MPG 1840.3
BASELINE
EFFECTIVE DATE: December 20, 1999
EXPIRATION DATE: December 20, 2004

MARSHALL PROCEDURES AND GUIDELINES

AD01

MSFC HAZARDOUS CHEMICALS IN LABORATORIES PROTECTION PROGRAM

DOCUMENT HISTORY LOG

Status (Baseline/ Revision/ Canceled)	Document Revision	Effective Date	Description
Revision	A	12/20/99	History log added with this revision; previous history contained in Directives Manager's Reference File. Updated format from MM to MPG and changed ownership from CO01 to AD01.

TABLE OF CONTENTS

PREFACE

P.1 PURPOSE

To establish the Marshall Space Flight Center (MSFC) Hazardous Chemicals in Laboratories Protection Program (also referred to as the Chemical Hygiene Standard (CHS)) in compliance with Occupational Safety and Health Administration (OSHA) standards.

P.2 APPLICABILITY

This Directive is applicable at all MSFC facilities.

P.3 AUTHORITY

a. OSHA Standard 29 CFR 1910.1450, January 1, 1990

b. NHS/IH-1845.5, “NASA Health Standard on Occupational Exposure to Hazardous Chemicals in Laboratories”

P.4 APPLICABLE DOCUMENTS

a. NPD 8715.1, “Safety and Health Handbook - Occupational Safety and Health Programs”

b. MPD 1840.3, “MSFC Respiratory Protection Program”

c. MPG 1810.1, “MSFC Occupational Medicine”

P.5 REFERENCES

None

P.6 CANCELLATION

MM 1845.2 dated December 9, 1991

Original Signed by
Sidney P. Saucier for

A. G. Stephenson
Director

DOCUMENT CONTENT

1. DEFINITIONS

1.1 Chemical Hygiene Officer. 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 (CHP).

1.2 Chemical Hygiene Plan (CHP). A written plan developed and carried out by MSFC laboratory facilities to ensure the protection of employees from the effects of hazardous chemicals. The Plan will set forth procedures, laboratory and control equipment, personal protective gear, and work practices that are capable of providing this protection.

1.3 Hazardous Chemical. 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. These include chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on hematopoietic system, and agents which damage the lungs, skin, eyes, or mucous membranes; also, chemicals for which there is scientifically valid evidence that they are: a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable (reactive), or water-reactive.

1.4 Laboratory. Any facility (large or small) where the handling/use of hazardous chemicals is accomplished in containers (used for reactions, transfer, etc.) designed to be easily and safely manipulated by one person. It is a work place where relatively small quantities of hazardous chemicals are used on a non-production basis.

2. RESPONSIBILITIES

2.1 The Center Director or his/her designee is responsible for:

2.1.1 Having ultimate accountability for chemical hygiene at MSFC and providing continuing support for the Chemical Hygiene Program; and

2.1.2 Ensuring the availability of resources necessary for the establishment, execution, and maintenance of the Chemical Hygiene Program.

2.2 Manager, Management Support Office, Center Operations Directorate, is responsible for:

2.2.1 Establishing a training curriculum to ensure Centerwide compliance with this Directive and OSHA Standard 1910.1450 (Appendix);

2.2.2 Assuring medical consultations/examinations are handled in accordance with this Directive;

2.2.3 Establishing and maintaining an accurate record of any measurements taken to monitor employees' exposures and any medical consultations and examinations including tests or written opinions required by OSHA Standard 1910.1450;

2.2.4 Providing oversight and serving in an advisory capacity to all Center organizations in establishing a CHP as defined in this Directive; and

2.2.5 Recommending, as feasible, permissible exposure levels for hazardous chemicals for which there are no established standards.

2.3 Directors/Managers/Team Leads/Supervisors are responsible for:

2.3.1 Developing and implementing a CHP for each applicable laboratory facility within their organization.

2.3.2 Designating a Chemical Hygiene Officer for each applicable laboratory facility within their organization.

2.3.3 Ensuring that appropriate employees attend all training classes as necessary to meet the requirements of this Directive.

2.3.4 Ensuring employees comply with the provisions of the CHP.

2.3.5 Ensuring appropriate personal protective and emergency equipment is available, used as required, maintained in good working order, and applicable training provided.

2.3.6 Knowing the current legal requirements concerning regulated substances.

2.3.7 Ensuring the facilities and training for use of any material are adequate.

2.3.8 Ensuring Material Safety Data Sheets (MSDS) used within the laboratory are readily accessible to the employees.

2.3.9 Conducting regular, formal chemical hygiene and housekeeping inspections including routine inspections of emergency equipment.

2.4 Manager, Environmental Engineering Department, Center Operations Directorate, is responsible for ensuring proper accumulation, removal, and disposal of chemical waste.

2.5 Chemical Hygiene Officer(s) is responsible for:

2.5.1 Working with appropriate managers, team leads, supervisors, employees, etc., to develop and implement the overall Chemical Hygiene Program including the CHP and procedures pertaining thereto;

2.5.2 Remaining current on the potential hazards associated with the use of laboratory chemicals, both regulated and non-regulated;

2.5.3 Reviewing proposed laboratory uses of highly toxic, carcinogenic, genotoxic, etc., chemicals and the proposed precautions used to protect employees, including specific designated work areas;

2.5.4 Providing for annual review of the CHP and ensuring that modifications are made as necessary;

2.5.5 Ensuring that exposure assessments are conducted if there is reason to believe that exposure levels to a chemical substance could routinely exceed the action level (or permissible exposure limt/threshold limit value (PEL/TLV) in the absence of an action level);

2.5.6 Ensuring that technical advice is available on exposure assessment; possible by-products of reactions; containment, decontamination, neutralization procedures, alternative procedures or less hazardous substitutes; etc.;

2.5.7 Ensuring that monitoring is conducted to evaluate the proper functioning of fume hoods and other engineering controls, and that prompt repairs are made as needed;

2.5.8 Ensuring that MSDS for all laboratory chemicals are included in the central MSDS file for the work-site; also ensuring that reference books and data bases containing information about potential health hazards, safe handling procedures, chemical storage, and emergency response to fire or releases of chemicals stored or used in the laboratory are maintained;

2.5.9 Ensuring that a complete and up-to-date inventory of all hazardous laboratory chemicals used within their responsible area is maintained;

2.5.10 Ensuring that sufficient coordination is employed so that regulatory requirements relating to procurement, storage, use, collection, transportation, and disposal of chemicals used in laboratories are followed;

2.5.11 Ensuring that employees are notified of any overexposures indicated by exposure assessments;

2.5.12 Ensuring that all employee complaints relative to health hazards in the laboratory are investigated and reviewed;

2.5.13 Providing an updated copy of the laboratory CHP to the Medical Center each year for review and retention; and

2.5.14 Maintaining adequate documentation of all accomplished training for laboratory personnel.

2.6 Laboratory Employees are responsible for:

2.6.1 Attending required training courses to ensure they are knowledgeable of all requirements for protecting themselves in a chemical laboratory environment;

2.6.2 Conducting each laboratory operation in accordance with the CHP (e.g., following established work practices and procedures, wearing appropriate protective equipment and clothing, etc.);

2.6.3 Developing, maintaining, and practicing good personal chemical hygiene while working with chemicals; and

2.6.4 Reporting all ill effects experienced, or conditions/ operations observed relating to chemical use which they feel may have an adverse affect on their health or well-being.

