CHEMICAL HYGIENE PLAN

Building Chemistry 091

Room(s) 0227a, 0225

Department Geology

Approved as UM Policy September 1994

Revised April 2002

Revised May 2003

Revised March 2005

Revised January 2006

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UM Policy on Occupational Exposure to Hazardous Chemicals in Laboratories

Approved by the President September 19, 1994

A. Purpose.

This is a statement of official University policy to establish the process for compliance with the Occupational Safety and Health Administration (OSHA) regulation

"Occupational Exposure to Hazardous Chemicals in Laboratories."

B. Policy.

The University is dedicated to providing safe and healthful laboratory facilities for students and employees, and complying with federal and state occupational health and safety standards. Laboratory administrators, managers, faculty, staff and students all share responsibility for minimizing their exposure to hazardous chemical substances which, for purposes of this policy, shall be defined as chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic systems, and agents which damage the lungs, skin, eyes, or mucous membranes.

The Chemical Hygiene Plan shall be implemented for all facilities at the University of Maryland, College Park, where hazardous chemicals are handled or used under all of the following conditions: (i) chemical manipulations are performed in containers designed to be easily and safely manipulated by one person; (ii) multiple chemical procedures or chemicals are used; and (iii) demonstrably effective laboratory practices and equipment are available and in common use to minimize the potential for employee exposure to hazardous chemicals.

The Chemical Hygiene Plan shall be reviewed and evaluated for its effectiveness at least annually, and updated as necessary.

C. Responsibilities.

1. Department of Environmental Safety shall:

(a) Appoint a Chemical Hygiene Officer to develop and coordinate administration of the UM Chemical Hygiene Plan (CHP);

(b) Prepare the CHP with annual review and revisions as needed;

(c) Distribute the CHP to each affected department for each Laboratory Supervisor or Principal Investigator (LS/PI);

(d) Provide consultation, worksite monitoring (sampling), advisory assistance and information concerning use of hazardous materials;

(e) Investigate, document and report to the BACH Committee, significant chemical exposure or contamination incidents;

(f) Collect and dispose of hazardous, radioactive and other regulated wastes;

(g) Direct periodic laboratory safety audits to determine regulatory compliance, and recommend action to correct conditions generating release of toxic chemicals;

(h) Provide training to all laboratory workers concerning:

(i) Provisions of the Chemical Hygiene Plan;

(ii) Physical and health hazards of chemicals in the work area;

(iii) Measures to protect employees from chemical hazards;

(iv) Signs and symptoms associated with hazardous chemical exposure;

(v) Location of reference materials on the hazards, safe handling, storage and disposal of laboratory chemicals;

(vi) The contents of the OSHA standard and its appendices;

(vii) The permissible exposure limits (PELs) for OSHA regulated substances or recommended exposure limits if no PEL is listed; and

(viii) The methods and observations used to detect the presence or release of a hazardous chemical.

2. Laboratory Supervisors/Principal Investigators (LS/PI) shall:

(a) Implement all provisions of the Chemical Hygiene Plan for laboratory facilities under their control;

(b) Develop and maintain a customized Chemical Hygiene Plan for laboratory operations under their control to include:

(i) Alphabetized inventory of all hazardous chemical substances,

(ii) Written Standard Operating Procedures to address safety and health issues associated with work practices, protective equipment, in laboratory facilities under their control;

(iii) Identification of occurrences or operations that may be encountered by laboratory employees and that require that the LS/PI be advised (prior approval).

(c) Prepare and implement laboratory-specific Standard Operating Procedures (SOPs) to include work practices, protective equipment, engineering controls, emergency procedures and waste disposal procedures;

(d) Demarcate and indicate on SOP all areas designated for the use of particularly hazardous chemicals (i.e., select carcinogens, reproductive toxins and acute toxins);

(e) Train laboratory workers regarding the specific practices and provisions contained in the laboratory SOP;

(f) Ensure that all lab employees have access to Material Safety Data

Sheets for hazardous chemicals that are purchased or otherwise acquired for use in the lab facility;

(g) Ensure that all necessary personal protective equipment is available and used by lab employees;

(h) Notify the designated UM contact points when any of the University of Maryland prior notification conditions are anticipated;

(i) Comply with necessary documentation requirements; and

(j) Submit a current copy of their Chemical Hygiene Plan(s) including all required components to the Department of Environmental Safety and Departmental Compliance Officer.

3. Biological and Chemical Hygiene (BACH) Committee shall:

Review and approve all aspects of the Chemical Hygiene Plan and provide technical guidance for implementation of campus policy concerning chemical and biological safety.

4. University Health Center shall:

(a) Coordinate and direct all required or recommended medical surveillance programs;

(b) Provide medical consultations and examinations for laboratory workers who have been overexposed, or suspect overexposure, to hazardous chemical substances; and

(c) Maintain medical records relating to consultations, examinations and medical surveillance as required by law.

5. Departmental and College Compliance Officers shall:

(a) Assist Environmental Safety and laboratory supervisors with implementation of the Chemical Hygiene Program; and

(b) Maintain current copies of Chemical Hygiene Plans.

6. Department Chairs and College Deans shall:

(a) Require implementation of the Chemical Hygiene Program for affected laboratories under their control.

7. Individual Researchers and Laboratory Users shall:

(a) Adhere to the requirements of the Chemical Hygiene Plan and SOPs;

(b) Complete all safety training requirements and comply with documentation procedures;

(c) Notify the PI/LM if any prior notification situations or occurrences are anticipated;

(d) Report all workplace injuries, chemical exposure incidents or unsafe conditions to their LS/PI as soon

as possible.

