a Chemical Hygiene Committee; and

(viii) Provisions for additional employee protection for work with particularly hazardous substances. These include "select carcinogens," reproductive toxins and substances which have a high degree of acute toxicity. Specific consideration shall be given to the following provisions which shall be included where appropriate:

(A) Establishment of a designated area;

(B) Use of containment devices such as fume hoods or glove boxes;

(C) Procedures for safe removal of contaminated waste; and

(D) Decontamination procedures.

(4) The employer shall review and evaluate the effectiveness of the Chemical Hygiene Plan at least annually and update it as necessary.

(f) *Employee information and training.* (1) The employer shall provide employees with information and training to ensure that they are apprised of the hazards of chemicals present in their work area.

(2) Such information shall be provided at the time of an employee's initial assignment to a work area where hazardous chemicals are present and prior to assignments involving new exposure situations. The frequency of refresher information and training shall be determined by the employer.

(3) *Information.* Employees shall be informed of:

(i) The contents of this standard and its appendices which shall be made available to employees;

(ii) The location and availability of the employer's Chemical Hygiene Plan;

(iii) The permissible exposure limits for OSHA regulated substances or recommended exposure limits for other hazardous chemicals where there is no applicable OSHA standard;

(iv) Signs and symptoms associated with exposures to hazardous chemicals used in the laboratory; and

(v) The location and availability of known reference material on the hazards, safe handling, storage and disposal of hazardous chemicals found in the laboratory including, but not limited to, Material Safety Data Sheets received from the chemical supplier.

(4) *Training.* (i) Employee training shall include:

(A) Methods and observations that may be used to detect the presence or release of a hazardous chemical (such as monitoring conducted by the employer, continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released, etc.);

(B) The physical and health hazards of chemicals in the work area; and

(C) The measures employees can take to protect themselves from these hazards, including specific procedures the employer has implemented to protect employees from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used.

(c) A spill control policy should be developed and should include consideration of prevention, containment, cleanup, and reporting (175).

(d) All accidents or near accidents should be carefully analyzed with the results distributed to all who might benefit (8, 28).

10. Information and Training Program

(a) Aim: To assure that all individuals at risk are adequately informed about the work in the laboratory, its risks, and what to do if an accident occurs (5, 15).

(b) Emergency and Personal Protection Training: Every laboratory worker should know the location and proper use of available protective apparel and equipment (154, 169).

Some of the full-time personnel of the laboratory should be trained in the proper use of emergency equipment and procedures (6).

Such training as well as first aid instruction should be available to (154) and encouraged for (176) everyone who might need it.

(c) Receiving and stockroom/storeroom personnel should know about hazards, handling equipment, protective apparel, and relevant regulations (217).

(d) Frequency of Training: The training and education program should be a regular, continuing activity—not simply an annual presentation (15).

(e) Literature/Consultation: Literature and consulting advice concerning chemical hygiene should be readily available to laboratory personnel, who should be encouraged to use these information resources (14).

11. *Waste Disposal Program.*

(a) Aim: To assure that minimal harm to people, other organisms, and the environment will result from the disposal of waste laboratory chemicals (5).

(b) Content (14, 232, 233, 240): The waste disposal program should specify how waste is to be collected, segregated, stored, and transported and include consideration of what materials can be incinerated. Transport from the institution must be in accordance with DOT regulations (244).

(c) Discarding Chemical Stocks: Unlabeled containers of chemicals and solutions should undergo prompt disposal; if partially used, they should not be opened (24, 27).

Before a worker's employment in the laboratory ends, chemicals for which that person was responsible should be discarded or returned to storage (226).

(d) Frequency of Disposal: Waste should be removed from laboratories to a central waste storage area at least once per week and from the central waste storage area at regular intervals (14).

(e) Method of Disposal: Incineration in an environmentally acceptable manner is the most practical disposal method for combustible laboratory waste (14, 238, 241).

Indiscriminate disposal by pouring waste chemicals down the drain (14, 231, 242) or adding them to mixed refuse for landfill burial is unacceptable (14).

Hoods should not be used as a means of disposal for volatile chemicals (40, 200).

Disposal by recycling (235, 243) or chemical decontamination (40, 230) should be used when possible.

E. Basic Rules and Procedures for Working with Chemicals

The Chemical Hygiene Plan should require that laboratory workers know and follow its rules and procedures. In addition to the procedures of the sub programs mentioned above, these should include the rules listed below.

1. General Rules

The following should be used for essentially all laboratory work with chemicals:

(a) *Accidents and spills*—Eye Contact: Promptly flush eyes with water for a prolonged period (15 minutes) and seek medical attention (33, 172).

Ingestion: Encourage the victim to drink large amounts of water (178).

Skin Contact: Promptly flush the affected area with water (33, 172, 178) and remove any contaminated clothing (172, 178). If symptoms persist after washing, seek medical attention (33).

Clean-up: Promptly clean up spills, using appropriate protective apparel and equipment and proper disposal (24, 33). See pp. 233–237 for specific clean-up recommendations.

(b) *Avoidance of "routine" exposure:* Develop and encourage safe habits (23); avoid unnecessary exposure to chemicals by any route (23).

Do not smell or taste chemicals (32). Vent apparatus which may discharge toxic chemicals (vacuum pumps, distillation columns, etc.) into local exhaust devices (199).

Inspect gloves (157) and test glove boxes (208) before use.

Do not allow release of toxic substances in cold rooms and warm rooms, since these have contained recirculated atmospheres (209).

(c) *Choice of chemicals:* Use only those chemicals for which the quality of the available ventilation system is appropriate (13).

(d) *Eating, smoking, etc.:* Avoid eating, drinking, smoking, gum chewing, or application of cosmetics in areas where laboratory chemicals are present (22, 24, 32, 40); wash hands before conducting these activities (23, 24).

Avoid storage, handling or consumption of food or beverages in storage areas, refrigerators, glassware or utensils which are also used for laboratory operations (23, 24, 226).

(e) *Equipment and glassware:* Handle and store laboratory glassware with care to avoid damage; do not use damaged glassware (25). Use extra care with Dewar flasks and other evacuated glass apparatus; shield or wrap them to contain chemicals and fragments should implosion occur (25). Use equipment only for its designed purpose (23, 26).

(f) *Exiting:* Wash areas of exposed skin well before leaving the laboratory (23).

(g) *Horseplay:* Avoid practical jokes or other behavior which might confuse, startle or distract another worker (23).

(h) *Mouth suction:* Do not use mouth suction for pipeting or starting a siphon (23, 32).

(i) *Personal apparel:* Confine long hair and loose clothing (23, 156). Wear shoes at all times in the laboratory but do not wear sandals, perforated shoes, or sneakers (158).

(j) *Personal housekeeping:* Keep the work area clean and uncluttered, with chemicals and equipment being properly labeled and stored; clean up the work area on completion of an operation or at the end of each day (24).

(k) *Personal protection:* Assure that appropriate eye protection (154–156) is worn by all persons, including visitors, where chemicals are stored or handled (22, 23, 33, 154).

Wear appropriate gloves when the potential for contact with toxic materials exists (157); inspect the gloves before each use, wash them before removal, and replace them periodically (157). (A table of resistance to chemicals of common glove materials is given p. 159).

Use appropriate (164–168) respiratory equipment when air contaminant concentrations are not sufficiently restricted by engineering controls (164–5), inspecting the respirator before use (169).

Use any other protective and emergency apparel and equipment as appropriate (22, 157–162).

Avoid use of contact lenses in the laboratory unless necessary; if they are used, inform supervisor so special precautions can be taken (155).

Remove laboratory coats immediately on significant contamination (161).

(l) *Planning:* Seek information and advice about hazards (7), plan appropriate protective procedures, and plan positioning of equipment before beginning any new operation (22, 23).

(m) *Unattended operations:* Leave lights on, place an appropriate sign on the door, and provide for containment of toxic substances in the event of failure of a utility service (such as cooling water) to an unattended operation (27, 128).

(n) *Use of hood:* Use the hood for operations which might result in release of toxic chemical vapors or dust (198–9).

As a rule of thumb, use a hood or other local ventilation device when working with any appreciably volatile substance with a TLV of less than 50 ppm (13).

Confirm adequate hood performance before use; keep hood closed at all times except when adjustments within the hood are being made (200); keep materials stored in hoods to a minimum and do not allow them to block vents or air flow (200).

Leave the hood "on" when it is not in active use if toxic substances are stored in it or if it is uncertain whether adequate general laboratory ventilation will be maintained when it is "off" (200).

(o) *Vigilance:* Be alert to unsafe conditions and see that they are corrected when detected (22).

(p) *Waste disposal:* Assure that the plan for each laboratory operation includes plans and training for waste disposal (230).

Deposit chemical waste in appropriately labeled receptacles and follow all other waste disposal procedures of the Chemical Hygiene Plan (22, 24).

Do not discharge to the sewer concentrated acids or bases (231); highly toxic, malodorous, or lachrymatory substances

2. Electrically powered laboratory apparatus. (179–92)
3. Fires, explosions: (26, 57–74, 162–4, 174–5, 219–20, 226–7)
4. Low temperature procedures: (26, 88)
5. Pressurized and vacuum operations (including use of compressed gas cylinders): (27, 75–101)

C. Material Safety Data Sheets

Material safety data sheets are presented in "Prudent Practices" for the chemicals listed below. (Asterisks denote that comprehensive material safety data sheets are provided).

*Acetyl peroxide (105)
*Acrolein (106)
*Acrylonitrile (107)
Ammonia (anhydrous) (91)
*Aniline (109)
*Benzene (110)
*Benzo[a]pyrene (112)
*Bis(chloromethyl) ether (113)
Boron trichloride (91)
Boron trifluoride (92)
Bromine (114)
*Tert-butyl hydroperoxide (148)
*Carbon disulfide (116)
Carbon monoxide (92)
*Carbon tetrachloride (118)
*Chlorine (119)
Chlorine trifluoride (94)
*Chloroform (121)
Chloromethane (93)
*Diethyl ether (122)
Diisopropyl fluorophosphate (41)
*Dimethylformamide (123)
*Dimethyl sulfate (125)
*Dioxane (126)
*Ethylene dibromide (128)
*Fluorine (95)
*Formaldehyde (130)
*Hydrazine and salts (132)
Hydrofluoric acid (43)
Hydrogen bromide (98)
Hydrogen chloride (98)
*Hydrogen cyanide (133)
*Hydrogen sulfide (135)
Mercury and compounds (52)
*Methanol (137)
*Morpholine (138)
*Nickel carbonyl (99)
*Nitrobenzene (139)
Nitrogen dioxide (100)
N-nitrosodiethylamine (54)
*Peracetic acid (141)
*Phenol (142)
*Phosgene (143)
*Pyridine (144)
*Sodium azide (145)
*Sodium cyanide (147)
Sulfur dioxide (101)
*Trichloroethylene (149)
*Vinyl chloride (150)

Appendix B to § 1910.1450—References (Non-Mandatory)

The following references are provided to assist the employer in the development of a Chemical Hygiene Plan. The materials listed below are offered as non-mandatory guidance. References listed here do not imply specific endorsement of a book, opinion, technique, policy or a specific solution for a safety or health problem. Other references not listed here may better meet the needs of a specific laboratory. (a) Materials for the development of the Chemical Hygiene Plan:

1. American Chemical Society, Safety in Academic Chemistry Laboratories, 4th edition, 1985.
2. Fawcett, H.H. and W. S. Wood, Safety and Accident Prevention in Chemical Operations, 2nd edition, Wiley-Interscience, New York, 1982.
3. Flury, Patricia A., Environmental Health and Safety in the Hospital Laboratory, Charles C. Thomas Publisher, Springfield IL, 1978.
3. Green, Michael E. and Turk, Amos, Safety in Working with Chemicals, Macmillan Publishing Co., NY, 1978.
5. Kaufman, James A., Laboratory Safety Guidelines, Dow Chemical Co., Box 1713, Midland, MI 48640, 1977.
6. National Institutes of Health, NIH Guidelines for the Laboratory use of Chemical Carcinogens, NIH Pub. No. 81-2385, GPO, Washington, DC 20402, 1981.
7. National Research Council, Prudent Practices for Disposal of Chemicals from Laboratories, National Academy Press, Washington, DC, 1983.
8. National Research Council, Prudent Practices for Handling Hazardous Chemicals in Laboratories, National Academy Press, Washington, DC, 1981.
9. Renfrew, Malcolm, Ed., Safety in the Chemical Laboratory, Vol. IV, *J. Chem. Ed.*, American Chemical Society, Easton, PA, 1981.
10. Steere, Norman V., Ed., Safety in the Chemical Laboratory, *J. Chem. Ed.* American Chemical Society, Easton, PA, 18042, Vol. I, 1967, Vol. II, 1971, Vol. III 1974.
11. Steere, Norman V., Handbook of Laboratory Safety, the Chemical Rubber Company Cleveland, OH, 1971.
12. Young, Jay A., Ed., Improving Safety in the Chemical Laboratory, John Wiley & Sons, Inc. New York, 1987.

(b) Hazardous Substances Information:

1. American Conference of Governmental Industrial Hygienists, Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment with Intended Changes, P.O. Box 1937 Cincinnati, OH 45201 (latest edition).
2. Annual Report on Carcinogens, National Toxicology Program U.S. Department of Health and Human Services, Public Health Service, U.S. Government Printing Office, Washington, DC, (latest edition).
3. Best Company, Best Safety Directory, Vols. I and II, Oldwick, N.J., 1981.
4. Bretherick, L., Handbook of Reactive Chemical Hazards, 2nd edition, Butterworths, London, 1979.
5. Bretherick, L., Hazards in the Chemical Laboratory, 3rd edition, Royal Society of Chemistry, London, 1986.
6. Code of Federal Regulations, 29 CFR part 1910 subpart Z, U.S. Govt. Printing Office, Washington, DC 20402, (latest edition).
7. IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man, World Health Organization Publications Center, 49 Sheridan Avenue, Albany, New York 12210 (latest editions).
8. NIOSH/OSHA Pocket Guide to Chemical Hazards, NIOSH Pub. No. 85-114, U.S. Government Printing Office, Washington, DC, 1985 (or latest edition).
9. Occupational Health Guidelines, NIOSH/OSHA NIOSH Pub. No. 81-123 U.S. Government Printing Office, Washington, DC, 1981.
10. Patty, F.A., Industrial Hygiene and Toxicology, John Wiley & Sons, Inc., New York, NY (Five Volumes).
11. Registry of Toxic Effects of Chemical Substances, U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, Revised Annually, for sale from Superintendent of Documents U.S. Govt. Printing Office, Washington, DC 20402.
12. The Merck Index: An Encyclopedia of Chemicals and Drugs, Merck and Company Inc. Rahway, N.J., 1976 (or latest edition).
13. Sax, N.I. Dangerous Properties of Industrial Materials, 5th edition, Van Nostrand Reinhold, NY., 1979.
14. Sittig, Marshall, Handbook of Toxic and Hazardous Chemicals, Noyes Publications, Park Ridge, NJ, 1981.

(c) Information on Ventilation:

1. American Conference of Governmental Industrial Hygienists Industrial Ventilation, 16th edition Lansing, MI, 1980.
2. American National Standards Institute, Inc. American National Standards Fundamentals Governing the Design and Operation of Local Exhaust Systems ANSI Z 9.2-1979 American National Standards Institute, N.Y. 1979.
3. Imad, A.P. and Watson, C.L. Ventilation Index: An Easy Way to Decide about Hazardous Liquids, Professional Safety pp 15-18, April 1980.
4. National Fire Protection Association, Fire Protection for Laboratories Using Chemicals NFPA-45, 1982.
Safety Standard for Laboratories in Health Related Institutions, NFPA, 56c, 1980.
Fire Protection Guide on Hazardous Materials, 7th edition, 1978.
National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.
5. Scientific Apparatus Makers Association (SAMA), Standard for Laboratory Fume Hoods, SAMA LF7-1980, 1101 16th Street, NW., Washington, DC 20036.

(d) Information on Availability of Referenced Material:

1. American National Standards Institute (ANSI), 1430 Broadway, New York, NY 10018.
2. American Society for Testing and Materials (ASTM), 1916 Race Street, Philadelphia, PA 19103.