2.7 Contracting Officers are responsible for ensuring this Directive is incorporated into contracts governing all operations at MSFC and component installations so that actions may be taken that are consistent with the intent and provisions of this Directive.

3. PROCEDURE

Chapters 1 through 7 provide guidelines which are intended to be used as a boilerplate for the laboratory chemical hygiene plan. Pages are provided at the end of each chapter for laboratories to insert specific documents or instructions.

4. RECORDS

None

5. FLOW DIAGRAM

None

CHAPTER 1

GENERAL REQUIREMENTS

1.1 Each laboratory facility shall prepare and have readily available a CHP (see Chapter 2). The CHP will be reviewed annually by the Chemical Hygiene Officer and updated as necessary. The CHP must, as a minimum, include:

1.1.1 Standard Operating Procedures relevant to protecting the employee's safety and health;

1.1.2 Criteria for control measures employed in the laboratory to reduce employee exposure; i.e., engineering controls, personal protective equipment, hygiene practices;

1.1.3 Specific measures to ensure proper fume hood and other protective equipment function;

1.1.4 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);

1.1.5 Designation of personnel responsible for implementation of the CHP, including the Chemical Hygiene Officer; and

1.1.6 Provisions for appropriate medical consultations/ examinations.

1.2 Adequate instructional detail to educate the employees so they can actively work to protect themselves will be provided. This should be performed by the CHO or supervisor and accomplished at the time of an employee's initial assignment to a work area where hazardous chemicals are present and prior to assignments involving exposure to new chemicals or processes. All training accomplishments must be documented. The information/training required includes:

1.2.1 The contents of the CHP and associated OSHA standards;

1.2.2 The location and availability of the CHP and various reference material on the hazards, safe handling, storage, and disposal of hazardous chemicals including, but not limited to, MSDS;

1.2.3 The Permissible Exposure Limits (PEL) or Threshold Limit Values (TLV) for regulated substances per OSHA, ACGIH, NIOSH, or recommended exposure limits for other hazardous chemicals where there is no other applicable standard;

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

1.2.5 Methods and observations that may be used to detect/monitor the presence or release of a hazardous chemical;

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

1.2.7 Protective measures available to guard against exposure, including written procedures.

1.3 Medical Consultation and Medical Examinations

1.3.1 An opportunity to receive medical attention will be provided for all employees who work with hazardous chemicals.

1.3.2 The following conditions will apply to the provision of medical attention:

1.3.2.1 When an employee develops signs and/or symptoms associated with a chemical to which the employee may have been exposed;

1.3.2.2 Where exposure monitoring reveals an exposure level routinely above the action level or PEL prescribed by a particular standard for which there are exposure monitoring and medical surveillance requirements; or

1.3.2.3 Following an event such as a spill, leak, explosion, or other occurrence which may have resulted in a hazardous exposure, medical consultation will be made available to the employee.

1.3.3 All medical examinations and consultations shall be performed by or under the direct supervision of a licensed physician and shall be provided without cost to the employee, without loss of pay, and at a reasonable time and place (normally at the MSFC Medical Center or on-site contractors' company physicians' office).

1.3.4 Information provided to the physician shall include:

1.3.4.1 Identity of the hazardous chemical(s);

1.3.4.2 Description of conditions under which the exposure occurred including quantitative data;

1.3.4.3 Description of the signs and symptoms of exposure experienced by the employee;

1.3.5 The MSFC Medical Center shall prepare/obtain a written opinion from the examining physician which shall include:

1.3.5.1 Recommendations for medical follow-up;

1.3.5.2 Results of examination and associated tests;

1.3.5.3 Any medical condition which may be revealed during the examination which may place the employee at increased risk resulting from exposure;

1.3.5.4 A statement that the employee has been informed by the physician of the results of the examination, consultation, and any medical condition; and

1.3.5.5 A written opinion which shall not reveal specific findings of diagnoses unrelated to occupational exposure.

CHAPTER 2

GUIDELINES FOR PREPARING A CHEMICAL HYGIENE PLAN

2.1 Introduction

The “Occupational Exposures to Hazardous Chemicals in Laboratories” Standard, published by OSHA on January 31, 1990, requires the development and implementation of a written CHP. This Directive is designed to be a tool for the Chemical Hygiene Officer to use in the development of the plan for his/her area of responsibility. The CHP must be a written plan which is readily available to employees, their representatives, and, if necessary, representatives of OSHA. The CHP establishes two broad performance goals:

2.1.2 The information provided in the CHP must be sufficient to support establishment of procedures “capable of protecting employees from health hazards associated with hazardous chemicals in that laboratory.”

2.1.3 The information provided in the CHP must be sufficient to support establishment of procedures “capable of keeping exposures below...PEL.” For laboratory uses of OSHA-regulated substances, the employer shall ensure that laboratory employees' exposures to such substances do not exceed the PEL specified in 29 CFR 1910, Subpart Z.

Laboratories vary widely in mission and structure. It is impossible to design a set of rules that will cover all possible hazards and occurrences. Some general guidelines are given in this Directive that experience has shown to be useful for avoiding accidents or reducing injuries in the laboratory. However, to make this an effective plan, specific information and procedures must be added that will apply to the facility where it is being used. This directive must be a “living” document. It must be completed based on the best current knowledge and information, and be continually re-evaluated and updated as experience increases knowledge.

2.2 Chemical Hygiene Responsibilities

For the implementation of the CHP, each laboratory must designate specific personnel responsible for the plan including a Chemical Hygiene Officer, and, if appropriate, a chemical hygiene

committee.

2.3 The Chemical Hygiene Officer

2.3.1 The person selected by the laboratory as the Chemical Hygiene Officer has primary responsibility for the CHP. The Chemical Hygiene Officer must be qualified by training or experience to provide guidance in the development and implementation of the provisions of the CHP, and must have authority to enforce and administer the requirements of the plan.

2.3.2 The Chemical Hygiene Officer's responsibilities are defined in paragraph 2.5 under RESPONSIBILITIES of this Directive.

2.3.3 Chemical hygiene requires a coordinated effort on the part of all personnel. The following are some of the areas of responsibility that should be assigned to specific personnel, either to be performed by, or under the supervision of, the Chemical Hygiene Officer (expertise available outside the laboratory should be called on as appropriate):

2.3.3.1 Determine when exposure monitoring is necessary or appropriate;

2.3.3.2 Perform exposure monitoring;

2.3.3.3 Provide technical assistance in complying with the CHP;

2.3.3.4 Assist project directors to develop safety precautions for new projects and procedures;

2.3.3.5 Monitor procurement of chemicals;

2.3.3.6 Monitor collection and disposal of chemical wastes;

2.3.3.7 Remain current on developing regulations and legal requirements regarding chemicals used in this facility;

2.3.3.8 Ensure that proper protective equipment is available as needed;

2.3.3.9 Ensure that protective and control equipment is functioning properly;

2.3.3.10 Perform regular chemical hygiene and housekeeping instruction;

2.3.3.11 Perform routine inspections of emergency equipment;

2.3.3.12 Maintain a file of MSDS;

2.3.3.13 Ensure that proper signs and labels are provided and used;

2.3.3.14 Monitor chemical inventory for chemicals that are particularly hazardous, including "select carcinogens;”

2.3.3.15 Determine when a complaint of possible over-exposure should be referred for medical consultation;

2.3.3.16 Determine when an "exposure assessment" is appropriate; and

2.3.3.17 Conduct "exposure assessments."

2.3.4 Every person in the laboratory is responsible for chemical hygiene, from the manager to the employee who conducts day-to-day operations in the laboratory.