D. Information

Assistance will be provided by the Department of Environmental Safety to any Department requesting guidance or training to satisfy implementation of this policy.

Emergency Telephone Numbers

UM Emergency (FIRE - POLICE - RESCUE) - 24 hour # 911

CALL IMMEDIATELY FOR ANY EMERGENCY INCLUDING

INJURED OR SICK PERSON, CHEMICAL SPILL OR FIRE

Environmental Safety (Main Office) (301) 405-3960

(Industrial Hygiene, Hazardous Waste Management, Fire Protection, Hazard Communication, Safety Education)

Chemical Hygiene Officer (301) 405-3980

(Program Consultation and Administration)

Biological Safety (301) 405-3960

(Biological Safety, Regulated Pathogen Consultation)

Radiation Safety (301) 405-3985

(Health Physics, Radioactive Materials Procurement)

University Health Center Occupational Health (301) 314-8172

(Medical Consultation and Evaluation)

Workers' Compensation Office (301) 405-5466

Facilities Management Work Control (301) 405-2222

(Repair of Facility Equipment Deficiencies, e.g., fume hoods, emergency eyewashes, ventilation, etc.)

Laboratory Supervisor(s): Business hours # After hours #

Prof. Willam F. McDonough 405 5561; 301 927 7366

Dr Richard Ash 405 7504; 410 685 5895

Laboratory Personnel: Business hours

Prof. Roberta Rudnick 51311

Prof. Richard Walker 54089/56981

Standard Operating Procedures (SOPs)

A comprehensive health and safety program should include documents that provide descriptions of standard methods or operations used within the facility. They should describe in clear and precise language the means and methods to be used by laboratory workers to minimize the risk of hazardous exposure while using hazardous chemicals. These documents, commonly referred to as standard operating procedures (SOPs), should be followed by all laboratory employees.

The LS/PI is responsible for preparation of lab-specific SOP documents for attachment to the CHP. The LS/PI is responsible for determining the adequacy of the SOPs prepared.

The lab-specific SOPs shall be incorporated in the on-site copy of the Chemical Hygiene Plan and placed in a designated location within the laboratory for immediate access by employees.

A good SOP is one that is clearly stated and realistic in scope. A laboratory LS/PI should prepare SOPs for all routine and repetitive operations as well as for general laboratory operations. The format of all SOPs should be consistent and should incorporate:

1. Facility name, department and section affected by or using the procedure;

2. Subject;

3. Issue date of the original document or current revision;

4. Any indication that revisions replace an earlier procedure;

6. Signature or initials of the SOP preparer as well as any reviewing authority; and

7. Concise instructions for safe and healthful performance of laboratory activities and procedures.

SOPs should indicate the measures that will be used to reduce or prevent employee exposure to hazardous chemicals, including engineering controls, hygiene practices. The use and maintenance of personal protective equipment.

SOPs should include provisions for additional employee protection for work with particularly hazardous substances, including select carcinogens, reproductive toxins, and substances which have a high degree of acute toxicity. (See "Identification of Hazardous Materials, below). Where appropriate, these additional measures should include:

1. Establishment of a designated area;

2. Use of containment devices such as fume hoods or glove boxes;

3. Procedures for safe removal of contaminated waste; and

4. Procedures for site and personal decontamination.

SOPs shall also indicate circumstances under which certain laboratory procedures, operations or activities require prior approval from the LS/PI before implementation (e.g., use of radioactive materials, bench top manipulation of volatile carcinogenic solvents without use of engineering controls, night or weekend work performed alone, reagent substitutions, etc.).

Examples of SOPs are available on the DES website at:

http://www.umd.edu/des/ls/index.html

Medical Consultation and Examinations

Employees who work with hazardous chemicals in the laboratory should be referred for medical consultation, examination, and/or surveillance (as appropriate to the circumstances) whenever:

1. An employee develops signs or symptoms associated with a hazardous chemical to which the employee may have been exposed in the laboratory;

2. An event takes place in the work area to create a likelihood of hazardous exposure; or

3. Exposure monitoring reveals an exposure level routinely above the action level (or in the absence of an action level, the Permissible Exposure Limit) for an OSHA-regulated substance for which there are exposure monitoring and medical surveillance requirements. (See "Exposure Monitoring" section, below).
Examples of events or circumstances which might result in hazardous exposure include:

1. A spill or leak which rapidly releases a hazardous chemical in an uncontrolled manner;

2. Direct skin or eye contact with a hazardous chemical;

3. Symptoms such as headache, rash, nausea, tearing, irritation or redness of eyes, irritation of nose or throat, dizziness, loss of motor dexterity or judgment which disappear when the employee is removed from the exposure area and which reappear when the employee returns to working with the same hazardous chemical;

4. Two or more employees in the same laboratory work area exhibit similar symptoms; or

5. Exposure monitoring indicates exposures above regulated or recommended limits.

The University has established procedures for responding to job-related injuries.

These procedures should be followed in the event of hazardous exposure due to the use of hazardous chemicals in the laboratory. Instructions and forms for reporting injuries and chemical exposures are

available through the DES web page:

http://www.umd.edu/des/risk_comm/wcomp/

In the event of life-threatening injuries or illnesses, the UM Emergency Dispatcher should be immediately notified. All injury or illness occurring as a result of work activities should be reported to the Workers' Compensation Office, immediately after the incident occurs or the injury is treated. All incidents of hazardous exposure, including their disposition, should be reported to the Chemical Hygiene Officer.