(Approved by the Office of Management and Budget under control number 1218-0131)

[FR Doc. 90-1717 Filed 1-30-90; 8:45 am]

BILLING CODE 4510-26-M

FEDERAL, SATE OR LOCAL ENVIRONMENTAL INSPECTIONS

ENVIRONMENTAL LAWS AND REGULATIONS AUTHORIZE REASONABLE INSPECTIONS OF REGULATED FACILITIES, BY AGENCY EMPLOYEES OR CONTRACTORS HIRED BY THE AGENCIES TO REVIEW FACILITY RECORDS ND DETERMINE FACILITY COMPLIANCE (I.E. CAA sec. 7414, RCRA sec. 6927, CWA sec. 1318).

BECAUSE OF THE RIGHT OF AGENCIES TO CONDUCT INSPECTIONS, SAIC EMPLOYEES SHOULD BE COOPERATIVE AND COURTEOUS WITH INSPECTORS. DO NOT ATTEMPT TO ANSWER A QUESTION YOU DO NOT UNDERSTAND, OR FOR WHICH YOU DO NOT HAVE AN ANSWER.

THE FOLLOWING GENERAL STEPS ARE TO BE TAKEN BY FACILITY PERSONNEL;

1. INSPECTORS SHOULD SIGN IN WITH FACILITY SECURITY/RECEPTIONIST. THEY SHOULD SPECIFICALLY NOTE THE PURPOSE OF THEIR VISIT.

2. DISCUS WITH THE INSPECTORS THE PURPOSE OF THE PLANT VISIT, INCLUDING THE AREAS/RECORDS TO BE INSPECTED.

3. LIMIT INSPECTORS TO THOSE AREAS/RECORDS THAT ARE APPLICABLE TO THE PURPOSE OF THEIR VISIT.

4. IF PICTURES ARE REQUESTED, SECURITY APPROVAL MUST BE OBTAINED. IF APPROVED BY SECURITY, REQUEST IN WRITING PRIOR TO THE INSPECTOR LEAVING THAT SAIC REQUESTS COPIES OF ALL EXPOSURES AND REQUESTS AN OPPORTUNITY TO MAKE APPROPRIATE BUSINESS CONFIDENTIALITY CLAIMS. COMPILE A LIST OF PICTURES TAKEN.

5. SPLIT ANY SAMPLES TAKEN OF WASTEWATER, SOLID OR HAZARDOUS WASTE, OR HAZARDOUS MATERIALS. ATTEMPT TO DETERMINE THE ANALYSES TO BE CONDUCTED BY THE AGENCY AND PROMPTLY PERFORM THE SAME AT AN "APPROVED LABORATORY". REQUEST COPIES OF ANY AGENCY ANALYSIS.

6. INSPECTORS MUST BE ACCOMPANIED AT ALL TIMES. INSPECTORS ARE NEVER TO BE ALLOWED UNRESTRICTED ACCESS TO THE FACILITY.

7. IF QUESTIONS REGARDING THE REASONABLENESS, OR UNUSUAL REQUESTS ARISE, HALT THE INSPECTION AND CONTACT SAIC LEGAL.

8. IF INSPECTORS ARRIVE AT THE FACILITY WITH A SEARCH WARRANT, ADMINISTRATIVE WARRANT, OR SUBPOENA, CONTACT SAIC LEGAL IMMEDIATELY, PRIOR TO THE INSPECTION.

9. AFTER THE INSPECTION, REQUEST A COPY OF ANY REPORT TO BE COMPILED AND WRITE A FILE MEMORANDUM ON THE INSPECTION AND DISCUSSIONS WITH THE INSPECTOR. SEND A COPY OF THIS MEMORANDUM TO CORPORATE EC&HS OFFICIAL AND LEGAL STAFF.

Pam

Date: 8 November 1991
To: ETC Staff
From: Diane MacBride
re: **Update on Vaccinations for Workers Handling Sewage**
This version corrects incomplete information given to us yesterday.

This notice is to supplement the information given to everyone last week concerning precautions for handling sewage. At that point we were requiring everyone to have tetanus shots but had left the matter of additional innoculations to the discretion of the individuals involved. In order to decide upon the need for shots, several persons had asked about the risk of hepatitus, its symptoms and treatment, and whether innoculation would affect their ability to donate blood. I've checked with Wayne Estes, the physicians' assistant at Newport hospital who handles occupational health matters for SAIC, and Dr. Yankee at the Rhode Island Blood Center.

There are several forms of hepatitus, the most serious of which is hepatitus B (serum hepatitus), a bloodborne disease which kills more people yearly than AIDS. It is transmitted via contaminated blood or other body fluids through sexual contact and/or dirty needles, and therefore could theoretically be transmitted by getting contaminated sample in a wound. There is a preventative vaccine which is specific for this disease. The versions in current use are produced by recombinant technology and carry no risk of AIDS. If you are innoculated with the vaccine, you must wait at least 72 hours before donating blood. Only if there has been a clear cut exposure to hepatitus would you be asked to defer blood donation for a year.

The form that is most likely to be transmitted through contact with polluted water, either by drinking the water or getting it into a cut or mucous membrane (mouth or eyes) is hepatitus A (infectious hepatitus). There is no specific vaccine for hepatitus A, but transitory (3 month) resistance is provided by innoculation with gamma globulin, a blood protein that may boost immunity. The gamma globulin is prepared by cold alcohol fractionation of pooled plasma, a process that the Food and Drug Administration, in its 1986 Drug Bulletin, says poses "no discernible risk" of transmitting AIDS. The shot, however, is an uncomfortable one which cannot be given in the arm. If you are innoculated with gamma globulin you would also be asked to defer blood donation for 72 hours.

The symptoms of hepatitus A and B, are similar to those of mononucleosis. There is a sensation of malaise, similar to flu, with a fever and general lousy feeling. Since these are liver infections, there may be a loss of appetite and yellowish discoloration of the skin, as well as a darkening of the urine and a lighter color to the stool. Hepatitus B (serum hepatitus) is very serious and would require hospitalization. Hepatitus A (infectious hepatitus) like viral flu, is a disease that has to run its course . Treatment consists of bedrest and TLC.

Who, besides us, worries about hepatitus shots? Sewage plant workers in Rhode Island do not routinely get gamma globulin shots, however, bilge workers in the Navy do. Sewage plant workers in the town of Barrington get shots for tetanus, hepatitus, cholera and typhoid, more protection than the Health department requires. OSHA requires immunization against Hepatitus B for some workers, but only those exposed to blood, including health care workers and police.

The OSHA philosophy stresses precautions and making the workplace itself safe by using appropriate engineering controls (fume hoods, plastic ware) and standard operating procedures (disinfection, isolating the splash and aerosol-producing operations to the hood), rather than the "quick fix" of having everyone take shots but still having an unsafe place to work. Both Wayne and Dr. Yankee reiterated the recommendation to wear surgical masks and eye protection whenever there would be a risk of having sample contact mucous membranes. Beyond that, there is an honest difference of opinion as to the precautions that we need to take. Dr. Yankee has little confidence in the gamma globulin shot as protection against infectious hepatitus A. He says that sometimes it works, sometimes it doesn't. He suggested that we should all have the preventative vaccine for serum hepatitus B. When I called

Wayne back to find out why, in the several discussions that we have had, he had not even mentioned the existence of a specific preventative for hepatitus B, he said that he felt that we were not at high risk for this form from sewage. Innoculation against hepatitus B requires 3 shots and costs $120 per person, so he had not recommended it because we were not working with blood.

In the case of both forms of hepatitus, there are shots that can be given after a clear-cut exposure (splash to mucous membrane or puncture). For infectious hepatitus A, the shot would be gamma globulin, same as mentioned above. For serum hepatitus B, a shot of hepatitus immune globulin would be required. After this injection, you would not be allowed to give blood for one year. There may be a risk of AIDS associated with this inocculation.

The differences in opinion from different sources make it very difficult for me to force people to get preventative shots. The gamma globulin shots may or may not help with the threat of hepatitus A and can probably be postponed unless someone has suffered a clear exposure through splash or wound. The seemingly low probability of catching serum hepatitus B from sewage, as opposed to blood, may not warrant the series of shots necessary for immunity.

Since I cannot state that there is no risk of hepatitus posed by working with our sewage samples, I cannot advise anyone not to take the shots. Anyone who is uncomfortable with the notion of waiting for protection can contact me and arrange for immediate innoculation with either or both vaccines.

It does seem clear that if someone get splashed, or gets sample in a cut, they should go immediately for a gamma globulin shot.

You must notify me if you have had reason to believe that you have had contact with any of our polluted samples.

Kam 8/a

Standard Operating Procedure for Handling Unchlorinated Sewage Effluents

We are required under Rhode Island's stringent Right-to-Know laws to inform all employees of the hazards to which they will be exposed in the workplace. This training must be updated whenever employees are assigned to a new task.

In November of 1991 and in early 1992 we will begin working with sewage that has received primary and secondary treatment but has not been disinfected. Primary and secondary treatments remove solids from sewage and reduce the biological oxygen demand of the marterial but do not kill bacteria or viruses. Therefore all effluent samples handled in this laboratory must be regarded as contaminated. These contaminants could include (but are not limited to) industrial wastes such as heavy metals or other pollutants, and viable bacteria and viruses including those causing tetanus, gangrene, polio, hepatitus and gastrointestinal and other diseases. Apparently, there is disagreement in the literature as to the viability of the AIDS (Acquired Immune Deficiency Syndrome) virus under these conditions. It should be obvious from this description that these samples are to be regarded as hazardous and should be handled with great care.

There are three routes of exposure that must be minimized to allow us to handle these samples safely. These these are ingestion, aspiration and injection. In other words, we must eliminate the possibility that anyone will eat, or breathe sample material, or introduce it into the blood stream through a new or existing cut or puncture in the skin.

The following guide lines must be followed for working with potentially infectious and toxic samples in this facility:

General Guidelines

No more visitors in the wet lab or prep room, including family members, roommates, significant others.

All lab personnel must have current tetanus innoculations. (Last one no more than 8-10 years ago.)

Observe all previous protocols to avoid contaminating the office and restroom area. (Red taped pens, clipboards, take off protective gear before leaving lab area, etc).

Whenever possible, work on a piece of absorbant paper, then dispose of it in the biohazard container after each use.

Look for ways to eliminate breakable or sharp equipment from testing protocols (but check with us before instituting any changes to the methods).

Keep this material contained at all times - don't slop it around.

Always wash your hands with bacterial soap before leaving the lab.

Personal Protective Equipment

Water repellant blue gowns and latex gloves must be worn for any operations involving contact with sewage, including, but not limited to checking the tests, renewals, set up and breakdown of tests. These gowns must be kept in the prep room between uses and discarded immediately if they become contaminated. We also have yellow polylaminated bunny suits. White tyvek labwear isn't suitable and aprons aren't adequate.

Safety glasses must be worn at all times because viral and bacterial diseases can be transmitted through the eyes. **Do not touch your face, eyes or other exposed skin with contaminated gloves. Don't handle earplugs or your or safety glasses with contaminated gloves.**

'v glasses and face shields must be worn for any operations involving pouring effluents, or ..ons in which there is danger of splashing.

Aspiration Hazards -- Aerosols

It is very important to minimize our exposure to sewage aerosols. All renewals, salinity adjustments, glassware rinsing, media disposal at test breakdown, etc. must be done in the prep room hood.

Spills must be wiped up immediately to avoid their drying and liberating dust.

For operations that may produce aerosols, we now have surgical masks available.

Ingestion Hazards

As always, there is no eating, drinking, or smoking in the lab.

Don't put pens or other equipment into your mouth.

Don't even think about mouth pipetting.

Don't put food in the sample coolers, or samples in the food refrigerator.

Wash hands before leaving the lab.

Notify the safety officer in case of spills or if pumps or other equipment become contaminated.

Injection Hazards

Check gloves frequently to make sure they are intact.

Minimize operations that could puncture gloves or skin; use unbreakable equipment wherever possible.

Immediately report all wounds, however small, to the safety officer.

If you sustain a cut, abrasion or puncture that could be contaminated by sewage, strip off and throwaway gloves; scrub cut for several minutes with the germicidal soap in the bathroom. Rinse and repeat. Rinse cut with alcohol. For a small puncture wound, squeeze the wound until it bleeds. Clean as above. Because of the danger of anaerobic infections (tetanus, gangrene) all cuts must be monitored daily. A cut that seems to heal over but then becomes red, swollen and hard may contain anaerobes. Cuts that develop these symptoms require immediate medical attention from a doctor to decontaminate the wound.

Clean up

All spills must be wiped up immediately with paper towels; don't use sponges. One waste barrel will be designated for infectious waste and will be supplied with biohazard bags. These bags must be marked with autoclave indicator tape and autoclaved at EPA before disposal in the dumpster. All soft waste (paper, polystyrene cups) from the East Greenwich project must be placed in the biohazard barrel for autoclaving. Soft waste from other projects should not be placed in the barrel, to minimize unnecessary autoclaving. No sharp objects such as pipets, blades or broken glass should be put in with the soft waste, to minimize the chance of wounding the person disposing of the trash. A five gallon bucket lined with two biohazard bags will be set aside for infectious sharp wastes. Do not overfill either of these containers. To avoid getting a blast of contaminated air in the face, do not scrunch down the waste in the soft waste can while leaning over it.

Work surfaces such as the hood floor should be decontaminated with a 1 to 20 dilution of Chlorox after use. However, we cannot use this near the tests because of its toxicity. It is also hazardous to humans; do not get it in your eyes or on your skin.

Where it is not possible to disinfect, but where there is the possibility of spillage, keep the area covered with absorbant paper and change it whenever sample is suspected to have been splashed. (The side ledges on the water tables, the light box and surrounding table, plant transfer areas. Use a minimum of tape so that the paper can quickly be ripped off the table, rolled up and dumped in the biohazard barrel for proper disposal.

Every night, a designated person will disinfect the doorknobs to the prep room, wet lab and restroom.

Additional Considerations

Wash Clothes separately - little Clorox

HAZARDOUS MATERIALS CLASSIFICATION

SPECIFIC HAZARD

Oxidizer	OXY
Acid	ACID
Alkali	ALK
Corrosive	COR
Use NO WATER	W
Radiation Hazard	☢

REACTIVITY

4 — May detonate

3 — Shock and heat may detonate

2 — Violent Chemical change

1 — Unstable if heated

0 — Stable

NOTICE

29 July 1991

On 19 July 1991 we notified all hands that analysis of a single formaldehyde monitoring badge suggested that we might have exceeded the action level for this chemical. We noted at that time that the analytical lab had failed to specify its units and that we were unclear as to the actual hazard. The Corporate Safety Officer has confirmed that the 0.28 ppm figure reported to us represents the 8 hour Time-Weighted Average and that we are therefore well below the 0.5 ppm legal limit. Despite letter-of-the-law compliance, we have taken the following steps to try to ensure the lowest possible level of exposure:

- o Vials containing formalin have been moved to the attic.
- o Henceforth, no more samples in formalin may be stored in the prep room, except for the samples to be processed that same day.
- o New carbon pads have been installed in all fume hoods.
- o Frames have been built to raise the level of the hoods so that the microscopes can be pushed in farther.
- o Air circulation tests with the newly-raised hoods confirm that suction is very good inside the plexiglass guard, but that fumes will escaped if formalin transfer and rinsing operations are performed too near the front edge.
- o Next time we have at least two persons scheduled to work at the scope for at least four hours, we will repeat monitoring with badges.
- o Additional badges have been ordered so that we can monitor again in a few weeks.

MATERIAL SAFETY DATA SHEETS

EMPLOYERS MUST HAVE MSDS FOR ALL HAZARDOUS SUBSTANCES. MSDS'S MUST BE AVAILABLE DURING EACH WORK SHIFT TO EMPLOYEES WHEN THEY ARE IN THEIR WORK AREA.

- CHEMICAL NAME AND CAS NUMBER OF HAZARDOUS INGREDIENTS
- PHYSICAL AND CHEMICAL PROPERTIES
- PHYSICAL HAZARDS
- HEALTH HAZARDS
- POTENTIAL ROUTES OF ENTRY
- PEL OR TLV
- CARCINOGEN OR POTENTIAL CARCINOGEN
- PRECAUTIONS FOR SAFE HANDLING
- APPROPRIATE ENGINEERING CONTROLS, WORK PRACTICES OR PERSONAL PROTECTIVE EQUIPMENT
- EMERGENCY AND FIRST AID PROCEDURES

Our Material safety data sheets are located in a folder (soon to be looseleaf notebook) on top of the filing cabinet near the door between the wet lab and the downstairs office.

Material safety data sheets are filed in alphabetical order using the most common chemical name.