2.3.5 The manager of the laboratory has ultimate responsibility for chemical hygiene within his/her organization and must, with other administrators, provide continuing support for chemical hygiene and safety. The manager must ensure that an effective safety program is in place and show an obvious and continuing interest in the safety program. The director, manager, team lead, and supervisors are responsible for chemical hygiene within their facility as defined in paragraph 2.3 under RESPONSIBILITIES of this Directive.

INSERT HERE:

SPECIFIC PERSONNEL ASSIGNMENTS

FOR CHEMICAL HYGIENE RESPONSIBILITY

IN THIS FACILITY

CHAPTER 3

GUIDELINES FOR PREPARING STANDARD OPERATING PROCEDURES

3.1 While it is impossible to design a set of rules and procedures that will cover every possible hazard or situation, this section of the plan lists guidelines for preparing standard operating procedures for good chemical hygiene under most circumstances. These procedures cover the following areas:

3.1.1 General Principles

3.1.2 General Procedures for Work With Laboratory Chemicals

3.1.3 Planning

3.1.4 Unattended Operations

3.1.5 Use of a Hood

3.1.6 Waste Disposal

3.1.7 Distribution and Storage

3.1.8 Signs and Labels

3.1.9 Spills and Accidents

3.1.10 Housekeeping, Maintenance, and Inspections

3.1.11 Specific Other Procedural Considerations for This Facility

3.2 General Principles

3.2.1 Minimize all Chemical Exposures

Almost all laboratory chemicals are hazardous in some way or degree. Instructional laboratories should teach students how to handle the materials and conduct routine operations with them safely. Personnel in research laboratories may be working with new chemicals or with biologically active materials whose hazards may be unknown. Even though minute samples and new observation methods are used, our increased understanding of environmental and health problems must be reflected in improved and safe working conditions in laboratories.

3.2.2 The hazards of handling chemicals may be classified as physical or chemical.

3.2.2.1 Physical hazards include fire, explosion, and electric shock. Other physical hazards arise from containment measures like compressed gas cylinders, cryogenic equipment, furnaces, refrigerators, and glass apparatus.

3.2.2.2 Chemical hazards are associated with their toxic effects and may be chronic or acute. Acute hazards produce prompt or only slightly delayed effect such as serious burns, inflammation, allergic responses or damage to the eyes, lungs or nervous system. Some chemicals require only small amounts to cause death or severe injury very quickly. Some chemicals such as chlorine or ammonia give considerable warning.

3.2.3 Chronic hazards show the toxicological effects after a long delay or after exposure over long periods of time. These effects may involve cumulative damage to many different organs or parts of the body. Some can be reversed by the elimination of exposure to the chemical but some are irreversible, especially after there has been much damage. Carcinogenic effects are usually chronic effects.

3.2.4 Many people who are not involved in laboratory operations may be exposed to chemical hazards: handling chemicals on the loading dock, in storerooms, stockrooms, transporting them, and disposing of them. These people must be warned to take actions to protect themselves from such hazards and what to do in case of an emergency.

3.2.5 Always use common sense, good judgment, professional expertise, and safety awareness when it comes to hazardous chemicals.

3.2.6 Always avoid skin contact with chemicals.

3.2.7 Prevent quantities of chemical vapors or dust that might produce adverse toxic effects from entering the general laboratory atmosphere.

3.3 Do not underestimate risk.

3.3.1 When dealing with chemicals, even if substances have no known significant hazards, always observe good laboratory practice, minimize exposure by working in an exhaust hood, and

wearing eye and hand protection and a laboratory coat or apron. If substances have special hazards, take special precautions. Consult any appropriate regulations to be advised of the necessary approvals, training, working conditions, monitoring, recordkeeping, and medical surveillance that might apply.

3.3.2 Always assume that any mixture will be more toxic than its most toxic component and that all substances of unknown toxicity are toxic.

3.3.3 It is important for all laboratory workers to understand the types of toxicity, know the routes of exposure, and recognize the major classes of toxic and corrosive chemicals.

3.3.4 Chemical reactions involving two or more substances may form reaction products that are significantly more toxic than the starting reactants.

3.3.5 All new and untested chemicals should be treated as though they are toxic until proven otherwise. Since chemical research is often concerned with new molecular structures, laboratory workers should try to anticipate the toxicity, acute or chronic, of a new substance. This is an important part of planning all research involving new chemicals.

3.4 Maintain 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. Indiscriminate release of chemicals in the work area should be avoided. Operations such as running reactions, heating or evaporating solvents, and the transfer of chemicals from one container to another should normally be performed in a hood. Especially toxic or corrosive exit gases should be passed through scrubbers or adsorption trains. Toxic substances must be stored in cabinets fitted with auxiliary local ventilation. Laboratory apparatus that may discharge toxic vapors must be vented to an auxiliary local exhaust system. If auxiliary local ventilation is not practical during measurement or storage, samples should be kept in closed containers.

3.5 Institute a Chemical Hygiene Program

A Chemical Hygiene Plan must be designed to minimize exposures. It must be a regular, on-going effort, not a standby or short-term activity. The program recommendations should be followed by

students as well as laboratory workers. Everyone must learn to work with, and to accept the responsibility for, the appropriate use of hazardous substances. The worker must learn to think about possible hazards and seek information and advice before starting any experiment or procedure.

3.6 Observance of Limits and Values

Control measures should be designed and utilized to prevent exposures exceeding OSHA PEL’s and/or American Conference of Government Industrial Hygienists TLV’s.

3.7 General Procedures for Work with Laboratory Chemicals

3.7.1 Laboratory workers must know and follow the rules and procedures in the CHP and these general rules:

3.7.1.1 Always be alert to unsafe conditions and actions. Make sure they are corrected immediately. Someone else's accident can be as dangerous to you as any you might have.

3.7.1.2 Think, act, and encourage safety so it becomes a habit.

3.8 Avoid Routine Exposure

3.8.1 Develop safe habits. Avoid unnecessary exposure to chemicals by any route. Do not taste or smell chemicals. Do not use mouth suction to pipet chemicals or to start a siphon. A pipet bulb or an aspirator should be used to create a vacuum. Vent apparatus that may discharge toxic chemicals into local exhaust devices.

3.8.2 Inspect gloves carefully before each use for discoloration, puncture, and tears. Glove materials will eventually be permeated by chemicals. Discard them correctly when they become contaminated. Never use damaged gloves. Use the correct type of glove for the specific exposure.

3.8.3 Test glove boxes for leaks and adequate airflow before each use.

3.8.4 Do not allow release of toxic substances within the work environment. Use appropriate methods of exhaust ventilation.

3.8.5 Avoid practical jokes or other behavior which might confuse, startle, or distract another worker. Practical jokes or horseplay cannot be tolerated at any time in the laboratory.

3.8.6 Avoid working alone in a building or laboratory if the procedures being conducted are hazardous. Arrangements can be made between individuals working in separate laboratories to crosscheck periodically. Experiments potentially hazardous or known to be hazardous should not be done by a worker who is alone in the laboratory.

3.8.7 Unusual conditions may require special rules. The supervisor of the laboratory has the responsibility for determining whether the work requires special safety precautions.