The following information should be provided at the time that an employee is referred for medical consultation and/or examination:

1. Identity of the chemical(s) to which the employee may have been exposed;

2. Description of the conditions under which the exposure occurred, including any quantitative exposure data, if available; and

3. A description of the signs and symptoms of exposure that the employee experienced, if any.

A written report must be provided to the employer from any physician to whom the employee is referred for medical consultation or examination in connection with hazardous exposure. The physician's report(s) should indicate ONLY the specific findings of diagnoses related to occupational exposure and should include the following information:

1. Any recommendation for further medical follow-up;

2. The results of the medical examination and any associated test(s);

3. Any medical condition which may be revealed in the course of the examination which may place the employee at increased risk as a result of exposure to a hazardous workplace; and

4. A statement that the employee has been informed by the physician of the results of the consultation or medical examination and any medical condition that may require further examination or treatment.

As indicated above, all incidents of hazardous exposure (including disposition) should be reported to, and documented by, the Chemical Hygiene Officer (CHO). If no further assessment of the incident is deemed necessary, the reason for that decision should be included in the documentation. If the event is determined to require investigation, a formal exposure assessment will be initiated by the CHO. The purpose of an exposure assessment is not to determine whether there was a failure to follow proper procedures, but to identify the hazardous chemical(s) involved and determine whether an exposure might have caused harm to an employee. An exposure assessment may include the following items:

1. Interviews with the employee and complainant (if different);

2. Obtaining the following information:

- the names of chemicals which may be involved
- other chemicals used by the employee
- all chemicals used by others in the immediate area
- other chemicals stored in the immediate area
- symptoms exhibited or claimed by the employee
- comparison of symptoms with those referenced in the Material Safety

Data Sheet for each involved chemical

- observation of control measures and personal protective equipment in use during the event
- notation of any on-site exposure monitoring performed previous to or during event

3. Monitoring or sampling the air in the area for suspect chemicals; and

4. Determination of whether the current control measures were adequate during the time of the incident.

Identification of Hazardous Materials

A hazardous chemical is defined by the OSHA laboratory standard as "a chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees." Hazardous chemicals include carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins,

nephrotoxins, neurotoxins, agents which act on the hematopoietic system and agents which damage the lungs, skin, eyes or mucous membranes.

Laboratory supervisors have certain responsibilities for the management of these hazardous chemicals, including:

1. Inventory of all hazardous chemical substances which are used in their laboratories, and attaching the inventory to this CHP;

2. Maintenance of the labels on incoming containers of hazardous chemicals to ensure that they are not removed or defaced;

3. Maintenance of any Material Safety Data Sheets (MSDSs) that are received with incoming shipments of hazardous chemicals, and ensuring that the MSDSs are readily accessible to laboratory employees; and

4. Determination of whether chemical substances that are developed in the laboratory are hazardous

chemicals within the definition of this CHP. If the chemical substance is a byproduct for which the composition is unknown, the substance should be deemed to be a hazardous chemical.

Laboratory supervisors also are responsible for identifying the following hazardous chemicals that are required to be used in an area specially designated for such use:

1. Select carcinogens: Any substance that meets one of the following criteria:

- it is regulated by OSHA as a carcinogen;

- it is listed under the category, "known to be carcinogens," in the Annual

Report on Carcinogens published by the National Toxicology Program (latest edition);

- it is listed under Group 1 ("carcinogenic to humans") by the International

Agency for Research on Cancer (IARC) Monographs (latest edition); or

- it is listed in either Group 2A or 2B by the IARC, or under the category, "reasonably anticipated to be carcinogens" by NTP, and causes statistically significant tumor incidence in experimental animals in accordance with criteria specified in the OSHA laboratory standard.

2. Reproductive toxins: Chemicals that affect the reproductive capabilities, including chemicals that are mutagenic and teratogenic;

3. Acute toxins;

4. Unknowns: Chemicals which are synthesized in the laboratory and which are byproducts for which the composition is unknown.

Information concerning the health effects of chemical substances can be located in the following reference sources:

1. Material Safety Data Sheets (MSDS)

MSDSs are available through:

(A) The Department of Environmental Safety (DES):

1. Web Page (http://www.umd.edu/des, http://ccinfoweb.ccohs.ca/msds/search.html)

2. Telephone (301-405-3960), or

3. After normal hours through UM Emergency Dispatcher at 911), and

(B) the vendor, manufacturer or distributor. (A MSDS must be provided at the time of initial purchase by the vendor, manufacturer or distributor without charge. A nominal fee may be assessed for additional copies.)

2. Registry of Toxic Effects of Chemical Substances (available through the DES

Web Page:

(http://www.umd.edu/des/os/ccinfo/index.html)

3. National Toxicology Program (Chemistry Library or DES)

4. International Agency for Research on Cancer (Chemistry Library or DES)

5. DES maintains an Internet database of the Select Carcinogens as well as chemical substances that may be considered acute and reproductive toxins.

This list may be accessed at:

www.umd.edu/des/ls

Use of any of the following materials may be subject to specific occupational safety and health standards as shown:

Asbestos, tremolite, anthophyllite and actinolite 29 CFR 1910.1001

4-Nitrobiphenyl .1003

alpha-Naphthylamine .1004

4,4'-Methylene bis(2-chloroaniline) .1005

Methyl chloromethyl ether .1006

3,3'-Dichlorobenzidine (and salts) .1007

bis-Chloromethyl ether .1008

beta-Naphthylamine .1009

Benzidine .1010

4-Aminodiphenyl .1011

Ethyleneimine .1012

beta-Propiolactone .1013

2-Acetylaminofluorene .1014

4-Dimethylaminoazobenzene .1015

N-Nitrosodimethylamine .1016

Vinyl Chloride .1017

Arsenic (inorganic) .1018

Lead .1025

Cadmium .1027

Benzene .1028

Cotton dust .1043

1,2-Dibromo-3-chloropropane .1044

Acrylonitrile .1045

Ethylene oxide .1047

Formaldehyde .1048

4,4'-Methylenedianiline .1050

Methylene Chloride .1052

Non-Asbestiform tremolite, anthophyllite and actinolite .1101 These standards are not replaced by the Occupational Exposure to Hazardous Chemicals in Laboratories standard. Users of these materials are expected to adhere to the provisions of all applicable substance-specific standards if employee exposure routinely exceeds the OSHA mandated permissible exposure limit (or Action Level, if specified). Copies of these standards may be obtained from the Department of Environmental Safety or through the OSHA website at:

www.osha.gov

Information and Training

All UM employees must assume an active role in maintaining a safe working environment by reporting any problems or noncompliance with policies to the LS/PI. All employees should fully utilize any information provided during formal and informal training sessions. Any staff member who does not understand a policy or procedure should consult the LS/PI, departmental safety committee or DES for clarification.

All employees shall be provided with information and training regarding the hazards of the chemicals in their work area. Employees shall be informed of:

1. The contents of the OSHA standard and its appendices;

2. The location and availability of the CHP;

3. The permissible exposure limits (PELs) for OSHA regulated substances or recommended exposure limits if no PEL is listed;

4. The methods and observations used to detect the presence or release of a hazardous chemical

5. The physical and health hazards of chemicals in the work area;

6. The measures employees can take to protect themselves from chemical hazards, including specific procedures (SOPs) to be used;

7. Signs and symptoms associated with exposures to hazardous chemicals used in the laboratory; and

8. The location of known reference material on the hazards, safe handling, storage, and disposal of chemicals found in the laboratory.

Distribution of training materials to LS/PIs and members of departmental safety committees is coordinated through the Department of Environmental Safety. Training of laboratory workers in general laboratory safety and the provisions of the OSHA laboratory standard's requirements shall be conducted by UM Chemical Hygiene Officer (or designee) during training sessions scheduled through the Department of Environmental Safety or through special arrangement with DES. An on-line Chemical Hygiene training course is also available to UM laboratory employees at the following website:

http://des.umd.edu/TrainingClass/index.cfm

The LS/PI shall be responsible for training of all supervised laboratory employees as to specific operations, safety equipment, emergency procedures, SOPs and chemical use which apply to the laboratory facilities. Documentation of general laboratory safety and CHP training conducted by the Department of Environmental Safety shall be maintained within each department and by the Department of Personnel Services as part of the employee's permanent record. Documentation of laboratory-specific training provided by the LS/PI shall be maintained within each department and laboratory.

Exposure Monitoring

OSHA has established "Permissible Exposure Limits" (PELs) for laboratory employees' exposures to certain regulated substances. Exposure levels must be determined and monitored under certain circumstances. A medical surveillance program has been established for certain specified employees whose work assignments involve regular and frequent handling of toxicologically significant quantities of a chemical. In addition, the Department of Environmental Safety is responsible for making determinations regarding the requirements for area and/or personal exposure monitoring in specific circumstances.

PELs are specified in the OSHA regulation 29 CFR 1910, Subpart Z Toxic and

Hazardous Substances. In addition, PELs are usually indicated on the MSDSs, and can be obtained from the Department of Environmental Safety.

These limits are defined as:

- Eight-hour time weighted average (TWA)

The average concentration to which an employee may be exposed to a particular chemical for up to eight

hours per day, five days per week.

- Short Term Exposure Limit (STEL)

The average concentration to which an employee may be exposed to a particular chemical for up to fifteen minutes per day.

- Ceiling (C)

The maximum concentration to which an employee may be exposed to a particular chemical at any time.

Often, a notation of "Skin" is printed with an exposure limit. This indicates that skin absorption of that chemical occurs readily which would contribute to an employee's overall exposure. Employee exposure to dermal absorption of chemical substances can often be monitored through the use of biological testing.

Employee exposure should be monitored in the following circumstances:

1. Initially, where there is reason to believe that exposure levels to any chemical substance regulated by a standard routinely exceed the action level (or in the absence of an action level, the PEL) for an OSHA-regulated substance for which there are exposure monitoring and medical surveillance requirements; and

2. Periodically, where the initial monitoring discloses employee exposure over the action level (or in absence of an action level, the PEL).

The general training provided by the Department of Environmental Safety will include information regarding the identification of situations where employee exposure might exceed the PEL, TLV or STEL. TLVs (Threshold Limit Values) are eight-hour time-weighted average inhalation exposure limits recommended by the American

Conference of Governmental Industrial Hygienists. The Department of Environmental Safety will perform area and/or personal exposure monitoring at the request of any LS/PI or laboratory worker. The employee will be provided written notification of monitoring results, within 15 working days after receipt of monitoring results by the University.

Where initial monitoring discloses employee exposure over the action level (or in the absence of an action level, the PEL), the affected employee must be provided with personal protective equipment, unless engineering controls are available as a feasible means of controlling exposure. The LS/PI is responsible for ensuring that appropriate protective equipment is available to laboratory employees.

Monitoring will be terminated when appropriate in accordance with the relevant standard.

Prior Approvals

The Principal Investigators/Laboratory Supervisors (LS/PI) is responsible for providing institutional

notifications as defined below:

1. Any purchase, possession or use of explosive materials (as defined by the US

Department of Alcohol, Tobacco & Firearms) must be approved by the UM Fire

Marshal (301-405-3970). A comprehensive list of explosive materials may be accessed from the ATF Website at:

http://www.atf.treas.gov/pub/fire-explo_pub/listofexp.htm

2. Any modification to a chemical fume hood or other laboratory local exhaust system must be reviewed and approved by the Department of Facilities Management (301-

405-0255) and/or the Department of Environmental Safety (405-3960) before it may be used as a means to control exposure to hazardous materials.