Material Safety Data Sheets (MSDS)

We have a file of material safety data sheets for all chemicals in house. They are located in the green looseleaf on top of the filing cabinet beside the door to the wetlab.

Person designated to maintain and update chemical inventory, and to review and update Material Safety Data Sheets: Diane MacBride
(Check sheets for completeness, assure that the most recent of multiple versions is in the notebook.) Written requests must be filed with the above before chemicals can be purchased.

Person designated to obtain MSDS for all incoming chemicals: Cathy Sheehan
(Calls vendors if chemicals arrive without MSDS. Forwards chemicals to Diane MacBride if MSDS is missing. Chemicals will not be released to the lab until an MSDS is obtained.)

SECTION V - HEALTH HAZARD DATA (Continued)

in the air may cause irreversible lung injury, kidney disease, and other adverse effects.
Dust may irritate eyes.

Medical Conditions Generally Aggravated By Exposure
None Identified

Routes Of Entry
ingestion, inhalation

Emergency and First Aid Procedures
CALL A PHYSICIAN.
If swallowed, if conscious, immediately induce vomiting.
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

SECTION VI - REACTIVITY DATA

Stability: Stable Hazardous Polymerization: Will not occur

Conditions to Avoid: none documented

Incompatibles: strong oxidizing agents, nitrates, nitric acid

SECTION VII - SPILL AND DISPOSAL PROCEDURES

Steps to be taken in the event of a spill or discharge
Wear self-contained breathing apparatus and full protective clothing. With clean shovel, carefully place material into clean, dry container and cover; remove from area. Flush spill area with water.

Disposal Procedure
Dispose in accordance with all applicable federal, state, and local environmental regulations.

EPA Hazardous Waste Number: D006 (EP Toxic Waste)

SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT

Ventilation: Use general or local exhaust ventilation to meet TLV requirements.

Respiratory Protection: Respiratory protection required if airborne concentration exceeds TLV. At concentrations up to 1 ppm, a high-efficiency particulate respirator is recommended. Above this level, a self-contained breathing apparatus is advised.

Eye/Skin Protection: Safety goggles, uniform, apron, rubber gloves are

SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT (Continued)

recommended.

SECTION IX - STORAGE AND HANDLING PRECAUTIONS

SAF-T-DATA™ Storage Color Code: Blue

Special Precautions

Keep container tightly closed. Store in secure poison area.

SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

DOMESTIC (D.O.T.)

Proper Shipping Name Chemicals, n.o.s. (Non-regulated)

INTERNATIONAL (I.M.O.)

Proper Shipping Name	Poisonous solids, n.o.s. (Cadmium)
Hazard Class	6.1
N/NA	UN2811
Labels	POISON

N/A = Not Applicable or Not Available

The information published in this Material Safety Data Sheet has been compiled from our experience and data presented in various technical publications. It is the user's responsibility to determine the suitability of this information for the adoption of necessary safety precautions. We reserve the right to revise Material Safety Data Sheets periodically as new information becomes available.

J.T.BAKER INC. 222 RED SCHOOL LANE, PHILLIPSBURG, NJ 08865
M A T E R I A L S A F E T Y D A T A S H E E T
24-HOUR EMERGENCY TELEPHONE -- (201) 859-2151
CHEMTREC # (800) 424-9300 -- NATIONAL RESPONSE CENTER # (800) 424-8802

S3670 003 SODIUM DODECYL SULFATE (SDS) PAGE: 1
EFFECTIVE: 05/01/89 ISSUED: 05/17/89

J.T.BAKER INC., 222 RED SCHOOL LANE, PHILLIPSBURG, NJ 08865

SECTION I - PRODUCT IDENTIFICATION

PRODUCT NAME: SODIUM DODECYL SULFATE (SDS)
COMMON SYNONYMS: SODIUM LAURYL SULFATE; DODECYL SODIUM SULFATE
CHEMICAL FAMILY: SURFACTANTS
FORMULA: CH3(CH2)11OSO3NA
FORMULA WT.: 288.38
CAS NO.: 151-21-3
NIOSH/RTECS NO.: WT1050000
PRODUCT USE: LABORATORY REAGENT
PRODUCT CODES: 4095,L050,V080

PRECAUTIONARY LABELING

BAKER SAF-T-DATA* SYSTEM

HEALTH	-	1	SLIGHT
FLAMMABILITY	-	0	NONE
REACTIVITY	-	1	SLIGHT
CONTACT eyes & skin	-	2	MODERATE

LABORATORY PROTECTIVE EQUIPMENT

GOGGLES; LAB COAT

U.S. PRECAUTIONARY LABELING

WARNING

CAUSES IRRITATION.
AVOID CONTACT WITH EYES, SKIN, CLOTHING. KEEP IN TIGHTLY CLOSED CONTAINER.
WASH THOROUGHLY AFTER HANDLING.

INTERNATIONAL LABELING

HARMFUL IF SWALLOWED.
DO NOT BREATHE DUST. AVOID CONTACT WITH SKIN AND EYES.

SAF-T-DATA* STORAGE COLOR CODE: ORANGE (GENERAL STORAGE)

CONTINUED ON PAGE: 2

SECTION II - COMPONENTS

COMPONENT	CAS NO.	WEIGHT %	OSHA/PEL	ACGIH/TLV
SODIUM DODECYL SULFATE	151-21-3	90-100	N/E	N/E

SECTION III - PHYSICAL DATA

BOILING POINT: N/A

VAPOR PRESSURE (MMHG): N/A

MELTING POINT: N/A

VAPOR DENSITY (AIR=1): N/A

SPECIFIC GRAVITY: 0.40 (H2O=1)

EVAPORATION RATE: N/A

SOLUBILITY(H2O): APPRECIABLE (>10%)

% VOLATILES BY VOLUME: 0 (21 C)

PH: N/A

ODOR THRESHOLD (P.P.M.): N/A

PHYSICAL STATE: SOLID

COEFFICIENT WATER/OIL DISTRIBUTION: N/A

APPEARANCE & ODOR: WHITE TO OFF-WHITE POWDER. FAINT ODOR.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (CLOSED CUP): N/A

AUTOIGNITION TEMPERATURE: N/A

FLAMMABLE LIMITS: UPPER - N/A LOWER - N/A

FIRE EXTINQUISHING MEDIA
USE EXTINGUISHING MEDIA APPROPRIATE FOR SURROUNDING FIRE.

SPECIAL FIRE-FIGHTING PROCEDURES
FIREFIGHTERS SHOULD WEAR PROPER PROTECTIVE EQUIPMENT AND SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN POSITIVE PRESSURE MODE.

CONTINUED ON PAGE: 3

SECTION IV - FIRE AND EXPLOSION HAZARD DATA (CONTINUED)

UNUSUAL FIRE & EXPLOSION HAZARDS
NONE IDENTIFIED.

TOXIC GASES PRODUCED
SULFUR DIOXIDE, CARBON MONOXIDE, CARBON DIOXIDE

EXPLOSION DATA-SENSITIVITY TO MECHANICAL IMPACT
NONE IDENTIFIED.

EXPLOSION DATA-SENSITIVITY TO STATIC DISCHARGE
NONE IDENTIFIED.

SECTION V - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE (TLV/TWA): NOT ESTABLISHED

SHORT-TERM EXPOSURE LIMIT (STEL): NOT ESTABLISHED

PERMISSIBLE EXPOSURE LIMIT (PEL): NOT ESTABLISHED

TOXICITY OF COMPONENTS

ORAL RAT LD50 FOR SODIUM DODECYL SULFATE	1288	MG/KG
INTRAPERITONEAL RAT LD50 FOR SODIUM DODECYL SULFATE	210	MG/KG
INTRAVENOUS RAT LD50 FOR SODIUM DODECYL SULFATE	118	MG/KG

CARCINOGENICITY: NTP: NO IARC: NO Z LIST: NO OSHA REG: NO

CARCINOGENICITY
NONE IDENTIFIED.

REPRODUCTIVE EFFECTS
NONE IDENTIFIED.

CONTINUED ON PAGE: 4

SECTION V - HEALTH HAZARD DATA (CONTINUED)

HAZARDOUS SUBSTANCE: NO
CHEMICALS: NO
NVENTORY: YES

SECTION VI - REACTIVITY DATA

ITY: STABLE HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

IONS TO AVOID: MOISTURE, HEAT

ATIBLES: STRONG ACIDS, STRONG OXIDIZING AGENTS

OSITION PRODUCTS: OXIDES OF SULFUR, CARBON MONOXIDE, CARBON DIOXIDE

SECTION VII - SPILL & DISPOSAL PROCEDURES

T BE TAKEN IN THE EVENT OF A SPILL OR DISCHARGE
AR SELF-CONTAINED BREATHING APPARATUS AND FULL PROTECTIVE CLOTHING. WITH
EAN SHOVEL, CAREFULLY PLACE MATERIAL INTO CLEAN, DRY CONTAINER AND
VER; REMOVE FROM AREA. FLUSH SPILL AREA WITH WATER.

AL PROCEDURE
SPOSE IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL
VIRONMENTAL REGULATIONS.

SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT

ATION: USE ADEQUATE GENERAL OR LOCAL EXHAUST VENTILATION TO KEEP FUME OR DUST LEVELS AS LOW AS POSSIBLE.

ATORY PROTECTION: NONE REQUIRED WHERE ADEQUATE VENTILATION CONDITIONS EXIST. IF AIRBORNE CONCENTRATION IS HIGH, USE AN APPROPRIATE RESPIRATOR OR DUST MASK.

IN PROTECTION: SAFETY GOGGLES, UNIFORM, PROPER GLOVES ARE RECOMMENDED.

CONTINUED ON PAGE: 6

SECTION IX - STORAGE AND HANDLING PRECAUTIONS

-DATA* STORAGE COLOR CODE: ORANGE (GENERAL STORAGE)

GE REQUIREMENTS
EEP CONTAINER TIGHTLY CLOSED. SUITABLE FOR ANY GENERAL CHEMICAL STORAGE
REA.

SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

TIC (D.O.T.)

SHIPPING NAME: CHEMICALS, N.O.S. (NON-REGULATED)

NATIONAL (I.M.O.)

SHIPPING NAME: CHEMICALS, N.O.S. (NON-REGULATED)
MARINE POLLUTANTS: NO

I.C.A.O.)

SHIPPING NAME: CHEMICALS, N.O.S. (NON-REGULATED)

CUSTOMS HARMONIZATION NUMBER: 34021100005

NOT APPLICABLE OR NOT AVAILABLE
NOT ESTABLISHED

FORMATION IN THIS MATERIAL SAFETY DATA SHEET MEETS THE
EMENTS OF THE UNITED STATES OCCUPATIONAL SAFETY AND HEALTH ACT AND
TIONS PROMULGATED THEREUNDER (29 CFR 1910.1200 ET. SEQ.) AND THE
AN WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM. THIS DOCUMENT
ENDED ONLY AS A GUIDE TO THE APPROPRIATE PRECAUTIONARY HANDLING OF
TERIAL BY A PERSON TRAINED IN, OR SUPERVISED BY A PERSON TRAINED
EMICAL HANDLING. THE USER IS RESPONSIBLE FOR DETERMINING THE
TIONS AND DANGERS OF THIS CHEMICAL FOR HIS OR HER PARTICULAR
ATION. DEPENDING ON USAGE, PROTECTIVE CLOTHING INCLUDING EYE AND
UARDS AND RESPIRATORS MUST BE USED TO AVOID CONTACT WITH MATERIAL
ATHING CHEMICAL VAPORS/FUMES.
RE TO THIS PRODUCT MAY HAVE SERIOUS ADVERSE HEALTH EFFECTS. THIS
AL MAY INTERACT WITH OTHER SUBSTANCES. SINCE THE POTENTIAL USES
VARIED, BAKER CANNOT WARN OF ALL OF THE POTENTIAL DANGERS OF USE

CONTINUED ON PAGE: 7

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ERACTION WITH OTHER CHEMICALS OR MATERIALS. BAKER WARRANTS THAT
EMICAL MEETS THE SPECIFICATIONS SET FORTH ON THE LABEL.
DISCLAIMS ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED WITH REGARD
PRODUCT SUPPLIED HEREUNDER, ITS MERCHANTABILITY OR ITS FITNESS
PARTICULAR PURPOSE.
ER SHOULD RECOGNIZE THAT THIS PRODUCT CAN CAUSE SEVERE INJURY AND
EATH, ESPECIALLY IF IMPROPERLY HANDLED OR THE KNOWN DANGERS OF USE
T HEEDED. READ ALL PRECAUTIONARY INFORMATION. AS NEW DOCUMENTED
L SAFETY INFORMATION BECOMES AVAILABLE, BAKER WILL PERIODICALLY
THIS MATERIAL SAFETY DATA SHEET. IF YOU HAVE ANY QUESTIONS,
CALL CUSTOMER SERVICE (1-800-JTBAKER) FOR ASSISTANCE.

ED BY QUALITY ASSURANCE DEPARTMENT.

-- LAST PAGE --

Material Safety Data Sheet

from Genium's Reference Collection
Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
(518) 377-8855

GENIUM PUBLISHING CORP.

No. 30A

HYDROCHLORIC ACID
(Revision B)
Issued: October 1977
Revised: November 1988

SECTION 1. MATERIAL IDENTIFICATION

27

Material Name: HYDROCHLORIC ACID

Description (Origin/Uses): Used in the production of chlorides; in refining ore in the production of tin and tantalum; for the neutralization of bases; for pickling and cleaning metal products; for oil- and gas-well treatments; and in removing scale from boilers and heat-exchange equipment.

NFPA: 3 / 0 / 0 / -

Other Designations: Aqueous Hydrogen Chloride; Muriatic Acid; HCl/H_2O; CAS No. 7647-01-0

Manufacturer: Contact your supplier or distributor. Consult the latest edition of the *Chemicalweek Buyers' Guide* (Genium ref. 73) for a list of suppliers.

HMIS			
H	3	R	1
F	0	I	4
R	0	S	4
PPG*		K	0

*See sect. 8

SECTION 2. INGREDIENTS AND HAZARDS

	%	EXPOSURE LIMITS
Hydrogen Chloride, CAS No. 7647-01-0	38 or Less	**OSHA PEL** Ceiling: 5 ppm, 7 mg/m³
Water	Balance*	**ACGIH TLV, 1988-89** TLV-Ceiling: 5 ppm, 7 mg/m³
*Impurities such as iron, chlorine, and traces of organic matter may be present in small amounts, depending on the grade of acid. **See NIOSH, *RTECS* (MW4025000), for additional data with references to reproductive and mutagenic effects. Continue to monitor NIOSH, *RTECS* (MW40300000), for toxicity data on hydrochloric acid itself.		**Toxicity Data**** Human, Inhalation, LC_{Lo}: 1300 ppm (30 Mins) Rat, Inhalation, LC_{50}: 3124 ppm (1 Hr) Rabbit, Oral, LD_{50}: 900 mg/kg

SECTION 3. PHYSICAL DATA

Boiling Point: 227°F (109°C) (20.22%)
Melting Point: -85°F (-65°C) (20.69%)
Vapor Density (Air = 1): 1.268
pH: Strong Mineral Acid
Molecular Weight: Not Applicable
Solubility in Water (%): Complete
Specific Gravity (H_2O = 1): >1
% Volatile by Volume: Ca 100

Appearance and Odor: A clear, colorless-to-lightly yellowish, fuming liquid; sharp, pungent, characteristic, irritating odor of hydrogen chloride gas. This odor is detectable at 1 to 5 ppm and becomes unpleasant and irritating at 5 to 10 ppm; however, the odor serves as a good warning property.

Comments: The specific physical properties of aqueous hydrochloric acid solutions vary with the amount of dissolved hydrogen chloride gas. Hydrochloric acid forms a constant boiling azeotrope (a mixture of hydrochloric acid and water that behaves like a single substance in that its vapor has the same composition as the mixture itself) with water (at 227°F or 109°C) that contains 20.22% hydrogen chloride and has a density of 1.096. Boiling weaker or stronger aqueous solutions results in the loss of either component until the constant boiling acid is produced.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temperature	LEL	UEL
*	*	*	*

Extinguishing Media: *Hydrochloric acid solutions do not burn. Use extinguishing agents that will put out the surrounding fire. **Unusual Fire or Explosion Hazards:** Use a water spray to cool fire-exposed containers of hydrochloric acid to prevent ruptures. Explosive hydrogen gas can be produced by the reaction of hydrochloric acid with metals such as iron. Neutralize spilled hydrochloric acid with limestone, slaked lime, or soda ash to minimize the possible generation of hydrogen gas. **Special Fire-fighting Procedures:** Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode. Special neutralization procedures, if applicable, include the application of chemically basic substances such as soda ash or slaked lime.