3.9 Planning

Safety is everyone's responsibility. Know the safety rules and procedures that apply to the work being done. Determine the potential hazards (physical, chemical, biological) and appropriate safety precautions before beginning any new operation. Get information and advice about hazards, plan appropriate protective procedures, and plan the positions of equipment before starting any new operation.

3.10 Unattended Operations

Leave the lights on and place an appropriate sign on the door. Take the proper precautions for containment of toxic substances in case a utility service such as cooling water should fail during an unattended operation.

3.11 Glassware

3.11.1 Use equipment only for its designed purpose. Handle and store laboratory glassware with care to avoid damage or breakage. Use extra care with Dewar flasks and other evacuated glass apparatus. Shield or wrap them to contain chemicals and fragments should implosion occur. Repair or discard any damaged items. Use adequate hand protection when inserting glass tubing into rubber stoppers or corks or when placing rubber tubing on glass hose connections.

3.11.2 Proper instruction should be given in the use of glass equipment designed for specialized tasks that may present unusual risks for the first time user.

3.11.3 Position and clamp reaction apparatus thoughtfully to permit manipulation without the need to move the apparatus until the entire reaction is completed. Combine reagents in

appropriate order and avoid adding solids to hot liquids.

3.12 Personal Hygiene

3.12.1 Do not eat, drink, smoke, chew gum, or apply cosmetics where chemicals are present. Wash hands before doing any of these activities. Wash hands before using sanitary facilities after being in areas where chemicals are used or stored. Wash hands and arms immediately after using any toxic substance. Wash well before leaving the laboratory area. Do not use solvents on the skin. They can cause irritation and inflammation.

3.12.2 Do not store food or beverages in laboratory refrigerators. Do not handle or eat any food or beverages in chemical storage areas. Do not use glassware or utensils which are used in laboratory operations.

3.13 Personal Apparel

3.13.1 Confine long hair and loose clothing. Do not wear loose (dangling neckties, too-large lab coats, etc.), skimpy (shorts, halter tops), or torn clothing. Loose or torn clothing could get caught in apparatus or moving machinery. Skimpy clothing offers little protection if there is a chemical splash.

3.13.2 Tuck away or remove loose or dangling jewelry. Rings may react with chemicals and also should be removed when working around equipment with moving parts.

3.13.3 Sandals, perforated shoes, or cloth sneakers should not be worn in laboratories or when handling chemicals.

3.14 Personal Housekeeping

3.14.1 Keep the work area clean and uncluttered. Properly label and properly store all chemicals and equipment. Clean up the work area at the end of an operation or at the end of each day. Spilled chemicals should be cleaned up immediately and disposed of properly (turned in to Environmental Engineering Department).

3.14.2 Unlabeled containers and chemical wastes should be promptly turned in to Environmental Engineering Department for proper disposal.

3.14.3 Equipment and chemicals should be stored properly. The laboratory is no place for clutter.

3.15 Personal Protection

3.15.1 Personnel must know the types of protective equipment available and use the proper type for each job. Everyone, including visitors, must wear the appropriate eye protection where chemicals are stored or handled.

3.15.2 Never enter a laboratory without appropriate eye protection. Use protective clothing, face shields, gloves, and other special clothing or footwear as needed.

3.15.3 If there is significant contamination, remove laboratory coats or other protective apparel immediately.

3.15.4 Wear appropriate gloves when the potential for contact with toxic materials exists. Inspect the gloves before each use and wash them before taking them off. Replace them periodically.

3.15.5 Use appropriate respiratory equipment when air contaminant concentrations are not sufficiently restricted by engineering controls. Inspect the respirator before use.

3.15.6 Specific requirements for selection and use of respiratory protection must be listed in the laboratory's written respirator program. Personnel must be properly trained before using any respiratory equipment.

3.15.7 Personnel must know the location and how to use the emergency equipment in their area, as well as how to obtain additional help in an emergency. They must be familiar with emergency procedures.

3.15.8 Do not use contact lenses in the laboratory unless necessary. If they are worn, inform the supervisor so special precautions can be taken.

3.15.9 Contact the Medical Center for recommendations regarding appropriate types of personal protection equipment.

3.16 Use of a Hood

3.16.1 Use the hood for operations which might result in the release of toxic chemical vapors or dust. A hood should be considered as a backup safety device to contain and exhaust toxic, offensive, or flammable materials. It is not a method for disposing of chemicals. Apparatus used in hoods should be fitted with condensers, traps, or scrubbers, to contain and collect

waste solvents or toxic vapors or dusts.

3.16.2 A hood should be evaluated before use to ensure adequate face velocities, usually 75-150 feet per minute (fpm). As a general rule, use a hood or other local ventilation device when working with any volatile substance with a TLV of less than 50 parts per million (ppm). There should be no excessive turbulence. A continuous monitoring device will confirm hood performance. If the performance of the hood is inadequate for the operation or chemicals involved, do not use it.

3.16.3 Keep a hood closed, vertical sashes down, and horizontal sashes closed, except for adjustments. A small face opening of the hood improves its overall performance.

3.16.4 The airflow pattern and the performance of a hood depends on such factors as the placement of equipment in the hood, room drafts from open doors and windows, persons walking by, and the presence of the user in front of the hood.

3.16.5 Chemicals should not be stored in hoods or on benches.

3.16.6 Solid objects and materials such as paper should not enter exhaust ducts.

3.16.7 An emergency plan should be prepared in case of ventilation failure or other unexpected occurrences such as fire or explosion in the hood.

3.16.8 Energy can be conserved by turning off hoods when not in use if it is confirmed there is adequate general laboratory ventilation and if toxic substances are not stored in the hood.

3.17 Waste Disposal

3.17.1 Proper disposal of waste or used substances is everyone's responsibility. Methods of disposal may vary from lab to lab depending on the waste chemicals involved. Contact Environmental Engineering Department for recommendations/regulations regarding appropriate waste disposal.

3.17.2 The waste disposal program (in accordance with MSFC waste disposal guidelines) should specify how waste is to be collected, segregated, and stored.

3.17.3 Be sure the layout for each laboratory operation includes plans and training for waste disposal (training provided by

Environmental Engineering Department). Avoid hazards to the environment by following MSFC waste disposal guidelines. Chemical reactions may require traps or scrubbing devices to prevent the escape of toxic substances.

3.17.4 Deposit chemical waste in approved, correctly labeled receptacles and follow MSFC acceptable waste disposal guidelines.

3.17.5 Unlabeled containers of chemicals and solutions should undergo prompt disposal; if partially used, they should not be opened. Before a worker's daily activities in the laboratory end, chemicals for which that person was responsible should be discarded or returned to storage.

3.17.6 Indiscriminate disposal by pouring waste chemicals down the drain or adding them to mixed refuse for landfill burial is unacceptable. Hoods should not be used as a means of disposal for volatile chemicals.

3.17.7 If an experiment creates new disposal considerations, they should be discussed with the laboratory supervisor and Environmental Engineering Department personnel.

3.18 Disposal of Solid Chemical Wastes

3.18.1 There should be procedures for the collection of solid wastes from the laboratories and proper disposal by the Center. Responsibilities for disposal should be clearly defined as well as the laboratory workers' responsibilities to identify hazards in handling and disposal.

3.18.2 Solid chemical wastes should be placed in properly labeled containers. If bottles are used, they should be placed in buckets.