3. Any use of hazardous chemicals that may present a hazardous condition due to inadequate ventilation must be reviewed and approved by the Chemical Hygiene Officer prior to initiation of the operation.

4. Any research involving animals must be reviewed and approved by the Institutional

Animal Care and Use Committee. Additional information is available at the following

Website:

http://www.umresearch.umd.edu/IACUC/

5. Any possession or use of radioactive materials or radiation-producing devices must be reviewed and approved by the Radiation Safety Officer. Additional information may be obtained by calling (301) 405-3985.

6. Any research work involving human subjects must be reviewed and approved by the Institutional Review Board. Additional information is available at the following

Website:

www.umresearch.umd.edu/IRB

7. Any purchase, possession or use of etiologic agents must be reviewed and approved by the UM Biosafety Officer. Additional information may be obtained by calling (301)

405-3975 or from the following website:

http://www.umd.edu/des/biosafety/infectious/index.html

8. Treatment (e.g., neutralization) or drain disposal of any hazardous waste must be reviewed and approved by the Environmental Affairs section of the Department of

Environmental Safety. Additional information may be obtained by calling (301) 405-

3163.

9. Any use of respirators must be reviewed and approved by the UM Respiratory Protection Program Administrator. Additional information may be obtained by calling

(301) 405-3980 or from the following website:

http://www.umd.edu/des/os/respirator/index.html

10. The use of extremely toxic gases must be reviewed and approved by the Chemical

Hygiene Officer prior to initiation of work. These gases include:

Arsine and gaseous derivatives

Chloropicrin in gas mixtures

Cyanogen chloride

Cyanogen

Diborane

Germane

Hexaethyltetraphosphate

Hydrogen cyanide

Hydrogen selenide

Nitric oxide

Nitrogen dioxide

Nitrogen Tetroxide

Phosgene

Phosphine

Laboratory employees are responsible for obtaining approval from the LS/PI if any of the following operations will occur:

1. Laboratory operations that will be left unattended.

2. Modification of any established laboratory procedure.

3. Modification to laboratory chemical inventory.

4. Continuation of any laboratory procedure if unexpected results occur.

5. Use of Particularly Hazardous Materials in locations where no engineering controls (e.g., fume hood) are to be used.

6. Any operation for which employees are not aware of the hazards nor are confident in their ability to be adequately protected.

The LS/PI is also required to evaluate these specific laboratory operations and include in Appendix II any additional conditions that require prior approval.

Laboratory Safety Guide and References

The Laboratory Safety Guide is a separate document prepared and distributed by the

Department of Environmental Safety which is available on-line at:

http://www.umd.edu/des/ls/index.html

The Guide was assembled to assist laboratory supervisors and workers in their daily operations at UM and to provide a means to lessen employee exposure to hazardous materials and operations. It can supply much of the information needed to provide laboratory workers a safe working environment. However, laboratory workers should not assume that this guide will supply sufficient information to prevent injury and protect the environment. The nature of the work that is performed in many research and testing laboratories increases the necessity for safety planning and awareness. The Principal Investigator and other faculty often have special expertise in the unique or specific experimental processes used in laboratories under their control, and the prepared SOP may supersede general laboratory safety guidelines.

Recommended reference sources concerning safe operations in laboratories include:

CRC Handbook of Laboratory Safety

CRC Press, Inc.

Guide for Safety in the Chemical Laboratory

Van Nostrand Reinhold Company

Improving Safety in the Chemical Laboratory

John Wiley and Sons

Prudent Practices for Handling Hazardous Chemicals in Laboratories

National Academy Press

Safe Storage of Laboratory Chemicals

John Wiley and Sons

Appendix I

X-7.00(A) UM POLICY CONCERNING FIRE EMERGENCIES

APPROVED BY THE PRESIDENT MARCH 6, 1993

A. Purpose. This is a statement of official University policy for the reporting of fire emergencies and for the evacuation of campus buildings during fire emergencies, in compliance with local, state, and federal regulations.

B. Policy. A fire emergency exists whenever:

1. A building fire evacuation alarm is sounding;

2. An uncontrolled fire or imminent fire hazard occurs in any building or area of the campus;

3. There is the presence of smoke, or the odor of burning;

4. There is spontaneous or abnormal heating of any material, an uncontrolled release of combustible or toxic gas or other material, or a flammable liquid spill.

C. Procedures. Campus Buildings shall be immediately and totally evacuated whenever the building evacuation alarm is sounding.

1. Upon discovery of evidence that a fire emergency exists, an individual shall accomplish, or cause to be accomplished, the following actions:

(a) SOUND AN ALARM. Activate the building fire alarm in buildings equipped with a manual fire alarm system. Shout a warning and knock on doors as you evacuate in buildings not equipped with a fire alarm.

(b) SHUT OFF ALL MACHINERY AND EQUIPMENT IN YOUR AREA.

(c) LEAVE THE BUILDING AT ONCE.

(d) CALL THE FIRE DEPARTMENT FROM A SAFE PLACE.

(1) On-Campus phones DIAL 911

(2) Off-Campus phones and campus pay phones DIAL 911

(3) Use Campus emergency phones;

Indoors - Yellow wall phones with red "EMERGENCY" markings (some corridors)

Outdoors - Yellow phone boxes with red "EMERGENCY" markings, under blue lights.

(4) When the emergency operator answers, ask for the fire department, give as much specific information as possible. State that you are from UMCP and include the proper name of the building and room number, floor, or other specific area. Do not hang up until released by the dispatcher. A PHONE

CALL MUST BE MADE! ALL BUILDING FIRE ALARMS DO NOT

NOTIFY THE FIRE DEPARTMENT.