SECTION 5. REACTIVITY DATA

Stability/Polymerization: Hydrochloric acid is stable in closed containers during routine operations at room temperature. Hazardous polymerization cannot occur. **Chemical Incompatibilities:** Hydrochloric acid reacts dangerously with acetic anhydride, 2-aminoethanol, ammonium hydroxide, calcium phosphide, chlorosulfonic acid, ethylene diamine, ethylenimine, oleum, perchloric acid, ß-propiolactone, propylene oxide, silver perchlorate and carbon tetrachloride, sodium hydroxide, sulfuric acid, uranium phosphide, vinyl acetate, sodium, and many carbide compounds (Genium ref. 84). This material is a strong mineral acid that is very reactive with bases. **Conditions to Avoid:** Avoid exposure to incompatible chemicals and to any other material whose compatibility with hydrochloric acid or its vapor has not yet been established. The corrosive action of hydrochloric acid on most metals can liberate extremely flammable/explosive hydrogen gas (H_2); piping systems and containment systems must be chosen carefully. **Hazardous Products of Decomposition:** During fires hydrochloric acid may decompose by reacting with certain metals to produce very flammable and explosive hydrogen gas (H_2). Significant amounts of hydrogen chloride gas (HCl) are given off at room temperature; the rate of this generation increases as the temperature and the strength (1%) by weight of HCl in H_2O increase. **Comments:** Reactions between hydrochloric acid and cyanides, sulfides, and formaldehyde, will produce extremely toxic hydrogen cyanide (HCN), hydrogen sulfide (H_2S), sulfur dioxide (SO_2), and *bis*chloromethylether, respectively.

SECTION 6. HEALTH HAZARD INFORMATION

Carcinogenicity: Hydrochloric acid is not listed as a carcinogen by the NTP, IARC, or OSHA.
Summary of Risks: See Genium Industrial MSDS 30 for details of the health effects of hydrogen chloride gas. Hydrochloric acid solutions will generate hydrogen chloride gas with all its health effects. These are irritating to the skin, eyes, and mucous membranes of the upper respiratory tract (URT). The severity of eye injury from splashes depends upon quantity, concentration/strength, and duration of the contact. Permanent visual damage has been reported. Ingestion of hydrochloric acid causes corrosion of the mucous membranes, esophagus, and stomach, as well as nausea, vomiting, intense thirst, and diarrhea. Erosion of exposed teeth may occur. Circulatory collapse and death are possible. **Medical Conditions Aggravated by Long-Term Exposure:** None reported. **Target Organs:** Skin, eyes, URT. **Primary Entry:** Inhalation, skin contact. **Acute Effects:** Corrosive skin and eye burns, tissue damage, and severe irritation of the URT. **Chronic Effects:** None reported. **FIRST AID: Eyes.** Immediately flush eyes, including under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes. **Skin.** Rinse the affected area with flooding amounts of water and then wash it with soap and water. Remove contaminated clothing under a safety shower. **Inhalation.** Remove the exposed person to fresh air; restore and/or support his or her breathing as needed. Have qualified medical personnel administer oxygen as required. **Ingestion.** Not likely. Should this type of exposure occur, and the exposed person is responsive, give him or her 2 to 3 glasses of water, then milk of magnesia or limewater to drink. Do not induce vomiting. Spontaneous laryngeal spasms can occur. Never give anything by mouth to someone who is unconscious or convulsing. **Get medical help (in plant, paramedic, community) for all exposures.** Seek prompt medical assistance for further treatment, observation, and support after first aid. **Note to physician:** Treatment for respiratory effects following inhalation of hydrogen chloride gas includes using a 5% sodium bicarbonate solution as an aerosol; maintaining a proper fluid balance (diuretics may be useful); and decreasing the inflammatory response of the lungs by administering steroids on a short-term basis (2 to 4 days). Severe inhalation exposure requires hospitalization and observation (72-hour minimum) for the delayed onset of pulmonary edema. Serial chest X rays and respiratory support, including intubation, may be required as an early intervention.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Notify safety personnel, evacuate unnecessary personnel, eliminate all sources of ignition immediately (hydrogen gas may be generated), and provide adequate ventilation. Cleanup personnel need a full set of protective clothing, including a self-contained breathing apparatus (SCBA). Small spills and residue can be covered with an excess of a mixture of soda ash and slaked lime. After neutralization, do not flush waste directly to a sewer or into lakes, ponds, or streams. **Waste Disposal:** Contact your supplier or a licensed contractor for detailed recommendations. The allowable concentration of neutral salt in the effluent discharge is apt to be regulated; study and follow Federal, state, and local regulations. Consider saving the waste hydrochloric acid for use as a neutralizing agent during cleanup operations of basic materials.

OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000 Subpart Z).
EPA Designations (40 CFR 302.4)
CERCLA Hazardous Substance, Reportable Quantity: 5000 lbs (2270 kg), per the Clean Water Act (CWA), §311 (b) (4)

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Where splashing is possible, wear a full face shield. Follow OSHA eye- and face-protection regulations (29 CFR 1910.133). **Respirator:** Wear a NIOSH-approved respirator per Genium reference 88 for the maximum-use concentrations and/or the exposure limits cited in section 2. Follow OSHA respirator regulations (29 CFR 1910.134). For emergency or nonroutine operations (spills or cleaning reactor vessels and storage tanks), wear an SCBA. All respirators must be acid resistant. **Warning:** Air-purifying respirators will *not* protect workers in oxygen-deficient atmospheres. **Other:** Wear impervious gloves, boots, aprons, gauntlets, etc., to prevent any contact with this material. All clothing must be acid resistant. **Ventilation:** Install and operate general and local maximum-explosion-proof ventilation systems powerful enough to maintain airborne levels of hydrogen chloride below the OSHA PEL cited in section 2. Local exhaust ventilation is preferred because it prevents dispersion of the contaminant into the general work area by eliminating it at its source. Consult the latest edition of Genium reference 103 for detailed recommendations. Make ventilation system ductwork and exposed fan components acid resistant. **Safety Stations:** Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work areas. **Contaminated Equipment:** Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them. Do *not* wear contact lenses in any work area. Remove contaminated clothing and launder it before wearing it again; clean this material from your shoes and equipment. **Other:** Design all engineering systems to be acid resistant and explosion proof (hydrogen gas may be accidentally generated). **Comments:** Practice good personal hygiene; always wash thoroughly after using this material and before eating, drinking, smoking, using the toilet, or applying cosmetics. Keep it off your clothing and equipment. Avoid transferring it from your hands to your mouth while eating, drinking, or smoking. Do *not* eat, drink, or smoke in any work area. Do not inhale hydrochloric acid vapor.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage/Segregation: Store hydrochloric acid in closed containers in a cool, dry, well-ventilated area away from sources of ignition, strong oxidizers, strong bases, out of direct sunlight, and away from incompatible chemicals (see sect. 5). Protect containers from physical damage. **Special Handling/Storage:** Storage areas should have acid-resistant floors and approved drainage facilities. Use nonsparking tools in areas around tanks and pipes where hydrogen gas may be generated. **Engineering Controls:** Make sure all engineering systems (production, transportation) are of maximum-explosion-proof design. Ground and bond all containers and pipelines, etc., used in shipping, transferring, reacting, production, and sampling operations to prevent static sparks. Hydrogen gas may become concentrated inside metal equipment; perform operations to search out possible hidden areas of hydrogen gas carefully. **Other Precautions:** Carefully follow your supplier's recommendations concerning the proper handling and storage procedures for hydrochloric acid. Provide emergency neutralization materials (soda ash, limestone, or slaked lime) and equipment near storage and use areas.

Transportation Data (49 CFR 172.101-2)

DOT Shipping Name: Hydrochloric Acid
DOT Hazard Class: Corrosive Material
ID No. UN1789
DOT Label: Corrosive
DOT Packaging Requirements, DOT Packaging Exceptions: 49 CFR 173.263

IMO Shipping Name: Hydrochloric Acid, Solution
IMO Hazard Class: 8
IMO Label: Corrosive
IMDG Packaging Group: II

References: 1, 26, 38, 84-94, 100, 116, 117, 120, 122.

Prepared by PJ Igoe, BS
Industrial Hygiene Review: DJ Wilson, CIH
Medical Review: W Silverman, MD

Material Safety Data Sheet

from Genium's Reference Collection
Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
(518) 377-8855

GENIUM PUBLISHING CORP.

No. 360
FORMALIN
(Revision B)
Issued: March 1981
Revised: November 1988

SECTION 1. MATERIAL IDENTIFICATION

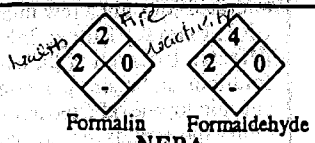
27

Material Name: FORMALIN

Description (Origin/Uses): Used as a disinfectant; as a germicide and fungicide for plants and vegetables; to destroy flies and other insects; to manufacture phenolic resins (formerly used in home construction but banned in 1982), artificial silks, cellulose esters, dyes, organic chemicals, glass mirrors, and explosives; in improving fastness of dyes in fabrics; tanning and preserving hides; and mordanting and waterproofing fabrics; also used in rubber latex applications and in embalming fluids.

Other Designations: Formal; Formaldehyde Solution; Morbicide

Manufacturer: Contact your supplier or distributor. Consult the latest edition of the *Chemicalweek Buyers' Guide* (Genium ref. 73) for a list of suppliers.



NFPA

HMIS			
H	2	R	1
F	2	I	4
R	0	S	2
PPG*		K	2

*See sect. 8

SECTION 2. INGREDIENTS AND HAZARDS

	%	EXPOSURE LIMITS
Formaldehyde,* HCHO, CAS No. 0050-00-0	37 to 55	**OSHA PELs** 8-Hr TWA: 1 ppm 15-Min STEL: 2 ppm 8-Hr TWA Action Level: 0.5 ppm **ACGIH TLVs, 1988-89** TLV-TWA: 1 ppm, 1.5 mg/m³ TLV-STEL: 2 ppm, 3 mg/m³
Methanol, CAS No. 0067-56-1	0 to 15	**OSHA PELs (Skin*)** 8-Hr TWA: 200 ppm, 260 mg/m³ 15-Min STEL: 250 ppm, 310 mg/m³ **ACGIH TLVs (Skin*), 1988-89** TLV-TWA: 200 ppm, 260 mg/m³ TLV-STEL: 250 pm, 310 mg/m³

*See Comments in section 3.
**Methyl alcohol may be absorbed through intact skin, which contributes to overall exposure.
Comments: See NIOSH, *RTECS* (LP8925000), for toxicity data on both free formaldehyde gas and formaldehyde-in-water solution (formalin); see *RTECS* (PC1400000) for toxicity data for the methanol stabilizer component of formalin.

SECTION 3. PHYSICAL DATA

Boiling Point: 205°F (96°C)
Melting Point: <32°F (0°C)
Specific Gravity (H_2O = 1): 1.0 to 1.15
pH: 2.8 to 4.0 (Basic)
% Volatile by Volume: 37 to 55
Appearance and Odor: A clear, water white liquid; with pungent, characteristic, formaldehyde odor (detection level: ca 1 ppm).
Comments: Commercial formalin solutions contain varying amounts of formaldehyde gas, methanol, and water. Contact your supplier for the specifications of the purchased product; the physical properties listed are representative values for the common 37%-by-weight formaldehyde-gas-in-water solution containing methanol as a stabilizer.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point: 122°F (50°C)*	Autoignition Temperature: 795°F (424°C), Formaldehyde Gas	LEL: 7%**	UEL: 73%**

*Determined for a formalin solution containing 37% formaldehyde and 15% methanol.

Extinguishing Media: Use dry chemical, carbon dioxide, water spray, or "alcohol" foam to extinguish formalin fires. Use a water spray to cool fire-exposed containers, to flush spills away from sources of ignition, and to dilute spills to nonflammable mixtures. If free formaldehyde gas is burning, direct fire-fighting operations toward stopping the flow of this gas; use a water spray to protect personnel attempting to do so. **Unusual Fire or Explosion Hazards:** Formalin liquid itself presents a moderate fire and explosion hazard. The formaldehyde gas that can be evolved from work operations is flammable. If the formalin solution is stabilized with methanol, take into account the increased possibility of flammability associated with the methanol vapor. **Special Fire-fighting Procedures:** Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.
**Mixtures of air and free formaldehyde gas are highly flammable; the wide range of explosibility is from 7 to 73%. Formalin is a combustible liquid. The flash point of a 37% formaldehyde and 0% methanol solution (a "37% methanol-free solution") is 185°F (85°C). The flash point of formalin solutions decreases as the amount of methanol increases.

SECTION 5. REACTIVITY DATA

Formalin is stable during routine use and handling. It cannot undergo hazardous polymerization. Formalin solutions can undergo a nonhazardous self-polymerization to form paraformaldehye, which precipitates out of solution as an undissolved solid at the bottom of the container. **Chemical Incompatibilities:** Formaldehyde gas reacts dangerously with nitrogen dioxide, perchloric acid and aniline, and performic acid. Atmospheric oxygen can oxidize formaldehyde to form corrosive formic acid, especially when the formalin solution is heated. Strong oxidizing agents and active organic materials such as phenol may promote unintended accidental polymerization reactions. **Conditions to Avoid:** Avoid direct contact with incompatible chemicals or exposure to sources of ignition. Always establish compatibility between formalin solutions and another material by testing small quantities of materials to replicate the expected conditions of bulk operations. **Hazardous Products of Decomposition:** Toxic gases such as carbon monoxide can be produced during formalin or formaldehyde fires. **Warning:** Formaldehyde can react with hydrogen chloride under certain atmospheric conditions to form bis (chloromethyl) ether, which is

SECTION 6. HEALTH HAZARD INFORMATION

Carcinogenisity: Formaldehyde is classified by the ACGIH as a group A2 (suspected human) carcinogen; by the IARC as a group 2B (probable human) carcinogen; and by the NTP as a group b (reasonably anticipated) carcinogen. **Summary of Risks:** Formaldehyde gas is irritating to the eyes, nose, throat, and upper respiratory tract (URT); coughing, difficulty in breathing, pulmonary edema, pneumonitis, and even death can result from inhalation of high concentrations. Skin contact with strong formalin solutions or with formaldehyde gas have caused primary skin irritation. Ingestion of formalin solutions causes corrosive gastritis with a high likelihood of perforation. Severe stomach pain, nausea, vomiting, coma, and even death can result. Approximately 2 ounces constitute a mean lethal dose of 37% formalin. Formalin solutions splashed into the eyes have caused severe injury and corneal damage. Sensitive individuals may develop symptoms from an exposure that is as low as 0.05 ppm. Exposure at 10 to 20 ppm causes profuse tearing, a severe burning sensation, and cough; it can be tolerated for only a few minutes. **Medical Conditions Aggravated by Long-Term Exposure:** None reported. **Target Organs:** Skin, eyes, URT. **Primary Entry:** Inhalation, skin contact. The formalin solution may contain methanol that can be absorbed through the skin. **Acute Effects:** Irritation of the eyes, skin, and URT. **Chronic Effects:** Cancer may be caused by chronic exposure to formaldehyde gas. Formalin solutions and resins that contain formaldehyde cause sensitization dermatitis. Sensitization to formaldehyde has been reported following chronic low-level exposures resulting in asthmatic symptoms after minimal exposure. **FIRST AID: Eyes.** Immediately flush eyes, including under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes. **Skin.** Rinse the area with water and then wash it with soap and water. **Inhalation.** Remove the exposed person to fresh air; restore and/or support his or her breathing as needed. Have qualified medical personnel administer oxygen as required. **Ingestion** (applicable only to accidental ingestion of formalin solutions, not applicable to formaldehyde gas): Never give anything by mouth to someone who is unconscious or convulsing. Begin immediate dilution with 4 to 8 ounces of water or milk. Get medical help (in plant paramedic, community) for all exposures. Seek prompt medical assistance for further treatment, observation, and support after first aid. **Note to physician:** Severe inhalation exposures (ca 50 ppm) may cause pulmonary edema. Treatment for accidental ingestion includes a gastric lavage with water or saline until clear, followed by activated charcoal with saline or sorbital catharsis. Treat exposed person for anion-gap acidosis; monitor blood methanol levels concurrently. The rapidly metabolized formic acid requires attention: treat for acidosis and use dialysis to remove the formic acid.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Notify safety personnel, eliminate all sources of ignition, provide adequate ventilation, and evacuate all nonessential personnel. Cleanup personnel need protection against skin contact with the liquid and inhalation of its vapor (see sect. 8). Contain large spills and collect waste. Neutralize the spilled formalin with aqueous ammonia or mix it with sodium sulfite. Wash the residues with dilute ammonia to eliminate vapor. Prevent runoff from entering streams, surface waters, waterways, watersheds, and sewers. Preplan for emergency response. **Waste Disposal:** Consider reclamation, recycling, or destruction rather than disposal in a landfill. Waste formalin can be burned in an approved incinerator. Approved landfills may accept properly neutralized formalin solutions. Follow Federal, state, and local regulations.