3.18.3 Incompatible materials should be segregated.

3.18.4 Check with the supervisor, Environmental Engineering Department, or Chemical Hygiene Officer about local, State, and Federal regulations about waste disposal.

3.19 Disposal of Liquid Chemical Wastes

3.19.1 There should be procedures for the collection of liquid wastes from the laboratories and proper disposal by the Center. Responsibilities for disposal should be clearly defined as well as the laboratory workers' responsibilities to identify hazards

in handling and disposal.

3.19.2 Suitable containers should be used. Containers must be properly labeled to identify what may and may not be put in them.

3.19.3 Waste solvents, free of solids and corrosive or reactive substances, may be collected in a common bottle or can. It is essential to determine what substances are compatible and to identify the materials that may be put in a particular bottle or can. Some solvents can form explosive peroxides on standing. It is vital that this determination be made correctly and waste disposal practices be followed exactly.

3.19.4 When large quantities are involved, consider recycling.

3.19.5 Check with the supervisor, Environmental Engineering Department Waste Disposal personnel, or Chemical Hygiene Officer about local, State, and Federal regulations regarding waste disposal.

3.20 Disposal of Especially Hazardous Wastes

3.20.1 This category includes very toxic substances, strong carcinogens, mutagens, nerve gases, explosives, and substances in tanks and other sealed containers.

3.20.2 The laboratory worker must make the proper arrangements for disposal of these materials.

3.20.3 When possible, laboratory procedures should be used to produce less hazardous substances.

3.20.4 Check with the supervisor, Environmental Engineering Department Waste Disposal personnel, or Chemical Hygiene Officer about local, State, and Federal regulations about waste disposal.

3.21 Stockrooms/Storerooms

3.21.1 Toxic substances should be segregated in a well-identified area with local exhaust ventilation. Toxic substances should be segregated from other substances and stored in a well-identified area that is cool, well-ventilated, and away from light, heat, acids, oxidizing agents, moisture, etc.

3.21.2 Chemicals which are highly toxic or other chemicals whose containers have been opened should be in unbreakable secondary containers.

3.21.3 Stored chemicals should be examined periodically (at least annually) for replacement, deterioration, and container integrity. This examination should be documented.

3.21.4 Stockrooms/storerooms should not be used as preparation or repackaging areas.

3.21.5 Stockrooms/storerooms should be open during normal working hours and should be controlled by one person.

3.22 Distribution

3.22.1 When chemicals are handcarried, the container should be placed in an outside container or acid-carrying bucket to protect against breakage and spillage.

3.22.2 If a wheeled cart is used, it should be stable under the load and have wheels that are large enough to handle uneven surfaces without tipping over or stopping suddenly.

3.22.3 Freight-only elevators should be used if possible to prevent exposure to people on passenger elevators.

3.22.4 If small quantities of flammable liquids must be moved, use rugged pressure-resistant, non-venting containers, store during transport in a well-ventilated vehicle, and eliminate potential ignition sources.

3.23 Laboratory Storage

3.23.1 The amounts permitted in storage should be as small as practical. Decisions about amounts should be based on the level of competence of the workers, the level of safety features designed into the facility, the location of the laboratory, the nature of the chemical operations, and the accessibility of central supply.

3.23.2 Every chemical in the laboratory should have a definite storage place and should be returned to that location after each use.

3.23.3 Chemicals should not be stored on bench tops or in hoods.

3.23.4 Storage trays or secondary containers should be used to minimize the distribution of material should a container break or leak.

3.23.5 Flammable liquids should not be stored in laboratory refrigerators unless the unit is an approved, explosion-proof or laboratory-safe type.

3.23.6 All containers in a laboratory refrigerator must be labeled in accordance with the OSHA Hazard Communication Standard (1910.1200), including identification of the contents, owner, date of acquisition or preparation, and nature of any potential hazards.

3.23.7 Avoid exposure to heat or direct sunlight.

3.23.8 Periodic inventories should be conducted. Obsolete or unneeded items should be properly discarded or turned in for proper disposal.

3.24 Signs and Labels

3.24.1 Be certain all chemicals are correctly and clearly labeled. Generic labels may be obtained from sub-stores.

3.24.2 Laboratory areas that have special or unusual hazards should be posted with warning signs. These hazards may be radiation, x-ray, laser operations, flammable materials, biological hazards, or other special situations.

3.24.3 Post prominent signs and labels such as:

3.24.4 Emergency telephone numbers of emergency personnel/facilities in the event of fire, accident, flood, or hazardous chemical spill.

3.24.5 Telephone numbers for supervisors and laboratory workers to be contacted in the event of an accident or emergency.

3.24.6 Identity labels showing contents of containers (including waste receptacles) and associated hazards.

3.24.7 Location signs for safety showers, eyewash stations, other safety and first aid equipment, and exits.

3.24.8 Areas where food and beverage may be consumed and stored.

3.25 Spills and Accidents

3.25.1 A written emergency plan should be established and

communicated to all personnel (MPG 1040.3). It should include procedures for ventilation failure, evacuation, medical care, reporting, and drills. Frequent drills and simulated emergencies should be held.

3.25.2 There should be an alarm system to alert people in all parts of the facility, including isolated areas such as cold rooms. Personnel should be familiar with the location and operation of the alarms.

3.25.3 Evacuation routes and alternatives should be identified and an outside assembly area or areas should be designated. All personnel should be adequately trained in the proper procedures.

3.25.4 Brief guidelines for shutting down operations during an emergency or evacuation should be developed and communicated to all personnel.

3.25.5 Return and start-up procedures for critical operations should be established and reviewed often.

3.25.6 A spill control policy should be developed, including prevention, containment, cleanup, and reporting in accordance with MPG 1040.3.

3.25.7 Prevention measures should include consideration of storage, operating procedures, monitoring, inspection, and personnel training.

3.25.8 Containment measures should include consideration of engineering controls on storage facilities and equipment.

3.25.9 Cleanup practices should include countermeasures and training of designated personnel to help reduce the impact of a chemical spill.

3.25.10 All accidents and near accidents should be carefully analyzed with the results distributed to all who might benefit to help create a safe environment.

3.26 Housekeeping, Maintenance, and Inspections

3.26.1 Work areas should be kept clean and free from obstructions. Cleanup should be done at the end of an operation or at the end of each day.

3.26.2 Wastes should be deposited in approved accumulation

containers supplied by Environmental Engineering Department.

3.26.3 Spills should be cleaned up immediately and reported to the Environmental Engineering Department.

3.26.4 Unlabeled containers and chemical wastes should be promptly turned in to the Environmental Engineering Department.

3.26.5 Floors should be cleaned regularly.

3.26.6 Stairways and hallways should not be used as storage areas even for a brief time.

3.26.7 Access to exits, emergency equipment, and utility controls must always be kept clear. They should never be blocked.

3.26.8 Equipment and chemicals must be properly stored.

3.26.9 Safety showers and eye wash fountains should be tested/inspected on a monthly basis. These inspections must be documented.

3.26.10 Respirators for routine use should be inspected periodically.

3.26.11 Other safety equipment should be inspected regularly, e.g., every 3-6 months.

3.26.12 Procedures to prevent restarting of out-of-service equipment should be established.

3.26.13 Formal housekeeping and chemical hygiene inspections should be held at least quarterly for areas which have frequent personnel changes and semiannually for others. Informal inspections should be done continually.