(e) MEET THE FIRE DEPARTMENT OUTSIDE AND DIRECT THEM TO THE

EMERGENCY.

(f) ALL FIRES, EVEN IF EXTINGUISHED OR FOUND EXTINGUISHED, MUST BE

REPORTED.

(g) ALL FIRE ALARMS, EVEN IF SUSPECTED T O BE FALSE OR ACCIDENT AL,

MUST BE REPORTED TO THE FIRE DEPARTMENT.

2. The evacuation procedures shall be as follows:

(a) It shall be the responsibility of ever y person to immediately leave a University building whenever the fire alarm is activated o r a fire emergency exists.

All students, faculty, and staff are required to leave the building and remain outside until the emergency is over. No one shall restrict or impede the evacuation.

(b) Department heads are expected to review annually fire prevention and fire survival information with faculty and staff, or to schedule such a presentation with the Department of Environmental Safety. Such information is available from the Department for use and distribution.

3. Whenever it is brought to the attention of the staff of residential buildings, or departmental personnel, that the fire alarm or sprinkler system is inoperable or has been placed out of service, a firewatch shall be established.

(a) Responsible personnel (residential staff, safety committee, etc.) shall be assigned to the firewatch.

(b) The entire building shall be toured at least one time during each hour of the firewatch.

(c) The emergency dispatcher (405-3555) shall be notified each hour that the watch has been performed.

(d) The firewatch shall be maintained at all times that the building is occupied until the fire protection system is repaired.

4. INTERRUPTION OF FIRE ALARM:

(a) No person may shut off any fire protection or alarm system during a fire emergency incident without the

permission of the fire department officer in charge.

(b) No person may shut off any fire protection or alarm system during a bomb threat emergency without the permission of the police officer in charge.

(c) It shall be the responsibility of the Department of Facilities Management Department to reset or repair any fire protection or alarm system after an emergency incident when notified by the fire or police department in charge. The Department of Facilities Management shall inspect each such system immediately after every emergency incident and place the system in serviceable condition.

(d) The fire and police departments may reset an alarm system only if there is no damage to the system and when it is within their technical capabilities to do so.

(e) Any person desiring to interrupt service to any fire protection or alarm system must obtain permission from the Department of Facilities Management, Work Control Center (405-2222) which shall notify the fire and police departments of every such interruption.

(f) Fire or police department must request the Facilities Management to repair o r rest a

fire protection system, via the Work Control Center (405-2222).

5. INFORMATION RELEASE TO MEDIA AND THE PUB LIC:

All information regarding University fires will be released through the Department of Environmental Safety in co-operation with the Public Information Office. No other University agency or employee may release official statements regarding the cause, origin, or nature of campus fires.

D. Information

Assistance will be provided by the Department of Environmental Safety to any Department requiring help and advice in its implementation of this UM policy.

Appendix II

Prior Approval Criteria

The LS/PI shall indicate any circumstances under which a particular laboratory operation, procedure or activity shall require prior approval from the LS/PI (or designee) before implementation. If no circumstances are identified, the LS/PI shall write "none" in the first provided sp ace. Additional pages may be added as determined necessary by the LS/PI.

1. Circumstance: Before **any** operation can be carried out in any of these labs prior approval must be obtained from **Bill McDonough or Richard Ash**_____

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Appendix III

Standard Operating Procedures

STANDARD OPERATING PROCEDURES FOR PLASMA LAB AND PREPARATION LAB.

0227 AND 0225.

Department of Geology, Chemistry Building 091

University of Maryland

"If in doubt – ASK"

1. SAFETY EQUIPMENT

Familiarise yourself with the location and usage of the following safety equipment:

Safety glasses: A variety of safety glasses for protection when working with solvents and acids can be found in the second drawer down to the left of the refrigerator [as you face the refrigerator]. THESE ARE NOT LASER GOGGLES AND DO NOT USE THEM AS SUCH.

Plastic nitrile gloves: These are found in numerous places in the lab, for your convenience in small, medium and large, sizes. Fresh boxes are kept on top of the cabinets in 0227. These should be worn whenever dealing with acids or solvents.

Lab coats: Beside the entrance door. We advise the use of these for the protection of your clothing and as another barrier between you and any acids or solvents that you may be using.

Fire extinguishers: There are fire extinguishers in 0227, beside the door to the corridor and in 0225 next to the door to 0227. These are suitable for all fire types including electrical and liquid fires.

Eye wash station: There is an emergency eye wash station attached to the door of the weighing room (on the left as you enter 0227 from the corridor).

Emergency shower: There are emergency showers situated in rooms 0221 and 0219 – as you leave 0227 turn left in the corridor and they are the third and forth doors down on the left. We do not have an emergency shower in the lab as you should not be using anything in either lab that would require an emergency shower if spilled.

Spill kit: There is a chemical spill kit under the desk top opposite the sink.

Laser safety glasses and goggles: Goggles and glasses, for use when the UP213 lid is off, are to be found in Room 0225, in the wall cabinets on the right as you enter from 0227.

2. FUME HOODS AND LAMINAR FLOW HOODS

The hood in **0225 is a fume hood** – *i.e.* it sucks air in at the bottom and blows it out the top. This is to protect you, the analyst, from acid fumes and other unpleasantness emanating from the hood. Dust and dirt in the air may get sucked in to the hood and deposited in you samples – so be careful! When using the hood try to keep the Plexiglass screen folded down as far as convenient to protect you from splashes, explosion *etc*. and to ensure they function at their greatest efficiency.