OSHA Designations
Listed as a specifically regulated substance (29 CFR 1910.1028).
EPA Designations (40 CFR 302.4)
RCRA Hazardous Waste, No. U122
CERCLA Hazardous Substance, Reportable Quantity: 1000 lbs (454 kg), per the Clean Water Act (CWA), Section 311 (b) (4), and the Resource Conservation and Recovery Act (RCRA), Section 3001.

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Where splashing of formalin solutions is possible, wear a full face shield. Follow OSHA eye- and face-protection regulations (29 CFR 1910.133). **Respirator:** Wear a NIOSH-approved respirator per Genium reference 88 for the maximum-use concentrations and/or the exposure limits cited in section 2. Follow OSHA respirator regulations (29 CFR 1910.134). For emergency or nonroutine operations (spills or cleaning reactor vessels and storage tanks), wear an SCBA. **Warning:** Air-purifying respirators will *not* protect workers in oxygen-deficient atmospheres. **Other:** Wear impervious nitrile, butyl rubber, or Viton gloves, boots, aprons, and gauntlets, etc., to prevent excessive or prolonged skin contact. **Ventilation:** Install and operate general and local exhaust-ventilation systems powerful enough to maintain airborne levels of formaldehyde below the OSHA PEL standard cited in section 2. Design all ventilation systems to be explosion proof in order to minimize sources of ignition. These recommendations apply to work areas where either formaldehyde gas or formalin solutions are used. **Safety Stations:** Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work areas. **Contaminated Equipment:** Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them. Do *not* wear contact lenses in any work area. Remove contaminated clothing and launder it before wearing it again; clean this material from shoes and equipment. **Other:** Design all engineering systems in a manner that minimizes sources of ignition such as open flame, uninsulated heaters, etc. Electrically ground and bond all containers and equipment used in shipping, receiving, manufacturing, and sampling operations that involve formaldehyde or formalin to prevent static sparks that could start a fire or explosion. **Comments:** Practice good personal hygiene; always wash thoroughly after using this material. Avoid transferring it from your hands to your mouth while eating, drinking, or smoking. Do *not* eat, drink, or smoke in any work area. Avoid any direct contact with formalin solutions or formaldehyde.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage/Segregation: Store formalin solutions in insulated, closed containers in a cool, dry, well-ventilated area separate from oxidizing agents and alkaline materials. The minimum storage temperature required to prevent polymerization reactions and subsequent degradation of the formalin product ranges from 83°F (28°C, or 37% formalin containing 0.05% methanol), to 29°F (-2°C, or 37% formalin containing 15% methanol). **Special Handling/Storage:** Control the inventory of formalin solutions. Protect formalin containers from physical damage. Before using this material in bulk operations, test a small quantity of it to ascertain its quality. **Engineering Controls:** Follow established safety procedures during transfers of formalin. **Comments:** Train personnel who work with formaldehyde in its safe use and in proper emergency response. Remove from further exposure any worker who exhibits signs of skin-sensitization reactions.

Transportation Data (49 CFR 172.101-2)*

DOT Shipping Name: Formaldehyde Solutions
DOT Class: ORM-A or Combustible Liquid
DOT Label: None
ID NOs. UN1198 or UN2209

*Formalin solutions vary in their flash points and the capacity of their shipping containers; the DOT regulations vary accordingly.

References: 1, 2, 26, 38, 84, 86-94, 100, 112, 113, 114, 116, 117, 120, 122.

Prepared by PJ Igoe, BS
Industrial Hygiene Review: DJ Wilson, CIH
Medical Review: MJ Hardies, MD; W Silverman, MD

J. T. Baker Chemical Co.
222 Red School Lane Phillipsburg, N.J. 08865
24-Hour Emergency Telephone -- (201) 859-2151
Chemtrec # (800) 424-9300
National Response Center # (800) 424-8802

To Wilcoxen & Hoffman 12/15/86

MATERIAL SAFETY DATA SHEET

12

ECO ANALYSIS

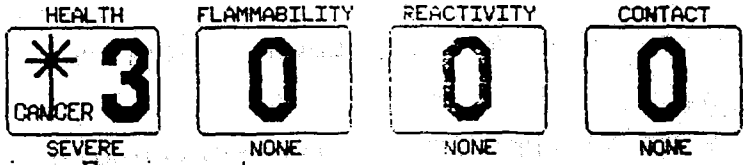
12

SECTION I - PRODUCT IDENTIFICATION

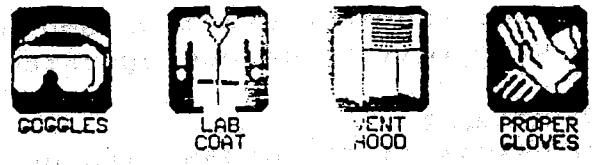
Product Name: Cadmium
Formula: Cd
Formula Wt: 112.40
CAS No.: 07440-43-9
NIOSH/RTECS No.: EU9800000
Product Codes: 1184,1182

PRECAUTIONARY LABELLING

BAKER SAF-T-DATA™ System



Laboratory Protective Equipment



Precautionary Label Statements

WARNING!
HARMFUL IF SWALLOWED OR INHALED
NOTE: REPORTED AS CAUSING CANCER IN LABORATORY ANIMALS. EXERCISE DUE CARE.
Avoid contact with eyes, skin, clothing
Avoid breathing dust. Keep in tightly closed container. Use with adequate ventilation. Wash thoroughly after handling.

SECTION II - HAZARDOUS COMPONENTS

Component	%	CAS No
Cadmium	90-100	07440-43-

SECTION III - PHYSICAL DATA

Boiling Point: 767°C (1413°F) Vapor Pressure(mmHg): N/A

Melting Point: 321°C (610°F) Vapor Density(air=1): 3.9

Continued on Page: 2

SECTION III - PHYSICAL DATA (Continued)

Specific Gravity: 8.64 (H_2O=1)

Evaporation Rate: N/A (Butyl Acetate=1)

Solubility(H_2O): Negligible (less than 0.1 %)

% Volatiles by Volume: 0

Appearance & Odor: Soft, blue-white solid.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: N/A

Flammable Limits: Upper - N/A % Lower - N/A %

Fire Extinguishing Media

Use extinguishing media appropriate for surrounding fire.

Special Fire-Fighting Procedures

Firefighters should wear proper protective equipment and self-contained breathing apparatus with full facepiece operated in positive pressure mod

Unusual Fire & Explosion Hazards

Contact with strong oxidizers may cause fire or explosion.

SECTION V - HEALTH HAZARD DATA

This substance is listed as NTP anticipated human carcinogen, IARC probable human carcinogen (Groups 2A and 2B). The acceptable ceiling concentration (PEL) is 0.6 mg/M^3.

Threshold Limit Value (TLV/TWA): 0.05 mg/m^3 (ppm)

Permissible Exposure Limit (PEL): 0.2 mg/m^3 (ppm)

Toxicity:

LD_{50} (oral-rat)(mg/kg)	-	225
LD_{50} (ipr-rat)(mg/kg)	-	4
LD_{50} (scu-rat)(mg/kg)	-	9

Carcinogenicity: NTP: Yes IARC: Yes Z List: No OSHA reg: Yes

Effects of Overexposure

Overexposure to vapors may cause irritation of mucous membranes, dryness of mouth and throat, headache, nausea and dizziness.
Inhalation may be harmful or fatal.
Chronic effects of cadmium compounds from low level exposure

PERSONAL PROTECTION

KEY POINTS:

USE PERSONAL PROTECTIVE EQUIPMENT TO PREVENT EXPOSURE TO OR CONTACT WITH HAZARDOUS MATERIALS.

EXAMPLES OF EQUIPMENT ARE:

- GLOVES
- GOGGLES
- FACE SHIELDS
- APRONS
- BOOTS
- RESPIRATORS

SELECT EQUIPMENT CAREFULLY AND BE SURE IT IS SUITABLE FOR THE JOB AND MATERIALS BEING USED.

CHECK EQUIPMENT BEFORE EACH USE TO BE SURE IT IS IN GOOD CONDITION.

KNOW THE LIMITATIONS OF THE EQUIPMENT.

CLEAN THE EQUIPMENT AFTER EACH USE. face shield / Nitrile Gloves

ALWAYS USE THE FUME HOOD OR EXHAUST SYSTEM IF AVAILABLE.

NOTICE

PERSONAL PROTECTION MEASURES TO BE TAKEN IN THE WET LAB

1. Waterproof (Tyvek) lab coats and gloves (latex) are to be worn in this laboratory whenever water or sediment samples are being handled. This includes daily test checks, any activities associated with the Cadmium reference tests, picking samples, cleanup after a test, and subsampling test chambers for chemical analysis.

2. Dielectric boots should be added to the above when electrical equipment is used near the water tables or sinks.

3. Safety glasses with side shields (or goggles) must be worn at all times in this lab.

4. Sandals and open-toed shoes may not be worn in this lab.

PERSONAL PROTECTION MEASURES TO BE TAKEN IN THE PREP ROOM

1. Waterproof (Tyvek) lab coats and gloves (latex) are to be worn in this laboratory whenever water, sediment, or chemical samples are being handled.

2. Dielectric boots should be added to the above when electrical equipment is used near the sinks or when messy operations involving the transfer of sediments could result in contaminated materials splashing on feet. Long pants must be worn year round for sieving, press sieving, and jar filling.

4. During sediment transfer operations (including sieving) three pairs of gloves must be worn: a pair of latex gloves next to the skin, followed by a pair of silver shields, followed by a pair of bluegreen nitrile gloves. Use fresh latex gloves daily and check the others frequently for leaks.

5. Full face shields must also be worn during sediment transfers and when handling caustic chemicals in the hood. (Formalin, Hydrochloric acid, etc.)

6. Hearing protection is required when the fume hood is running.

7. Sandals and open-toed shoes may not be worn in this lab.

8. Eye protection (safety glasses with side shields) must be worn at all times.

A. General Principles for Work with Laboratory Chemicals

In addition to the more detailed recommendations listed below in sections B–E, "Prudent Practices" expresses certain general principles, including the following:

1. *It is prudent to minimize all chemical exposures.* Because few laboratory chemicals are without hazards, general precautions for handling all laboratory chemicals should be adopted, rather than specific guidelines for particular chemicals (2, 10). Skin contact with chemicals should be avoided as a cardinal rule (198).

2. *Avoid underestimation of risk.* Even for substances of no known significant hazard, exposure should be minimized; for work with substances which present special hazards, special precautions should be taken (10, 37, 38). One should assume that any mixture will be more toxic than its most toxic component (30, 103) and that all substances of unknown toxicity are toxic (3, 34).

3. *Provide adequate ventilation.* The best way to prevent exposure to airborne substances is to prevent their escape into the working atmosphere by use of hoods and other ventilation devices (32, 198).

4. *Institute a chemical hygiene program.* A mandatory chemical hygiene program designed to minimize exposures is needed; it should be a regular, continuing effort, not merely a standby or short-term activity (6, 11). Its recommendations should be followed in academic teaching laboratories as well as by full-time laboratory workers (13).

5. *Observe the PELs, TLVs.* The Permissible Exposure Limits of OSHA and the Threshold Limit Values of the American Conference of Governmental Industrial Hygienists should not be exceeded (13).

with Chemicals

The Chemical Hygiene Plan should require that laboratory workers know and follow its rules and procedures. In addition to the procedures of the sub programs mentioned above, these should include the rules listed below.

1. General Rules

The following should be used for essentially all laboratory work with chemicals:

(a) *Accidents and spills*—Eye Contact: Promptly flush eyes with water for a prolonged period (15 minutes) and seek medical attention (33, 172).

Ingestion: Encourage the victim to drink large amounts of water (178).

Skin Contact: Promptly flush the affected area with water (33, 172, 178) and remove any contaminated clothing (172, 178). If symptoms persist after washing, seek medical attention (33).

Clean-up. Promptly clean up spills, using appropriate protective apparel and equipment and proper disposal (24 33). See pp. 233–237 for specific clean-up recommendations.

(b) *Avoidance of "routine" exposure:* Develop and encourage safe habits (23); avoid unnecessary exposure to chemicals by any route (23):

Do not smell or taste chemicals (32). Vent apparatus which may discharge toxic chemicals (vacuum pumps, distillation columns, etc.) into local exhaust devices (199).

Inspect gloves (157) and test glove boxes (208) before use.

Do not allow release of toxic substances in cold rooms and warm rooms, since these have contained recirculated atmospheres (209).

(c) *Choice of chemicals:* Use only those chemicals for which the quality of the available ventilation system is appropriate (13).

(d) *Eating, smoking, etc.:* Avoid eating, drinking, smoking, gum chewing, or application of cosmetics in areas where laboratory chemicals are present (22, 24, 32, 40); wash hands before conducting these activities (23, 24).

Avoid storage, handling or consumption of food or beverages in storage areas, refrigerators, glassware or utensils which are also used for laboratory operations (23, 24, 226).

(e) *Equipment and glassware:* Handle and store laboratory glassware with care to avoid damage; do not use damaged glassware (25). Use extra care with Dewar flasks and other evacuated glass apparatus; shield or wrap them to contain chemicals and fragments should implosion occur (25). Use equipment only for its designed purpose (23, 26).

(f) *Exiting:* Wash areas of exposed skin well before leaving the laboratory (23).

(g) *Horseplay:* Avoid practical jokes or other behavior which might confuse, startle or distract another worker (23).

(h) *Mouth suction:* Do not use mouth suction for pipeting or starting a siphon (23, 32).

sandals, perforated shoes, or sneakers (158).

(j) *Personal housekeeping:* Keep the work area clean and uncluttered, with chemicals and equipment being properly labeled and stored; clean up the work area on completion of an operation or at the end of each day (24).

(k) *Personal protection:* Assure that appropriate eye protection (154–156) is worn by all persons, including visitors, where chemicals are stored or handled (22, 23, 33, 154).

Wear appropriate gloves when the potential for contact with toxic materials exists (157); inspect the gloves before each use, wash them before removal, and replace them periodically (157). (A table of resistance to chemicals of common glove materials is given p. 159).

Use appropriate (164–168) respiratory equipment when air contaminant concentrations are not sufficiently restricted by engineering controls (164–5), inspecting the respirator before use (169).

Use any other protective and emergency apparel and equipment as appropriate (22, 157–162).

Avoid use of contact lenses in the laboratory unless necessary; if they are used, inform supervisor so special precautions can be taken (155).

Remove laboratory coats immediately on significant contamination (161).

(l) *Planning:* Seek information and advice about hazards (7), plan appropriate protective procedures, and plan positioning of equipment before beginning any new operation (22, 23).

(m) *Unattended operations:* Leave lights on, place an appropriate sign on the door, and provide for containment of toxic substances in the event of failure of a utility service (such as cooling water) to an unattended operation (27, 128).

(n) *Use of hood:* Use the hood for operations which might result in release of toxic chemical vapors or dust (198–9).

As a rule of thumb, use a hood or other local ventilation device when working with any appreciably volatile substance with a TLV of less than 50 ppm (13).

Confirm adequate hood performance before use; keep hood closed at all times except when adjustments within the hood are being made (200); keep materials stored in hoods to a minimum and do not allow them to block vents or air flow (200).

Leave the hood "on" when it is not in active use if toxic substances are stored in it or if it is uncertain whether adequate general laboratory ventilation will be maintained when it is "off" (200).

(o) *Vigilance:* Be alert to unsafe conditions and see that they are corrected when detected (22).

(p) *Waste disposal:* Assure that the plan for each laboratory operation includes plans and training for waste disposal (230).

Deposit chemical waste in appropriately labeled receptacles and follow all other waste disposal procedures of the Chemical Hygiene Plan (22, 24).