INSERT HERE

ANY SPECIFIC PROCEDURES THAT SHOULD BE INCORPORATED INTO

THIS FACILITY'S

STANDARD OPERATING PROCEDURES

(MPG 1040.3, "MSFC EMERGENCY PLAN" IS ONE SUGGESTION)

CHAPTER 4

GUIDELINES FOR CONTROL MEASURES

4.1 There are three general types of controls to be used:

4.1.1 Engineering Controls
4.1.2 Personal Protective Equipment and Apparel
4.1.3 Hygiene Practices

4.2 Engineering Controls

4.2.1 Engineering controls start with the general ventilation system. The general ventilation system should have air intakes and exhausts located so as to avoid intake of contaminated air. This system should provide a source of air for breathing and for input to local ventilation devices. It should not be relied on for protection from toxic substances released into the laboratory. The system should ensure that laboratory air is continually replaced, preventing increase of air concentrations of toxic substances during the work day, and direct air flow into the laboratory from non-laboratory areas and out to the exterior of the building. Thus, air pressure in the laboratory should always be negative with respect to the rest of the building. Also, air intakes for a laboratory building should be located in such a way that reduces the possibility that the input air will be contaminated by exhaust air.

4.2.2 The fume hood is the primary engineering control in the laboratory. Ideally, each hood should have a continuous monitoring device to allow convenient confirmation of adequate hood performance before use. If this is not possible, work with substances of unknown toxicity should be avoided or other types of local ventilation devices should be provided.

4.2.3 Other local ventilation devices include ventilated storage cabinets, canopy hoods, snorkels, etc. These should be provided as needed. Each canopy hood and snorkel should have a separate exhaust duct.

4.2.4 Some areas have special ventilation concerns. Exhaust air from glove boxes and isolation rooms should be passed through scrubbers or other treatment before release into the regular exhaust system. Cold rooms and warm rooms should have provisions for rapid escape and for escape in the event of electrical failure.

4.2.5 Any alteration of the ventilation system should be made only if thorough testing indicates that worker protection from airborne toxic substances will continue to be adequate.

4.3 Other Engineering Controls

4.3.1 Other engineering controls include special containers and storage equipment for substances with specific hazards.

4.3.2 Flammable and combustible liquids should be kept in safety cans designed for that purpose. Quantities greater than one liter should be stored in metal containers. Portable safety cans have a spring-loaded spout cover that can open to relieve internal pressure when subjected to a fire and will prevent leakage if tipped over. Some are equipped with a flame arrester in the spout that will prevent flame propagation into the can. Cans must be properly labeled to identify their contents.

4.3.3 Small quantities of flammable liquids should be stored in ventilated metal cabinets. Typical construction is a double-walled configuration of 18-gauge steel, having riveted and spot-welded seams. The door is 2 inches above the floor and the cabinet is liquid-tight at this point. It is provided with vapor-venting provisions and can be equipped with a sprinkler system. (Do not store materials that react with water in sprinkler-equipped cabinets.)

4.3.4 Materials that are corrosive must be stored in cabinets designed to hold them. Special care must be taken to separate acids from bases by distance or barrier.

4.3.5 Special precautions must be followed when handling chemicals that are defined as reactive, to prevent mixing with other chemicals except under controlled conditions. Storage for reactive chemicals must be segregated, personal protective equipment must be used, and other precautions followed.

4.3.6 All laboratories where chemicals are used should have available safety showers and eyewash stations.

4.3.7 Safety showers for immediate first aid treatment of chemical splashes and for extinguishing clothing fires should be provided in areas where chemicals are handled. Safety showers should have an emergency water supply and be tested routinely by laboratory personnel.

4.3.8 Eyewash fountains should provide a soft stream or spray of aerated water for an extended period (15 minutes). These fountains should be located near the safety showers so that, if necessary, the eyes can be washed while the body is showered.

4.4 Personal Safety Eyewear Protection

4.4.1 Personal protection starts with safety eyewear. Eye protection is required for all personnel, including visitors, where chemicals are stored or handled.

4.4.2 Contact lenses should not be used in the laboratory unless secondary protection is used, e.g. safety glasses with side shields.

4.4.3 The basic eye protection in the laboratory is safety glasses with side shields. These must have approved impact-resistant safety lenses. Ordinary prescription glasses or sunglasses do not give adequate protection.

4.4.4 The side shields offer some protection from objects that approach from the side, but do not provide adequate protection from splashes. Splash-proof goggles have sides that create a barrier against liquids. Goggles should be used if there is a significant possibility of a harmful chemical splash. They will also give protection against flying particles.

4.4.5 Goggles should be worn when working with glassware used under reduced or elevated pressure or in high-temperature situations.

4.4.6 Goggles do not protect the face and neck. A full-face shield should be used when maximum protection from flying particles and liquids is needed.

4.4.7 Other specialized eyewear may be needed for such things as laser hazards, ultraviolet, or other intense light sources.

4.5 Respiratory Protection

4.5.1 Prevention of inhalation of airborne chemicals begins by minimizing the amount of these chemicals entering the laboratory air through the use of hoods and other ventilation techniques.

4.5.2 If these engineering controls are not adequate in any

situation, the appropriate respiratory equipment must be used.

4.5.3 There are three types of respirators.

4.5.3.1 Chemical cartridge respirators are only effective against particular vapors or classes of vapors, in concentrations specified by the manufacturer.

4.5.3.2 Dust, fume, and mist respirators are likewise only effective against particular individual (or classes of) dusts, fumes, and mists, as specified by the manufacturer.

4.5.3.3 Supplied-air respirators (including self-contained breathing apparatus) are effective against a wide range of air contaminants and can be used where oxygen-deficient atmospheres are present.

4.5.4 Self-contained breathing apparatus (SCBA) is the only kind of respiratory protection equipment that is suitable for emergency or rescue work.

4.5.5 All personnel who use respiratory protection equipment shall be medically certified and trained in the selection, use, and care of the equipment.

4.5.6 Detailed information on the MSFC Respiratory Protection Program is found in MPD 1840.3.

4.6 Prevention of Skin Contact

4.6.1 Skin contact is a major concern. The proper gloves are the first defense against skin contact or injury to the hands.

4.6.2 Gloves should be worn whenever corrosive materials, rough or sharp-edged objects, very hot or very cold materials are handled, or whenever protection is needed against accidental chemical exposure. Gloves also protect the hands from chemicals entering the body through a cut from broken glassware or a cut that occurred away from work. Gloves are not intended to be submersed; they are to avoid incidental contact

4.6.3 There are various compositions and thicknesses of rubber gloves. Common materials include neoprene, polyvinyl chloride, nitrile, butyl and natural rubbers. These materials differ in their resistance to various substances. Gloves should be selected based on the specific material being handled.

4.6.4 Gloves should be inspected carefully for discoloration or damage. Gloves with even a small pinhole will not give adequate protection. Glove materials are eventually permeated by chemicals and should be discarded when contaminated.

4.6.5 There is a wide range of other protective clothing such as laboratory coats and aprons, disposable outer garments such as tyvek suits, and special shoes or boots that offer protection against a variety of hazards. Selection and use of these items will depend on the chemicals being used.

4.6.6 In addition to engineering controls and the use of personal protective equipment, all workers must apply the basic rules of chemical hygiene. Good chemical hygiene must become an integral part of everyone's daily routine. The basic procedures for good chemical hygiene are included in the section on "Standard Operating Procedures."

4.7 Criteria for the Use of Control Measures

4.7.1 The use of any engineering control, protective equipment, or hygiene practice will be determined by the chemical(s) being used.