Both hoods in **0227 are laminar flow hoods** and designed to protect the samples NOT to protect the analyst – they suck air through the top and blow out of the hood toward the analyst. Do not use these hoods for handling dangerous chemicals.

These hoods are not for sample dissolution. This and other processing should be done in the appropriate facilities in the clean lab or in the rock preparation lab.

3. CHEMICAL STORAGE

Chemicals stored in 0227

A variety of chemicals are used in room 0227 and 0225. The Material Safety Data Sheets (MSDS) for these can be found in the folder so marked in 0227. They can also be found at the following website: http://ccinfoweb.ccohs.ca/msds/search.html

In the wall cabinet above and to the left of the sink.

There are numerous 0.1% solutions in 2-5% nitric acid or 2-5%HCl. These are standard solutions of the following elements:

B, Li, Na, Mg, K, Ca, Sc, Fe, Co, Ga, Sr, Y, Zr, Nb, Mo, Ru, Rh, Ag, Cd, In, Sb, Ba, Ce, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Hf, Ta, W, Re, Tl, Pb, Bi, Th, U. There are also multi-element combinations of these solutions.

None of these should be disposed of by pouring them down the sink. If you need to dispose of these see Richard Ash or Bill McDonough and one of them will contact the Environmental Health for disposal.

In the Hood. A variety of frequently used acids and standard solutions (in 2% nitric) are held in the hood in 0227.

Cupboard under the Hood in 0227

The left hand cupboard is for storing organic solvents. The right hand cupboard is for storing acids. *Please preserve this segregation for the sake of safety.*

Left: Acetone, ethanol, carbon tetrachloride, ethylene glycol, propan-2-ol, organic waste, acetone waste, waste pump oil.

Right: Nitric acid (70%), nitric acid waste.

Refrigerator: Anhydrous ammonia, silver solutions, various samples in nitric acid.

The refrigerator in 0227 is NOT for food or drink. If you wish to refrigerate food or drink please use the refrigerator in the office suite (Room 0227a) that may be used for this purpose.

Compressed gases.

Lab 0227 contains the following compressed gases: Ar, N_2 (x2), He (x2). At the end of the day, when you have finished, close the valve at the top of the cylinder and the knob from the regulator to the gas line.

Chemicals stored in 0225

In and under the laminar flow hoods in 0225 are acids, standards, spike solutions and cleaning solutions (MilliQ water and ethanol) that are required on a regular basis.

Elemental standards in 2% or 5% nitric acid, or in 5% hydrochloric are stored in the wall cabinet above and to the left of the sink.

4. LABORATORY PROCEDURES

General:

This is an analytical laboratory containing potentially dangerous materials and instruments so please use common sense and behave with respect in the laboratory.

If you do not know how to deal with something, or have doubts about what you are doing – DO NOT HESITATE TO ASK – there are many people who may be able to help you but **Richard Ash (0227b – Tel: 405 7504)** or Bill McDonough (0229 – Tel: 405 5561) are probably the best people to ask and should be available for help. We would much rather you ask before you do something rather than for us to have to deal with any problems that could have been easily avoided.

Remember – after using any solvents or acids, after removing your nitrile gloves, please wash your hands.

Acid dilution:

Never use a mouth or bulb pipette – use the electronic pipettes to the left of the fume hood.

Our Ultratrace nitric acid is concentrated (70%). When preparing more dilute acid solutions with milliQ water from the 70% you MUST wear safety glasses, nitrile gloves and a lab coat.

Remember when diluting always add acid to water. The recipe for the preparation of 2% acid is as follows:

If you prepare it by weight (thereby avoiding pipetting from the Ultratrace bottle) it is quite simple – put ~986g of milliQ into the clean 2% nitric bottle then add 14g of 70% Ultratrace HNO_3 and this comes out to be pretty much exactly 2% nitric. Don't worry if you are out by a few g for the water as this affects the concentration only minimally – the acid is a little trickier.

Remember to remove the glove and wash your hands immediately after you have finished preparing the acid. The nitrile gloves work well for 5-10 minutes but a small spillage of 70% acid may eat through the gloves.

Diluting sample and standard solutions:

Always wear nitrile gloves and safety glasses when diluting solutions with acid. When diluting samples or standard solutions use a clean pipette and, when finished, pop the tip off the end of the pipette into the sink. Rinse them off with water then put them in the trash. Don't just put them straight in the trash as they can fall out the bag or poke through and cause irritation if unrinsed.

Remember that you should always label any standards or samples – the label should have the date, your name (or initials) and a sample number and/or list of elements contained in the bottle.

Cone Cleaning:

When cone cleaning you must wear nitrile gloves and safety glasses – and I suggest a lab coat to preserve the cleanliness of your clothes. Please carry this task out in the rock preparation lab as a bit of mess there is not as serious as it would be in 0227 (this is not a license to be messy – please clean up after yourself).
We went through a phase of using the Dremel tool for cone cleaning but found that this was difficult to control and caused damage to the cones tips. We clean all cones by hand using the metal polish and tissue or cotton buds. This equipment is to be found in the drawers to the left of the sink. The most important thing to note when cleaning is that the tips of the cones are easily damaged and great care should be taken when cleaning this portion of the cone. However it is important that the tips are cleaned as the geometry of the tip plays a great role in determining sensitivity and the oxide production.

Cleaning glassware:

When carrying out cleaning of glassware using acid always wear nitrile gloves, safety glasses and a lab coat. Glassware is generally cleaned in 10% HNO_3. This is carried out in the hood in 0227. You must label any beakers in which you are cleaning or soaking

glassware – we need to know if the beaker contains acid (and its strength), or water. Also remember to label the beaker with your name (or initials) and the date on which you start the soaking.