Do not discharge to the sewer concentrated

APPENDIX F

Risk Assessment Support Study
Portsmouth Naval Shipyard

Health and Safety Plan

prepared by
Frederick T. Short
University of New Hampshire
Jackson Estuarine Laboratory
Durham, NH 03824-3406

Field Work

When collecting samples (water, sediments, plants or animals) it may not be known if these materials are contaminated with chemicals or infectious agents. Therefore, care should be taken in the collection and transporting of these materials. The procedures outlined below should be followed carefully to protect human health and maintain proper disposal procedures at JEL.

A. Collection

Personnel involved in the collection should wear protective clothing including: coveralls, disposable outerwear, or full foul-weather suit, safety boots, and rubber gloves. When sampling requires the use of pumps, tubing, etc. these articles and any others that come in direct contact with liquid samples should be held in sturdy plastic bags after they are contaminated to prevent contamination of the personnel or the vehicle used. Care should be taken to avoid direct skin contact with all samples taken. All personnel should wash any potentially, exposed skin after collection each day with antimicrobial soap.

B. Transporting

Containers used in the collection, transport, and storage of effluents should be resistant to breakage. During transportation the sample containers should be placed in coolers or other watertight container in case the original one fails.

Laboratory Work

The uncertainties of the chemical and biological constituents in a complex sample make it necessary to prevent any direct contact with the skin and minimize volatilization.

A. Sample Handling

If volatilization (aeration) is required, it should be conducted under an operating fume hood. When handling samples in the laboratory, many of the same rules stated for field collections apply. At a minimum, gloves and a disposable lab coat must be worn. In addition, safety boots are provided to all employees and should also be worn. After handling samples and removing protective clothing, hands should be washed with an anti-bacterial soap, regardless of the use of rubber gloves.

All contaminated glassware should be given a preliminary decontamination before sending it to the washroom. First, empty excess sample into the proper container and rinse thoroughly with tap water. Soak the glassware in a 2 to 5% chlorox solution to sanitize it as much as possible. If the sample is known to contain significant chlorinated hydrocarbons, rinse the glassware briefly with acetone under an approved, functioning hood. A final rinse with tap water is made before it is sent to the wash room. All sinks

used for washing and rinsing contaminated glassware should drain to the laboratory waste treatment system. Samples heavily contaminated with microbial pathogens should be autoclave-sterilized before disposal.

B. Waste Disposal

All samples entered into the data log should also have an entry as to how and when it was disposed. All excess samples (those not used in toxicity tests or chemical analyses) should be treated by the laboratory waste treatment system or placed in a proper container for disposal (SOP for waste disposal at ERL-N). Disposable gloves, labcoats, etc. may be put in a plastic bag and place directly into trash containers. Broken contaminated glassware should be rinsed with tapwater and then disposed in a container specifically for broken glass.

APPENDIX G

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CHEMICAL HYGIENE PLAN

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APPENDIX I

NORMANDEAU ASSOCIATES

M E M O R A N D U M

TO: Bob Hasevlat, Project Manager

FROM: Felice Janelle, Safety/Compliance Officer

RE: Site Safety Plan for Portsmouth Naval Shipyard
Project #12918.00

DATE: September 12, 1991

A review of the information regarding hazardous substance on Seavey Island has been completed. The following health and safety measures should be taken:

1) When collecting benthic samples from the vicinity of the Island, wear gloves and avoid contact with sediments. Wash face and hands before eating or drinking. Wash down the inside of boat and any surfaces or equipment that have come in contact with sediments. Shower as soon as possible after leaving the site.

2) Precautions when collecting lobster and flounder, or benthic samples from other sample points, is not warrented.

3) A copy of the attached guidelines should accompany benthic samples to the lab. Clearly label which samples are potentially contaminated.

4) Based on knowledge of activities on the island which may involve radioactive substances, pre- and post-urinalysis for gross gamma radiation should be performed for all project field personnel. In addition, these individuals will wear radiation-sensing dosimeters when working near Seavey Island.

SITE SAFETY PLAN
CLIENT QUESTIONNAIRE

1. Client's name? UNIVERSITY OF NH - DR. FRED SHORT
2. Client's address? JACKSON ESTUARINE LABORATORY
DURHAM NH 03824
(NAI IS A SUBCONTRACTOR TO UNH WHO IS THE PRIME CONTRACTOR TO SAIC.)
3. Client's phone number? 603/862-2175
4. Study site location? PORTSMOUTH NAVAL SHIPYARD
PISCATAQUA RIVER KITTERY, MAINE
5. Present use of the study site? PORTSMOUTH NAVAL SHIPYARD
6. How large is the study site (acreage)? >25 acres
7. What has the study site been used for in the past? SHIPYARD SINCE LATE 1800'S
8. Is there any history of industrial activity on the study site? SHIPYARD ACTIVITIES
   a. If yes, what was produced? CONSTRUCTION OF SHIPS, SUBMARINES. MAINTENANCE CONTINUES AT THIS SITE.
9. Has the study site ever been used as a landfill? YES
10. Has there ever been waste disposal on the study site? PRESUMABLY SO
   a. If yes, what chemicals and amounts and concentrations of each? SEE ATTACHED INFORMATION
   b. What are the locations of each waste disposed on the study site? UNKNOWN
11. Has there ever been wastes stored on the study site? PRESUMABLY SO
   a. If yes, what chemicals and amounts and concentrations of each? SEE ATTACHED
   b. What are the locations of waste storage areas on the study site? UNKNOWN
12. What are the adjacent parcels used for? RESIDENTIAL, FISHING OPERATIONS, PRISON (ABANDONED)
13. Are there any industries in the area that discharge into streams that cross the study site? UNKNOWN
   a. If yes, what chemicals are discharged and at what concentrations? —
14. Have there ever been chemical analyses for hazardous substances performed on soils or water on or near the study site?
   a. If yes, what were the results? (Ask for a copy of the results.) YES.
   SEE ATTACHED INFORMATION
15. Will samples of any type be collected for analyis? YES
   a. If yes, state type of samples and name of laboratory that will perform analysis
   BENTHIC - ORGANISMS SUCH AS POLYCHAETES, AMPHIPODS ETC - NAI BENTHIC LAB / PRESERVED IN FORMALDEHYDE
   SEDIMENT - SENT TO SAIC FOR DISTRIBUTION TO ANALYTICAL LAB.
   FLOUNDER, LOBSTER - SENT TO SAIC FOR DISTRIBUTION TO ANALYTICAL LAB.

SITE SAFETY PLAN

Project: PORTSMOUTH NAVAL SHIPYARD Project No: 12918.00

No:

Client: ~~SAIC~~ UNIVERSITY OF N.H.

Date: 9/5/91

Project Location (provide brief description, attach a legible copy of Client Questionnaire and of a Site Location map):

PORTSMOUTH NAVAL SHIPYARD AREA LOCATED ON SEAVEY ISLAND IN THE PISCATAQUA RIVER. SEE ATTACHED MAP.

Objective of Investigation (provide brief description of the proposed field and/or laboratory investigation):

TO ASSESS LANDFILL IMPACTS, BENTHIC, SEDIMENT AND FISH/LOBSTER SAMPLES WILL BE COLLECTED AT SEVERAL LOCATIONS NEAR THE SHIPYARD AND YORK HARBOR, MAINE (CONTRL

Potential Hazards:

Contaminant	Concentration	TLV (TWA)	Routes of Exposure: Inhalation	Ingestion	Contact/Skin absorption
PCB's	Unknown	0.5 mg/m³	✓	✓	✓
Cadmium	"	0.05 mg/m³	✓	✓	✓
lead	"	0.15 mg/m³	✓	✓	✓

(Attach additional page if necessary)

Level of Protection (to be determined by H & S Representative):

Protective Clothing & Equipment: GLOVES: SURGICAL INSIDE, NITRILE OUTSIDE; RUBBER BOOTS; NEOPRENE BIB-TYPE OVERPANTS.

Protective Measures: KEEP SEDIMENTS OFF SKIN; WASH HANDS BEFORE EATING OR DRINKING

Project Coordination and Emergency Phone Numbers:

	Location		Phone Number	
Project Manager	BOB HASEVLAT	BEDFORD	X186	472-5191
Safety Officer	FELICE JANELLE	BEDFORD	X 106	472-5191
Fire	PORTSMOUTH FIRE DEPT		436-5000	
Hospital	PORTSMOUTH HOSPITAL - EMERGENCY -		433-4012	
Ambulance	THRU PORTSMOUTH FIRE DEPT.		436-1127 OR 436-5000	

Directions to Hospital (Attach map and written directions to hospital):

LEAVE THE GLENN NORMANDEA DOCK AREA; PROCEED TO INTERSECTION AT END OF PICKERING AVENUE; HEAD WEST ON SOUTH STREET APPROXIMATEY 1/2 MILE. HOSPITAL ON RIGHT.

Normandeau Associates, Inc.
25 Nashua Road
Bedford, NH 03102-5999
(603) 472-5191
(603) 472-7052 (Fax)

NORMANDEAU ASSOCIATES

COLLECTION OF CONTAMINATED SAMPLES

SAFETY GUIDELINES

1. Use the MARITIME with side-mounted framework to allow samples and sampling equipment to rest over the side thereby reducing contamination of the vessel itself.

2. Sampling personnel should wear neoprene gloves, lower arm protection, Hicar aprons and chemical resistant boots.

3. Personnel should avoid contact with sediments or muddy water with bare skin.

4. Wash hands and face with soap and water before eating or drinking and immediately after removing protective clothing.

5. Shower as soon as possible after completion of sampling effort each day.

6. Wash down the inside and outside of the boat after each sample and again with soap and water at the end of the sampling day.

5/30/90

EAST COAST MAPPING / HOLDEN ENG.

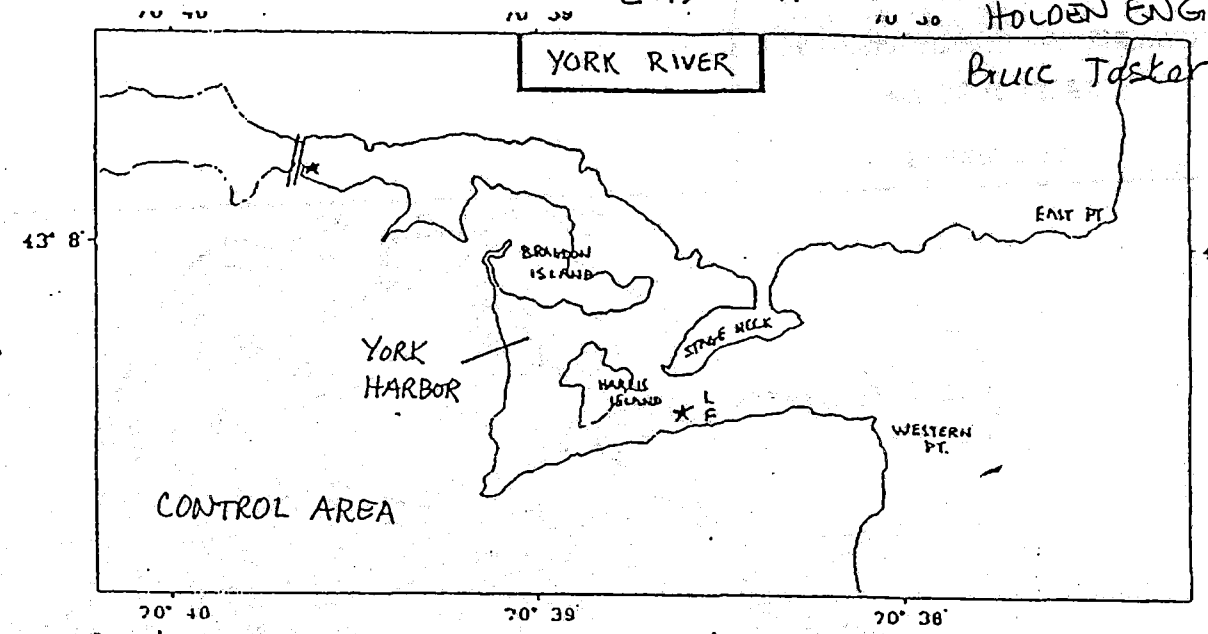
Bruce Tasker

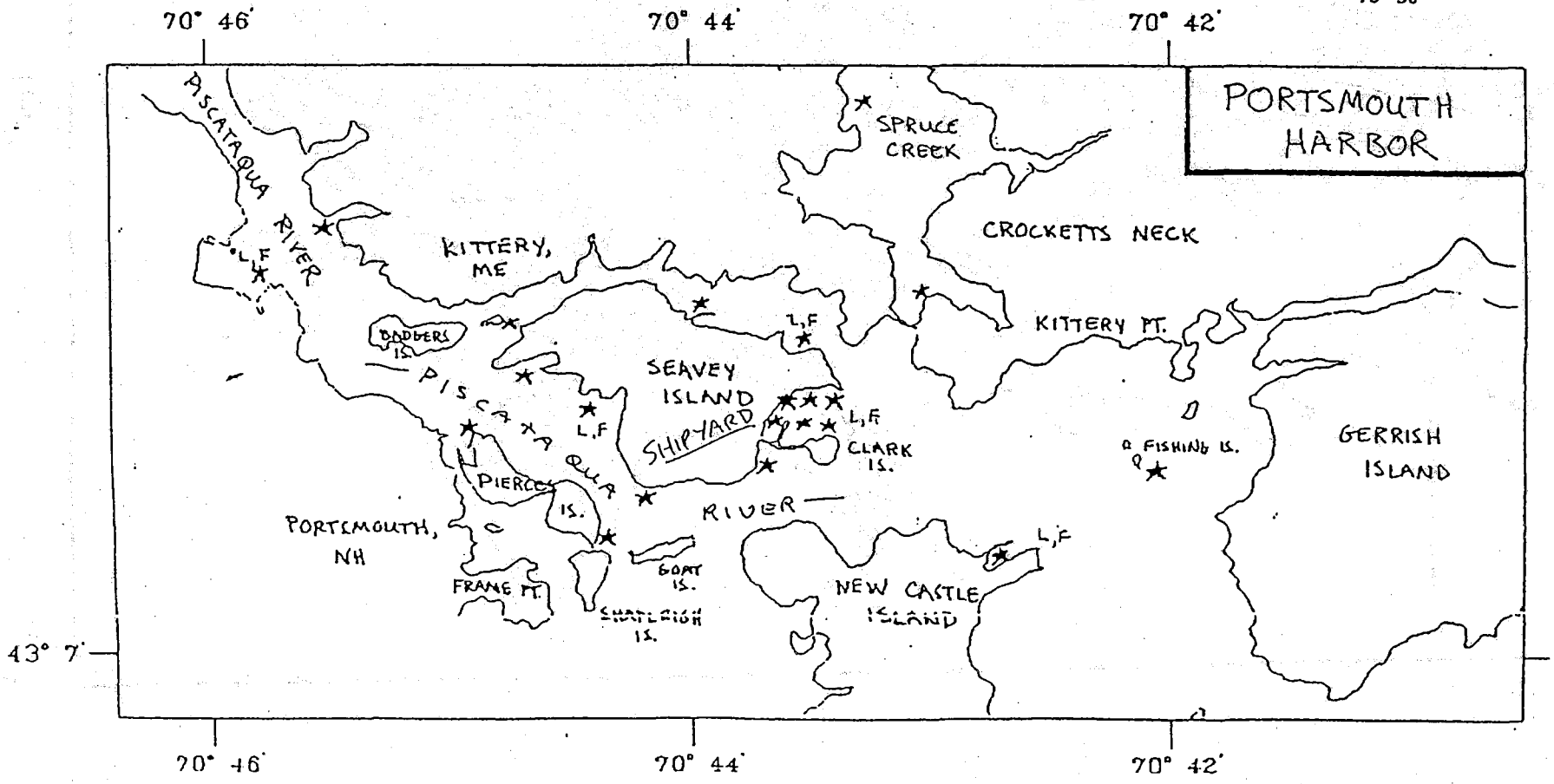
TOTAL P.02

FIGURE 1. Sampling locations.

★ sediment collection (surficial and core)
water collection
mussel collection[1]
eelgrass collection[1]
Fucus collection[1]
benthic collection
L lobster collection ← NAI TASKS
F flounder collection
M seasonal biota collection[2]
W monthly water collection[2]

[1]if present at station
[2]station selection based on initial sampling





ACTUAL STATION LOCATIONS MAY VARY.