4.7.2 The four overriding principles of chemical hygiene bear repeating here:

4.7.2.1 Minimize all chemical exposure.
4.7.2.2 Do not underestimate risk.
4.7.2.3 Provide adequate ventilation.
4.7.2.4 Observe PEL’s and TLV’s.

These principles provide the general criteria for the use of control measures in the laboratory.

4.7.3 The nature of the hazard presented by the chemical will determine the type of protection required. For example, a person handling a corrosive material is required to wear appropriate gloves, eye protection, and, if appropriate, a lab apron or other protective clothing. If the material or process might result in toxic fumes or vapors, then ventilation is an important control.

4.7.4 In general, if the PEL/TLV of a substance is low, or the substance has a high vapor pressure, ventilation and/or respiratory protection should be used.

4.7.5 The severity of the hazard will determine the extent of

the control to be used. If the material is slightly corrosive, goggles alone might be enough; but, if it is very corrosive, a full-face shield would be in order. If the fumes are slight, working in a hood might be adequate; but, if the fumes are likely to be heavy or extremely toxic, then a closed system or respirators might be necessary.

4.7.6 Information on the hazards that will determine the type and extent of control measures can be found in the manufacturer's MSDS, as well as information from the OSHA and the American Conference of Governmental Industrial Hygienists.

4.8 Exposure Determination

4.8.1 Regular, routine monitoring of the airborne concentrations of a variety of toxic materials is generally not required, as long as care is taken to ensure that:

4.8.1.1 The ventilation system (including the hood) is performing and is being used properly;

4.8.1.2 The laboratory workers are using proper protective equipment and clothing; and

4.8.1.3 The laboratory workers are following good hygiene and laboratory safety practices.

4.8.2 However, there are situations where monitoring of individual compounds is appropriate or required:

4.8.2.1 In testing or redesigning hoods and other ventilation devices in the laboratory, air sampling procedures may be helpful in the evaluation of the new ventilation situation.

4.8.2.2 If a specific substance is highly toxic and regularly and continuously used in the laboratory, instrumental monitoring of that substance may be appropriate. This is especially true if a relatively large amount of the material is being stored or used in the laboratory.

4.8.2.3 Measurement of employees' exposure to any substance regulated by an expanded standard which requires monitoring.

4.8.2.4 If this monitoring indicates exposure over the action level or PEL, then the Center must immediately comply with the provisions of the relevant standard. The Center will notify laboratory occupants of the results of this monitoring.

4.8.2.5 It is the Chemical Hygiene Officer's responsibility to determine when exposure monitoring is necessary or appropriate and to arrange with the MSFC Medical Center to accomplish said monitoring.

INSERT HERE:

SPECIFIC INFORMATION ON CONTROL MEASURES

BEING USED IN THE FACILITY

AND SPECIFIC INFORMATION ABOUT

THE CRITERIA FOR THEIR USE

4.9 Ventilation and Hood Performance

4.9.1 The various ventilation systems must function properly. In the general ventilation system, 4-12 room air changes/hour is normally adequate. General air flow should not be turbulent and should be relatively uniform throughout the laboratory with no high-velocity or static areas.

4.9.2 The average time required for a ventilation system to change the air within a laboratory can be estimated from the total volume of the laboratory (usually measured in cubic feet) and the rate at which input air is introduced or exhaust is removed (usually measured in cubic feet per minute (cfm)). The latter value is usually determined by measuring (usually in feet per minute (fpm)) the average face velocity for each laboratory exhaust port such as the hoods or other local ventilation systems. For each exhaust port, the product of the face area (in square feet) and the average face velocity (in fpm) will give the rate at which the air is being exhausted by that port (in cfm). The sum of these rates for all exhaust ports in the laboratory will give the total rate at which air is being exhausted in the laboratory. It is important to realize that, up to the capacity of the exhaust system, the rate at which air is exhausted from the laboratory will equal the rate at which input air is introduced. Thus, decreasing the flow rate of input air (perhaps to conserve energy) will decrease the number of air changes per hour in the laboratory, the face velocities of the hoods, and the capture velocities of all other local ventilation systems.

4.9.3 Hood face velocity should be adequate to capture and retain chemicals handled in the hood. Airflow into and within hoods should not be excessively turbulent.

4.9.4 The performance of a hood depends on such factors as placement of equipment in the hood, room drafts from open doors or windows, persons walking by or even the presence of the user in front of the hood.

4.9.5 A continuous monitoring device for adequate hood performance should be present and checked before each hood is used. If inadequate hood performance is suspected, it should be established that the hood is performing adequately before it is used.

4.10 Hood Evaluation

4.10.1 Ventilation should be evaluated when the hood is

installed and at least annually. (Contact the MSFC Medical Center Environmental Health personnel.)

4.10.2 It should be reevaluated whenever there is a change in any aspect of the ventilation system. Thus, changes in the total volume of input air, changes in the locations of air-input ports, or the addition of other auxiliary local ventilation devices call for reevaluation of all hoods in the laboratory.

4.10.3 The measurement of airflow rates requires special instruments and personnel trained to use them (contact the Facilities Engineering Department). Pitot tubes are used for measuring duct velocities, and anemometers or velometers are used to measure airflow rates within rooms and at the faces of input or exhaust ports. The proper calibration and use of these instruments requires specialized training to ensure the accurate collection and evaluation of data.

4.11 Prior Approval

4.11.1 Some laboratory operations require prior approval before they are carried out.

4.11.2 Prior approval is required:

4.11.2.1 When there is a new procedure, process, or test, even if it is very similar to established practices;

4.11.2.2 If there is a change or substitution of any of the ingredient chemicals in a procedure;

4.11.2.3 If there is a substantial change in the amount of chemicals being used; (e.g., safety practices should be reviewed if the volume of chemicals used is increased by 20% or more.);

4.11.2.4 When there is a failure of any of the equipment used in the process, especially safeguards such as fume hoods or clamp apparatus;

4.11.2.5 If there are unexpected test results; or

4.11.2.6 When members of the laboratory staff suspect exposure, smell chemicals, or otherwise suspect a failure of engineered safeguards.

4.11.2.7 Prior approval may be required for certain unattended operations.

4.12 Hazard Review

Situations requiring prior approval for a procedure may also require a hazard review. The review is conducted by a group of senior lab personnel who consider the proposed activity and discuss the safety aspects of the procedure with the personnel involved. The procedure will be approved only after the safety questions are adequately answered and all are satisfied that it can proceed safely. A hazard review will generally be required before conducting a procedure that is new and complex, or is suspected to be especially hazardous.

INSERT HERE:

SPECIFIC INFORMATION REGARDING CIRCUMSTANCES

AND PROCEDURES FOR PRIOR APPROVAL AND

HAZARD REVIEW IN THIS FACILITY

CHAPTER 5

GUIDELINES for PARTICULARLY HAZARDOUS SUBSTANCES

5.1 Particularly hazardous materials such as "select carcinogens," reproductive toxins, and substances that have a high degree of acute toxicity require special procedures and precautions. In general, procedures for handling these particular hazardous materials include:

5.1.1 Establishment of a designated area where the specific procedures will be carried out. These areas should be identified as areas of special hazard, and access should be restricted to personnel who are trained about the hazards and safe handling of the materials.