Disposal of Waste:

NEVER MIX ORGANIC WASTE AND ACID WASTE – it can be extremely dangerous. Always make sure you use the appropriate container.

You should not have any *chlorinated organic solvents* in the lab – but if you do, do NOT add them to the organic waste container – they should go into a chlorinated organic solvents container as they are much more expensive to dispose of.

NEVER POUR WASTE DOWN THE SINK

Acid waste is disposed of in the Acid Waste Drum or Bottle that is kept in the *right* hand cupboard under the fume hood in 0227.

Organic waste (non-chlorinated) is collected in the bottle so marked in the *left* hand cupboard under the hood.

We have a separate container for waste acetone held in the same cupboard as the organic waste.

When any of the waste containers are approaching full please arrange for them to be collected by the DES – details of how to do this can be found on their website at: http://www.inform.umd.edu/des/. This will require you to learn something about waste and involve taking a short test – it is well worth doing this exercise. If you will not or cannot do this simple test then please inform Richard Ash that the waste containers are getting full.

Liquid argon:

The plasma instruments use an argon plasma to ionise the sample material. The argon is stored in two liquid argon tanks, each with a back-up of two compressed argon cylinders. These are all kept in the cupboard in the corridor outside 0227. Please keep an eye on the

argon levels in the tanks at the beginning and end of the day. If liquid levels are low please tell either Bill McDonough or Richard Ash, we will order a new tank (which will arrive the next day) and, when it arrives, we will swap with the empty one. If, for your education, you wish to find out more about this procedure please see Richard Ash. DO NOT TRY TO DEAL WITH THESE TANKS IF YOU HAVE NOT BEEN TRAINED TO DO SO. The tanks are heavy and liquid argon can cause severe cold burns.

Changing Gas Cylinders:

We use compressed gases for a variety of purposes – 1) Ar as back up for the liquid argon tanks, 2) He as the gas for laser ablation 3) nitrogen for the Aridus spray chamber.

When changing a gas cylinder remember that there may be residual pressure in the space above the cylinder and in the line.

Close the valve on the top of the cylinder. Close the valve to the line. Undo the nut between the regulator and the cylinder. Just crack this open and let any gas escape. Undo the nut and carefully rest the regulator somewhere safe – make sure you do not damage the rounded end of the brass fitting that attaches to the cylinder – this is where the seal is made to prevent gas escaping.

Once the regulator is removed immediately attach the metal screw top to the cylinder NEVER move a cylinder without a top securely attached. Move the new cylinder to the correct place, fasten it with the belt and chain then take off the top and attach the regulator. Make sure you do not cross the threads. Once the regulator is securely fasten crack open the top of the cylinder valve then shut is – use the soap/water mix to check for leaks (squeeze a small amount of the soap mix onto the regulator/cylinder join – if bubbles appear there is a leak). If you have a leak then you may need to repeat the process (be careful as there will be a high gas pressure in this volume) but put a little Teflon tape onto the screw thread and try again.

The use of Dust Off™:

Dust Off™ is compressed air that we use to remove surficial dust from samples, cones, electronics *etc*. Follow the instructions on the can. Do not hold the can upside down when spraying and do not spray continuously for a long period of time. Both of these can lead to freezing.

5. MASS SPECTROMETRY (0225)

Mass Spectrometer – General

DO NOT TRY TO OPEN THE COVERS WHILST THE INSTRUMENT IS RUNNING. There is no reason to take any part of the mass spectrometer to pieces, or to open any of the covers. Interlocked safety switches should automatically shut down the instrument if you do this. If the interlock safety switches do not function there is a danger of electrocution, UV irradiation and burning.

With the exception of the torch and the cones there are no part of either instrument that require your attention and it is easy to damage yourself and/or the instrument if you start messing with things you do not understand. If you have a problem talk to Richard Ash or Bill McDonough about it – do not try to fix it yourself.

Mass spectrometer – gases

In both laser ablation and some solution modes both instruments require the use of additional gases (N_2 or He). These gases are supplied by tanks in 0227. Turn the valve at the top of the tank anti-clockwise to open and the small knob after the regulator to allow gas into the instrument. You should not have to adjust the regulator. At the end of the day shut off the valve on the top of the tank and the small black knob valve. It is important not to leave these open when not in use.

Running the mass spectrometer – solutions.

When running solutions you should use nitrile gloves – both to preserve you skin form the acid and the cleanliness of your samples. Do not pick up the autosampler sampling straw with your fingers as you will contaminate your sample.

Running the mass spectrometer – laser.

The lasers should only be run by trained personnel. If you wish to use the laser please ask Bill McDonough or Richard Ash.

UP 213. Whilst the lid is on theUP213 laser system it is a Class I laser – this means that the beam is entirely enclosed and the system is safe. UNDER NO CIRCUMSTANCES SHOULD YOU REMOVE THE TOP OF THE LASER. If the top is removed the laser is a class IV product and can cause severe burns and blindness, and possible death. If you have trouble with the laser do not try to fix it yourself – find Bill McDonough or Richard Ash and tell them about it. There are no parts in here that you can fix.

The excimer laser has three gas tanks attached to the cart. These contain premix gas (a mixture of He, Ne, Ar and 0.17 %F_2) the second tank contains helium, the third nitrogen. When changing the fill in the excimer it must be pumped out through the special pump on the excimer as this contains a filter that neutralizes the F_2 in the premix. Never try to open any of the lines or laser cavity without first pumping out the system and filling with He. The inhalation of F_2 is extremely dangerous.

Dr Richard Ash

Laboratory Manager

Room 0227b

last updated: 3rd February 2005

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Appendix IV

Chemical Inventory

and

Material Safety Data

(to be supplied by Laboratory Supervisor)

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