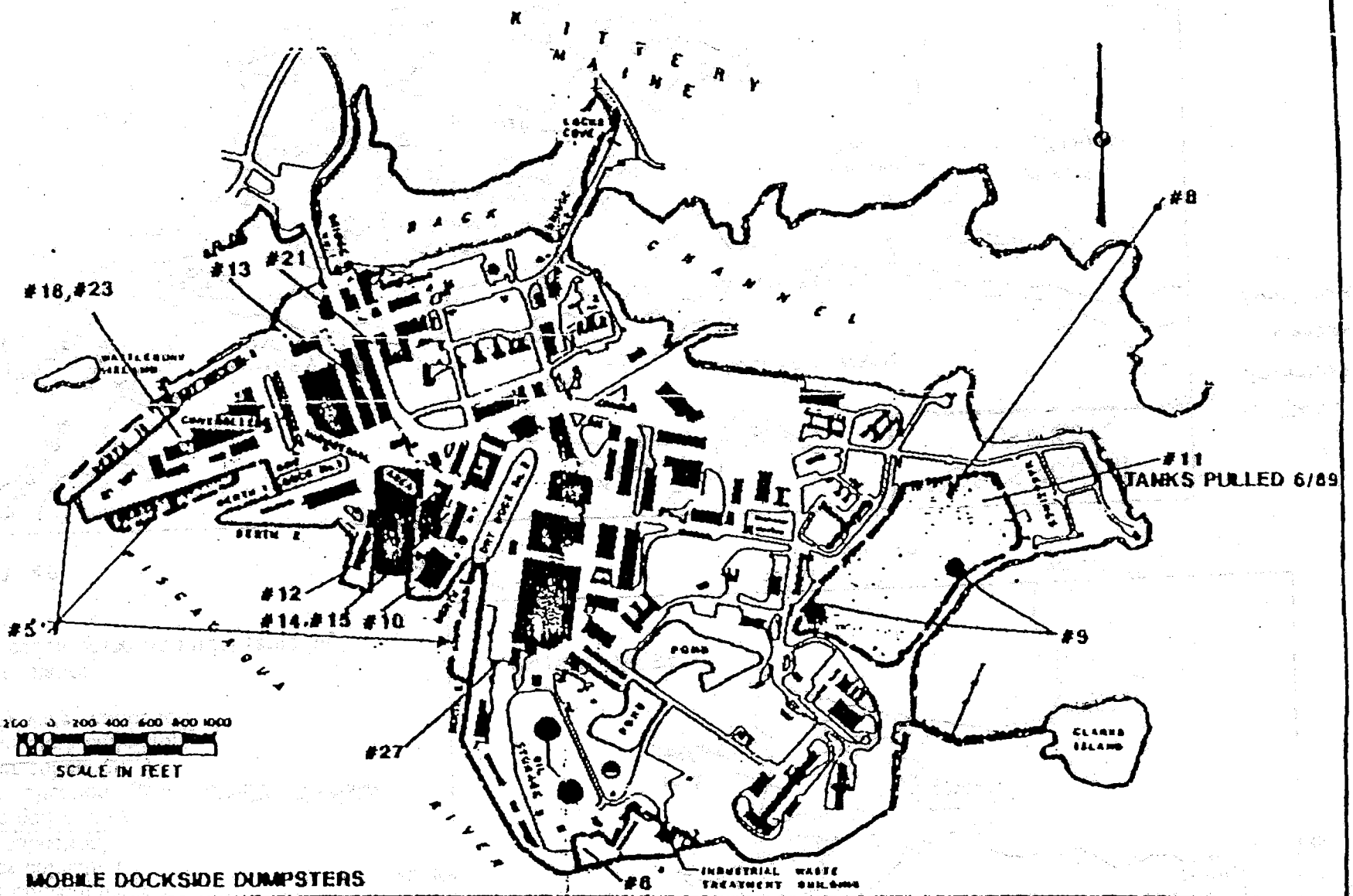


FIGURE 1-12

DISPOSAL SITES

PORTSMOUTH NAVAL SHIPYARD

KITTERY, ME JUNE 1989

SWMU #10	Battery Acid Tank No.24
SWMU #11	Waste Oil Tanks (2) No.12 (pulled June 1989)
SWMU #12	Boiler Blowdown Tank No. 6 & 7
SWMU #13	Rinse Water Tank No.27
SWMU #16	Rinse Water Tank No. 34
SWMU #21	Acid/Alkaline Drain Tank
SWMU #23	Chemical Cleaning Facility Tank (Building 174)
SWMU #26	Oil/Water Dumpsters
SWMU #27	Fuel Oil Spillage Area Southeast of Berth 6

The following is a brief summary of SWMUs 5, 6, 8, 9, and 10 from the RCRA Facility Assessment, Portsmouth Naval Shipyard, Phase II Report, Kearney, A.T., Inc. and Baker/TSA, Inc., July 1, 1986. Table 1-6 addresses the tank-related SWMUs: 11, 12, 13, 16, 21, 23, 26, and 27.

SWMU #5. Unit Name: Industrial Waste Outfalls

Description: Several discharge points along the Piscataqua River were located at the western end of the site. The outfalls were used to discharge liquid industrial wastes prior to construction of the Industrial Waste Treatment Plant. The outfalls were located near Berths 6, 11 and 13.

Period of Operation: 1946 to 1975

Wastes: Industrial wastewaters including wastes from plating and battery shops contained in Buildings 79 and 238.

Release Controls: None

History of Releases: In 1976 sediments in the outfall areas were sampled and tested. The results show heavy metals contamination including mercury, lead, cadmium, chromium, copper and zinc; high concentrations of oils and grease; PCBs; and concentrations of total cyanide and phenols. Dredging operations were conducted to remove contaminated sediment which were disposed in the Jamaica Island Landfill. The effectiveness of dredging operations is not known. Since that time discharges from the outfalls have ceased.

SWMU #6. Unit Name: DRMO Storage Yard

Description: The storage yard is a 4-acre site that serves as a temporary storage area for refuse prior to off-site recycling or disposal.

Period of Operation: The unit is presently active and has been in operation over 30 years.

Wastes: Lead and nickel-cadmium battery elements, motors, typewriters, paper products, and scrap metal.

Table 1-4. Tank Related Solid Waste Management Units

Underground Storage Tanks

SWMU No.	Name	Content Description	Tank Description	Analytical Parameters
10	Battery Acid Tank	Spent Battery Acid	Tank Pulled	Lead
11	Waste Oil Tank No. 6 and 7	Used Lubricating Oil and Degreasers	7,500 gal. each Capacity Steel Construction Inspected 11/86, pulled 6/89	PCB's, RCRA Metals, TCL Volatiles
12	Boiler Blowdown Tank No. 25	Heated Water	1,000 gal. Capacity 1974 to Present	TAL Metals, Cyanide
13	Rinse Water Tank No. 27	Unspecified Rinse Water	695 gal. Capacity Steel Construction 1974 to Present	TAL Metals, Cyanide
15	Rinse Water Tank No. 34	Unspecified Rinse Water	750 gal. Capacity Steel Construction 1974 to Present	TAL Metals, Cyanide
21	Acid/Alkaline Drain Tank	Spent Cleaning Solutions	695 gal. Capacity	TAL Metals, Cyanide and TPH
23	Chemical Cleaning Facility Tank	Spent Cleaning Solutions	2,270 gal. Capacity 1978 to Present	TAL Metals, Cyanide and TPH

Aboveground Storage Tanks

26	Oil/Water Dumpsters	Waste Oil	Mobile Dockside Dumpsters on Berth	TPH

Pipeline

27	Former Pipeline	Fuel Oil	Ruptured pipeline 1978. Pipeline and soil excavated.	TPH, PAH

Release Controls: There are no release controls. Visual inspection indicates ponding of precipitation in some areas and direct runoff to the river in other areas.

History of Releases: The facility characterization report documents elevated concentrations of chromium, cadmium, lead, and nickel in the soils. No soil remediation program has been conducted. Storage operations have been modified to prevent the potential for further releases of lead.

SWMU #8. Unit Name: Jamaica Island Landfill

Description: The landfill covers an area of 25 acres and contains an unknown amount of materials considered as hazardous waste.

Prior to landfilling activities, tidal flats separated Jamaica Island from Seavey Island. Over a 20-30 year period this area was filled with hazardous and nonhazardous wastes. In 1978, the shipyard received approval to dredge over 10,000 cubic yards of sediment from Berths 6, 11 and 13, and to dispose of the material in the area of the landfill illustrated in Figure 9-1. The material was placed on top of a portion of the landfill and was encapsulated by a clay barrier wall along the Piscataqua River and a clay cap to prevent infiltration.

Period of Operation: Approximately 1945 to 1978

Wastes: In addition to general refuse, trash and construction rubble, the unit accepted incinerator ash, plating sludges containing chrome, lead and cadmium; asbestos insulation; volatile organics including TCE, methylene chloride, toluene and MEK; acetylene and chlorine gas cylinders; contaminated dredge spoils containing chromium, lead, small amounts of PCB, mercury and possibly phenols; waste paints and solvents; and spent sandblasting grit. Personnel have indicated that waste oils containing PCBs may also have been disposed at the site prior to construction of a holding tank in 1972.

Corrective Actions: A 2-foot clay cap has been placed over the portion of the landfill that accepted contaminated dredge spoils. In addition, a clay barrier has been constructed lining the inside of the rock dike.

History of Releases: Sampling and testing of sediments along the face of the landfill have indicated elevated levels of chromium, lead, and nickel. However, this data does not confirm the landfill as the source of contamination.

SWMU #9. Unit Name: Mercury Burial Sites

Description: Two mercury burial areas are located within the Jamaica Landfill Area.

Period of Operation: 1973 to 1975

Wastes: Mercury contaminated wastes including fluorescent bulbs, thermometers, mercury switches and rags, brooms, and dust pans contaminated with mercury.

Release Controls: The wastes were encapsulated in 4-foot-diameter concrete pipe sections with the ends capped with one foot of poured concrete. The concrete vaults were buried under 8 to 10 feet of fill. There are approximately 6 vaults in each of the two areas. Visual inspection indicates that the areas are vegetated with no signs of erosion or distress.

History of Releases: There is no record of a release from the concrete capsules.

SWMU #10. Unit Name: Tank No. 24

Description: This unit is an underground, 9680-gallon holding tank for waste battery acid resulting from battery disposal operations. The tank has been removed.

Table 1-4

Hazardous Materials Disposed of at Site 1, Jamaica Island Landfill

Substance	Estimated Quantity	Time Period	Comments
Plating Sludges			
Chrome	5,000-10,000 pounds	1945-1972	Sludges were mixed in with normal refuse and were disposed of directly into the landfill. Exact location unknown.
Lead	5,000-10,000 pounds	1945-1972	
Cadmium	5,000-10,000 pounds	1945-1972	
Asbestos insulation	Several thousand pounds	1945-1960	Exact location unknown.
Volatile organics			
TCE, methylene chloride, toluene, MEK	20,000 gallons	1955-1975	Drums were taken to the landfill where wastes were drained out directly onto the ground.
Acetylene and chlorine gas cylinders	100-200 cylinders	1955	Cylinders were buried full.
Contaminated dredge spoils containing:		1978	Total spoils deposited was 108,000 cubic yards. Small amounts of PCBs and mercury were also found in dredge spoils. Dredge material came from sediments at Berths 6, 11, and 13.
Chromium	5,000 pounds		
Lead	20,000 pounds		
Waste paints and solvents	500,000 gallons	1945-1955	Probably disposed of in whole drums.
Spent sandblasting grit.	50,000 tons/year	1945-1975	Scattered throughout the site.

PROJECT 12918.00
PORTSMOUTH NAVAL SHIPYARD

STATION NUMBER	CONTAMINATED *	NON-CONTAMINATED *
1		X
2		X
3	X	
4	X	
5	X	
6	X	
7	X	
8	X	
9	X	
10	X	
11		X
12	X	
13	X	
14		X
15		X
16		X
17		X
18		X
19	X	
20		X
21		X
22		X
23		X

* BASED ON PROXIMITY TO KNOWN HAZARDOUS WASTE STORAGE AREAS AT THE PORTSMOUTH NAVAL SHIPYARD.

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NORMANDEAU ASSOCIATES

PROCESSING OF CONTAMINATED SAMPLES

SAFETY GUIDELINES

1. Wear surgical gloves, lower arm covers and aprons when processing samples. Re-powder gloves for ease of use, if needed. Dispose of gloves in disposal bucket located in sample washdown area.

2. Wear dust masks for designated projects. Project manager will alert you to these projects.

3. Keep sample covered with liquid while being sorted, cover for the night.

4. Wash sorting tray, forceps, scope and personal work space at the end of each day using TSP and sponges. Rinse TSP'd area with water afterwards (TSP can be caustic).

5. Wash samples ONLY at area designated for contaminated sample washdown.

6. Use equipment designated for contaminated samples only. Wash bottle for washing less than 0.5 mm-sediment into bucket, sieves, sponges, spoons and TSP are to be kept in contaminated sample washdown area only.

7. Wash hands with bar soap when gloves are removed especially before eating or drinking and always before leaving work at the end of the day. No eating or drinking at your work space when working on samples.

8. Do not touch communal equipment, e.g. phone, sink area, door knobs, etc., with gloves on.

5/30/90

NORMANDEAU ASSOCIATES

Material Safety Data Sheets

J.T.BAKER INC. 222 RED SCHOOL LANE, PHILLIPSBURG, NJ 08865
M A T E R I A L S A F E T Y D A T A S H E E T
24-HOUR EMERGENCY TELEPHONE -- (201) 859-2151
CHEMTREC # (800) 424-9300 -- NATIONAL RESPONSE CENTER # (800) 424-8802

J.T.BAKER INC., 222 RED SCHOOL LANE, PHILLIPSBURG, NJ 08865

SECTION I - PRODUCT IDENTIFICATION

PRODUCT NAME: FORMALDEHYDE, 37% SOLUTION
COMMON SYNONYMS: FORMALIN; METHYLENE OXIDE; METHYL ALDEHYDE; METHANAL
CHEMICAL FAMILY: AQUEOUS SOLUTIONS
FORMULA: HCHO
FORMULA WT.: 30.03
CAS NO.: 50-00-0
NIOSH/RTECS NO.: LP8925000
PRODUCT USE: LABORATORY REAGENT
PRODUCT CODES: 2112,2105,2106

PRECAUTIONARY LABELING

BAKER SAF-T-DATA* SYSTEM

HEALTH	-	3	SEVERE (CANCER CAUSING)
FLAMMABILITY	-	2	MODERATE
REACTIVITY	-	2	MODERATE
CONTACT	-	3	SEVERE (CORROSIVE)

LABORATORY PROTECTIVE EQUIPMENT

GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER

U.S. PRECAUTIONARY LABELING

POISON DANGER

CAUSES BURNS. COMBUSTIBLE. MAY BE FATAL IF SWALLOWED OR INHALED. NOTE: REPORTED AS CAUSING CANCER IN LABORATORY ANIMALS. EXERCISE DUE CARE. EXCEPTIONAL HEALTH AND CONTACT HAZARDS: READ MATERIAL SAFETY DATA SHEET. KEEP AWAY FROM HEAT, SPARKS, FLAME. DO NOT GET IN EYES, ON SKIN, ON CLOTHING. AVOID BREATHING VAPOR. KEEP IN TIGHTLY CLOSED CONTAINER. USE WITH ADEQUATE VENTILATION. WASH THOROUGHLY AFTER HANDLING. IN CASE OF FIRE, USE WATER SPRAY, ALCOHOL FOAM, DRY CHEMICAL, OR CARBON DIOXIDE. FLUSH SPILL AREA WITH WATER SPRAY.

CONTINUED ON PAGE: 2

PRECAUTIONARY LABELING (CONTINUED)

INTERNATIONAL LABELING

TOXIC BY INHALATION, IN CONTACT WITH SKIN AND IF SWALLOWED. POSSIBLE RISKS OF IRREVERSIBLE EFFECTS. MAY CAUSE SENSITIZATION BY SKIN CONTACT.
KEEP OUT OF REACH OF CHILDREN. AFTER CONTACT WITH SKIN, WASH IMMEDIATELY WITH PLENTY OF SOAP AND WATER. IN CASE OF CONTACT WITH EYES, RINSE IMMEDIATELY WITH PLENTY OF WATER AND SEEK MEDICAL ADVICE. USE ONLY IN WELL VENTILATED AREAS.

SAF-T-DATA* STORAGE COLOR CODE: RED (FLAMMABLE)

SECTION II - COMPONENTS

COMPONENT	CAS NO.	WEIGHT %	OSHA/PEL	ACGIH/TLV
FORMALDEHYDE	50-00-0	37-38	3 PPM	1 PPM
METHANOL	67-56-1	10-15	200 PPM	200 PPM
WATER	7732-18-5	47-53	N/E	N/E

SECTION III - PHYSICAL DATA

BOILING POINT: 96 C (204 F)
(AT 760 MM HG)

VAPOR PRESSURE (MMHG): 1.3
(20 C)

MELTING POINT: N/A

VAPOR DENSITY (AIR=1): 1.0

SPECIFIC GRAVITY: 1.08
(H2O=1)

EVAPORATION RATE: N/A

SOLUBILITY(H2O): COMPLETE (100%)

% VOLATILES BY VOLUME: 100
(21 C)

PH: 2.8 (31% SOLUTION)

ODOR THRESHOLD (P.P.M.): N/A

PHYSICAL STATE: LIQUID

COEFFICIENT WATER/OIL DISTRIBUTION: N/A

CONTINUED ON PAGE: 3

SECTION III - PHYSICAL DATA (CONTINUED)

APPEARANCE & ODOR: CLEAR, COLORLESS LIQUID. PUNGENT ODOR.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (CLOSED CUP): 59 C (140 F) NFPA 704M RATING: 2-2-0

AUTOIGNITION TEMPERATURE: 423 C (795 F)

FLAMMABLE LIMITS: UPPER - 73.0 % LOWER - 7.0 %

FIRE EXTINQUISHING MEDIA
USE WATER SPRAY, ALCOHOL FOAM, DRY CHEMICAL OR CARBON DIOXIDE.

SPECIAL FIRE-FIGHTING PROCEDURES
FIREFIGHTERS SHOULD WEAR PROPER PROTECTIVE EQUIPMENT AND SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN POSITIVE PRESSURE MODE. MOVE CONTAINERS FROM FIRE AREA IF IT CAN BE DONE WITHOUT RISK. USE WATER TO KEEP FIRE-EXPOSED CONTAINERS COOL.

UNUSUAL FIRE & EXPLOSION HAZARDS
VAPORS MAY FLOW ALONG SURFACES TO DISTANT IGNITION SOURCES AND FLASH BACK. CLOSED CONTAINERS EXPOSED TO HEAT MAY EXPLODE. CONTACT WITH STRONG OXIDIZERS MAY CAUSE FIRE.

TOXIC GASES PRODUCED
FORMALDEHYDE, CARBON MONOXIDE, CARBON DIOXIDE

EXPLOSION DATA-SENSITIVITY TO MECHANICAL IMPACT
NONE IDENTIFIED.

EXPLOSION DATA-SENSITIVITY TO STATIC DISCHARGE
NONE IDENTIFIED.

SECTION V - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE (TLV/TWA): 1.5 MG/M3 (1 PPM)

CONTINUED ON PAGE: 4

SECTION V - HEALTH HAZARD DATA (CONTINUED)

TLV IS FOR FORMALDEHYDE.

SHORT-TERM EXPOSURE LIMIT (STEL): 3 MG/M3 (2 PPM)

STEL IS FOR FORMALDEHYDE.

PERMISSIBLE EXPOSURE LIMIT (PEL): (3 PPM)

PEL IS FOR FORMALDEHYDE.

TOXICITY OF COMPONENTS

ORAL RAT LD50 FOR FORMALDEHYDE	800	MG/KG
SKIN RABBIT LD50 FOR FORMALDEHYDE	270	MG/KG
SUBCUTANEOUS RAT LD50 FOR FORMALDEHYDE	420	MG/KG
INHALATION RAT LC50 FOR FORMALDEHYDE	590	MG/KG
ORAL RAT LD50 FOR METHANOL	5628	MG/KG
INTRAPERITONEAL RAT LD50 FOR METHANOL	9540	MG/KG
SUBCUTANEOUS MOUSE LD50 FOR METHANOL	9800	MG/KG
SKIN RABBIT LD50 FOR METHANOL	20	G/KG
INTRAPERITONEAL MOUSE LD50 FOR WATER	190	G/KG
INTRAVENOUS MOUSE LD50 FOR WATER	25	G/KG

CARCINOGENICITY: NTP: YES IARC: NO Z LIST: NO OSHA REG: NO

CARCINOGENICITY
THIS SUBSTANCE IS LISTED AS AN ACGIH SUSPECTED HUMAN CARCINOGEN AND A NTP ANTICIPATED HUMAN CARCINOGEN.

REPRODUCTIVE EFFECTS
TESTS ON LABORATORY ANIMALS INDICATE THAT FORMALDEHYDE MAY BE MUTAGENIC.

EFFECTS OF OVEREXPOSURE

INHALATION: HEADACHE, NAUSEA, VOMITING, DIZZINESS, DROWSINESS, IRRITATION OF UPPER RESPIRATORY TRACT, UNCONSCIOUSNESS, AND MAY BE FATAL

SKIN CONTACT: SEVERE IRRITATION OR BURNS, PROLONGED CONTACT MAY CAUSE SKIN SENSITIZATION

EYE CONTACT: SEVERE IRRITATION OR BURNS

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SECTION V - HEALTH HAZARD DATA (CONTINUED)

SKIN ABSORPTION: RAPID ABSORPTION

INGESTION: BLINDNESS, NAUSEA, VOMITING, GASTROINTESTINAL IRRITATION, BURNS TO MOUTH AND THROAT, AND MAY BE FATAL

CHRONIC EFFECTS: KIDNEY DAMAGE, LIVER DAMAGE

TARGET ORGANS
RESPIRATORY SYSTEM, EYES, SKIN, LIVER, KIDNEYS

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE
NONE IDENTIFIED

PRIMARY ROUTES OF ENTRY
INHALATION, INGESTION, EYE CONTACT, SKIN CONTACT, ABSORPTION

EMERGENCY AND FIRST AID PROCEDURES

INGESTION: CALL A PHYSICIAN. IF SWALLOWED, IF CONSCIOUS, GIVE LARGE AMOUNTS OF WATER. INDUCE VOMITING.

INHALATION: IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.

SKIN CONTACT: IN CASE OF CONTACT, IMMEDIATELY FLUSH SKIN WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES.

EYE CONTACT: IN CASE OF EYE CONTACT, IMMEDIATELY FLUSH WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES.

SARA/TITLE III HAZARD CATEGORIES AND LISTS

ACUTE: YES CHRONIC: YES FLAMMABILITY: YES PRESSURE: NO REACTIVITY: NO

EXTREMELY HAZARDOUS SUBSTANCE:	YES	CONTAINS FORMALDEHYDE (RQ = 1,000 LBS, TPQ = 500 LBS)
CERCLA HAZARDOUS SUBSTANCE:	YES	CONTAINS FORMALDEHYDE (RQ = 1000 LBS)
TOXIC CHEMICALS:	YES	CONTAINS FORMALDEHYDE AND METHANOL
GENERIC CLASS:		C05, C07
TSCA INVENTORY:	YES	

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SECTION VI - REACTIVITY DATA

STABILITY: STABLE HAZARDOUS POLYMERIZATION: MAY OCCUR

CONDITIONS TO AVOID: HEAT, FLAME, OTHER SOURCES OF IGNITION

INCOMPATIBLES: STRONG OXIDIZING AGENTS, STRONG ACIDS, STRONG BASES, ALKALIES, ALKALI METALS, AMINES AND AMMONIA, PHENOL, STRONG REDUCING AGENTS

DECOMPOSITION PRODUCTS: FORMALDEHYDE, CARBON MONOXIDE, CARBON DIOXIDE

SECTION VII - SPILL & DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN THE EVENT OF A SPILL OR DISCHARGE
WEAR SELF-CONTAINED BREATHING APPARATUS AND FULL PROTECTIVE CLOTHING. SHUT OFF IGNITION SOURCES; NO FLARES, SMOKING OR FLAMES IN AREA. STOP LEAK IF YOU CAN DO SO WITHOUT RISK. USE WATER SPRAY TO REDUCE VAPORS. TAKE UP WITH SAND OR OTHER NON-COMBUSTIBLE ABSORBENT MATERIAL AND PLACE INTO CONTAINER FOR LATER DISPOSAL. FLUSH AREA WITH WATER.

DISPOSAL PROCEDURE
DISPOSE IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL ENVIRONMENTAL REGULATIONS.

EPA HAZARDOUS WASTE NUMBER: U122 (TOXIC WASTE)

SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT

VENTILATION: USE GENERAL OR LOCAL EXHAUST VENTILATION TO MEET TLV REQUIREMENTS.

RESPIRATORY PROTECTION: RESPIRATORY PROTECTION REQUIRED IF AIRBORNE CONCENTRATION EXCEEDS TLV. AT CONCENTRATIONS UP TO 50 PPM, A CHEMICAL CARTRIDGE RESPIRATOR WITH ORGANIC VAPOR CARTRIDGE IS RECOMMENDED. ABOVE THIS LEVEL, A SELF-CONTAINED BREATHING APPARATUS IS RECOMMENDED.

EYE/SKIN PROTECTION: SAFETY GOGGLES AND FACE SHIELD, UNIFORM, PROTECTIVE SUIT, PROPER GLOVES ARE RECOMMENDED.

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SECTION IX - STORAGE AND HANDLING PRECAUTIONS

SAF-T-DATA* STORAGE COLOR CODE: RED (FLAMMABLE)

STORAGE REQUIREMENTS
KEEP CONTAINER TIGHTLY CLOSED. STORE IN A COOL, DRY, WELL-VENTILATED, FLAMMABLE LIQUID STORAGE AREA OR CABINET. ISOLATE FROM INCOMPATIBLE MATERIALS. STORE ABOVE 15 C.

SPECIAL PRECAUTIONS
FORMALDEHYDE SOLUTIONS WITH A FLASH POINT BELOW 141 F IN CONTAINERS EXCEEDING 110 GALLONS ARE CLASSIFIED AS A COMBUSTIBLE WITH UN1198. SEE 49CFR 172.101.

SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

DOMESTIC (D.O.T.)

PROPER SHIPPING NAME: FORMALDEHYDE SOLUTION (FLASH PT. BELOW 141 F.)
HAZARD CLASS: ORM-A
UN/NA: UN1198 REPORTABLE QUANTITY: 1000 LBS.
LABELS: NO LABEL REQUIRED UNDER 110 GALLONS
REGULATORY REFERENCES: 49CFR 172.101; 173.500; 173.510

INTERNATIONAL (I.M.O.)

PROPER SHIPPING NAME: FORMALDEHYDE, SOLUTIONS
HAZARD CLASS: 3.3 I.M.O. PAGE: 3139
UN: UN1198 MARINE POLLUTANTS: NO PACKAGING GROUP: III
LABELS: FLAMMABLE LIQUID
REGULATORY REFERENCES: 49CFR 172.102; PART 176; IMO

AIR (I.C.A.O.)

PROPER SHIPPING NAME: FORMALDEHYDE, SOLUTIONS
HAZARD CLASS: 3.3
UN: UN1198 PACKAGING GROUP: III
LABELS: FLAMMABLE LIQUID
REGULATORY REFERENCES: 49CFR 172.101; 173.6; PART 175; ICAO/IATA

U.S. CUSTOMS HARMONIZATION NUMBER: 29121100000

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N/A = NOT APPLICABLE OR NOT AVAILABLE
N/E = NOT ESTABLISHED

THE INFORMATION IN THIS MATERIAL SAFETY DATA SHEET MEETS THE REQUIREMENTS OF THE UNITED STATES OCCUPATIONAL SAFETY AND HEALTH ACT AND REGULATIONS PROMULGATED THEREUNDER (29 CFR 1910.1200 ET. SEQ.) AND THE CANADIAN WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM. THIS DOCUMENT IS INTENDED ONLY AS A GUIDE TO THE APPROPRIATE PRECAUTIONARY HANDLING OF THE MATERIAL BY A PERSON TRAINED IN, OR SUPERVISED BY A PERSON TRAINED IN, CHEMICAL HANDLING. THE USER IS RESPONSIBLE FOR DETERMINING THE PRECAUTIONS AND DANGERS OF THIS CHEMICAL FOR HIS OR HER PARTICULAR APPLICATION. DEPENDING ON USAGE, PROTECTIVE CLOTHING INCLUDING EYE AND FACE GUARDS AND RESPIRATORS MUST BE USED TO AVOID CONTACT WITH MATERIAL OR BREATHING CHEMICAL VAPORS/FUMES.
EXPOSURE TO THIS PRODUCT MAY HAVE SERIOUS ADVERSE HEALTH EFFECTS. THIS CHEMICAL MAY INTERACT WITH OTHER SUBSTANCES. SINCE THE POTENTIAL USES ARE SO VARIED, BAKER CANNOT WARN OF ALL OF THE POTENTIAL DANGERS OF USE OR INTERACTION WITH OTHER CHEMICALS OR MATERIALS. BAKER WARRANTS THAT THE CHEMICAL MEETS THE SPECIFICATIONS SET FORTH ON THE LABEL.
BAKER DISCLAIMS ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED WITH REGARD THE PRODUCT SUPPLIED HEREUNDER, ITS MERCHANTABILITY OR ITS FITNESS FOR A PARTICULAR PURPOSE.
THE USER SHOULD RECOGNIZE THAT THIS PRODUCT CAN CAUSE SEVERE INJURY AND EVEN DEATH, ESPECIALLY IF IMPROPERLY HANDLED OR THE KNOWN DANGERS OF USE ARE NOT HEEDED. READ ALL PRECAUTIONARY INFORMATION. AS NEW DOCUMENTED GENERAL SAFETY INFORMATION BECOMES AVAILABLE, BAKER WILL PERIODICALLY REVISE THIS MATERIAL SAFETY DATA SHEET. IF YOU HAVE ANY QUESTIONS, PLEASE CALL CUSTOMER SERVICE (1-800-JTBAKER) FOR ASSISTANCE.

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APPROVED BY QUALITY ASSURANCE DEPARTMENT.

-- LAST PAGE --

Normandeau Associates Inc.
Chemical Information Form

Chemical Name:

HEXANES

Routes/Symptoms of Exposure:

ingestion-headache, nausea, vomiting, dizziness
inhalation-irritation of nasal and resp. passages, headache, dizziness, nausea
skin contact-irritation

Exposure Limits:

TLV = 50 ppm

Personal Protection and Sanitation:

Use adequate ventilation, protective gloves (nitrile or equivalent) and eye protection. Wear a respirator equipped with organic vapor filters if no fume hood is available.

First Aid:

SKIN: immediately flush skin with large amounts of soap and water
EYES: immediately flush thoroughly with water for at least fifteen minutes
INHALATION: remove to fresh air; give artificial respiration if breathing has stopped
INGESTION: do not induce vomiting; seek immediate medical attention

Spill response:

Turn off any source of ignition and ventilate area.
Wear protective clothing as described above.
Take up spilled material with toweling or sand or with SPILL-X-S if the spill is large.
Dispose of according to state and federal regulations.

Other:

Hexane is a dangerous fire and explosion hazard.

Normandeau Associates Inc.
Chemical Information Form

Chemical Name:

NITRIC ACID

Routes/Symptoms of Exposure:

ingestion-nausea, vomiting, severe burns, ulceration of the mouth, throat, and stomach
inhalation-severe irritation or burns of the resp. system, coughing, difficulty breathing, chest pains
skin contact-severe irritation or burns

Exposure Limits:

PEL = 2 ppm

Personal Protection and Sanitation:

Use adequate ventilation, protective gloves (nitrile or equivalent) and eye protection. Use a respirator with acid gas filters if fume hood is not available. Wash hands after handling.

First Aid:

SKIN: immediately flush skin with soap and large amounts of water for at least 15 minutes
EYES: immediately flush thoroughly with water for at least fifteen minutes
INHALATION: remove to fresh air; give artificial respiration if breathing has stopped
INGESTION: do not induce vomiting; give water or milk; seek immediate medical attention

Spill response:

Wear respiratory, skin and eye protection as described above. Ventilate area. Neutralize spill with soda ash or SPILL-X-A. Carefully place material in a clean, dry container and dispose of according to state and federal regulations.

Other:

Spillage may cause fire or liberate dangerous gas. Harmful if inhaled and may cause delayed lung injury. Strong oxidizer. Contact with other material may cause fire. May be fatal if swallowed or inhaled.