5.1.2 Work with these materials should be done in a closed system to reduce exposure risks. This includes the use of containment devices such as fume hoods, glove boxes, and similar equipment. It is also recommended that rooms where "select carcinogens" are used and stored be kept at a slight negative air pressure as compared with other spaces in the facility.

5.1.3 Decontamination procedures include extra precautions on the part of laboratory workers in maintaining good personal hygiene. No food, beverages, or tobacco products should be permitted in the restricted areas, and workers should wash before leaving the facility.

5.1.4 Procedures for safe removal of contaminated waste should be consistent with the MSFC hazardous waste procedures and must meet the requirements of the Resource Conservation and Recovery Act, and other applicable regulations.

5.2 The following are recommendations for handling of specific classes of particularly hazardous substances:

5.2.1 Allergens (ex: diazomethane, isocyanates, bichromates)

A wide variety of substances can produce skin and lung hypersensitivity. Because of this variety and because of the varying response of individuals, suitable gloves should be used to prevent hand contact with allergens or substances of unknown allergenic activity.

5.2.2 Embryotoxins (ex: organomercurials, lead compounds,

formamide)
Because the period of greatest susceptibility to embryotoxins is the first 8-12 weeks of pregnancy, which includes a period when a woman may not know she is pregnant, women of child-bearing potential should take care to avoid skin contact with all chemicals. All hoods, glove boxes, or other essential engineering control should be known to be operating at required efficiency before work with embryotoxins is started.

Review each use of these materials with the research supervisor and review continuing uses annually or whenever a procedural change is made. Store these substances, properly labeled, in an adequately ventilated area in an unbreakable secondary container. Notify supervisors of all incidents of exposure or spills; consult a qualified physician when appropriate.

5.2.3 Chemicals of Moderate, Chronic, or High Acute Toxicity (ex: diisopropylflurophosphate, hydrofluoric acid, hydrogen cyanide)

Supplemental rules to be followed in addition to those mentioned above:

5.2.3.1 The aim is to minimize exposure to these toxic substances by any route using all reasonable precautions.

5.2.3.2 These precautions are appropriate for substances with moderate, chronic, or high acute toxicity used in significant quantities.

5.2.3.3 Use and store these substances only in areas of restricted access with special warning signs.

5.2.3.4 Always use a hood (previously evaluated to confirm adequate performance with a face velocity of at least 75 fpm) or other containment device for procedures which may result in the generation of aerosols or vapors containing the substance. Trap released vapors to prevent their discharge with the hood exhaust.

5.2.3.5 Always avoid skin contact by use of gloves and long sleeves (and other protective apparel as appropriate). Always wash hands and arms immediately after working with these materials.

5.2.3.6 Maintain records of the amounts of these materials on hand, amounts used, and the names of the workers involved.

5.2.3.7 Be prepared for accidents and spills.

5.2.3.8 Ensure that at least two people are present at all times if a compound in use is highly toxic or of unknown toxicity.

5.2.3.9 Store breakable containers of these substances in chemically resistant trays. If a major spill occurs outside the hood, evacuate the area and assure that cleanup personnel wear suitable protective apparel and equipment.

5.2.3.10 Thoroughly decontaminate or incinerate contaminated clothing or shoes. If possible, chemically decontaminate by chemical conversion. Store contaminated waste in closed, suitably labeled, impervious containers (for liquids, in glass or plastic bottles half-filled with vermiculite).

5.2.4 Chemicals of High Chronic Toxicity (ex: dimethylmercury and nickel carbonyl, benzo-a-pyrene, N-nitrosodiethylamine, other human carcinogens or substances with high carcinogenic potency in animals)

Further supplemental rules to be followed, in addition to those mentioned above, for work with substances of known high chronic toxicity (in quantities above a few milligrams to a few grams, depending on the substance):

5.2.4.1 Conduct all transfers and work with these substances in a “controlled area:” a restricted-access hood, glove box, or portion of a lab, designated for use with highly toxic substances, for which all people with access are aware of the substance(s) being used and necessary precautions.

5.2.4.2 Prepare a plan for use and disposal of these materials and obtain the approval of appropriate personnel.

5.2.4.3 Protect vacuum pumps against contamination by scrubbers or HEPA filters and vent them into the hood. Decontaminate vacuum pumps or other contaminated equipment, including glassware, in the hood before removing them from the controlled area.

5.2.4.4 Decontaminate the controlled area before normal work is resumed there.

5.2.4.5 On leaving a controlled area, remove any protective apparel (placing it in an appropriate, labeled container) and thoroughly wash hands, forearms, face, and neck.

5.2.4.6 Use a wet mop or a vacuum cleaner equipped with a HEPA filter instead of dry sweeping if the toxic substance was a dry powder.

5.2.4.7 If using toxicologically significant quantities of such a substance on a regular basis (e.g., 3 times per week), consult a qualified physician concerning desirability of regular medical surveillance.

5.2.4.8 Keep accurate records of the amounts of these substances stored and used, the dates of use, and names of users.

5.2.4.9 Signs and labels: Ensure that the controlled area is conspicuously marked with warning and restricted access signs and that all containers of these substances are appropriately labeled with identity and warning labels.

5.2.4.10 Ensure that contingency plans, equipment, and materials to minimize exposures of people and property in case of accident are available.

5.2.4.11 Store containers of these chemicals only in a ventilated, limited access area in appropriately labeled, unbreakable, chemically resistant, secondary containers.

5.2.4.12 For a negative pressure glove box, ventilation rate must be at least 2 volume changes/hour and pressure at least 0.5 inch of water. For a positive pressure glove box, thoroughly check for leaks before each use. In either case, trap the exit gases or filter them through a HEPA filter and then release them into the hood.

5.2.4.13 Use chemical decontamination whenever possible; ensure that containers of contaminated waste (including washings from contaminated flasks) are transferred from the controlled area in a secondary container under the supervision of authorized personnel.

INSERT HERE:

SPECIFIC INFORMATION ABOUT THE

PARTICULARLY HAZARDOUS SUBSTANCES

USED IN THIS FACILITY, INCLUDING

WHICH SUBSTANCES ARE USED AND THE

SPECIFIC PROCEDURES REQUIRED FOR

THEIR HANDLING

CHAPTER 6

GUIDELINES for MEDICAL CONSULTATION AND EXAMINATIONS

6.1 It is MSFC policy to promptly investigate all complaints to determine risk of employee overexposure to the toxic substances in their workplace.

6.2 There should be a medical consultation whenever there is reason to believe an employee has been exposed to a hazardous chemical.

6.3 Some examples of circumstances that would indicate the possibility of exposure are:

6.3.1 The employee had direct skin or eye contact with a chemical substance.

6.3.2 Odor was noticed, especially if the employee was working with any chemical which has a PEL or TLV below the odor threshold.

6.3.3 The employee is experiencing health hazard symptoms such as headache, rash, nausea, coughing, tearing, irritation or redness of the eyes, irritation of nose or throat, dizziness, loss of motor dexterity or judgment which resemble drunkenness, etc.

6.3.4 Some or all of the symptoms disappear when the employee is taken away from the chemical area and into fresh air.

6.3.5 Symptoms previously complained about reappear soon after the employee starts working with chemicals again.

6.3.6 Complaints are received from more than one person in the same work area.

6.4 Other circumstances include:

6.4.1 When exposure monitoring reveals an exposure level routinely above the action level (or PEL in the absence of an action level); or

6.4.2 Whenever there is a spill, leak, or other release resulting in the likelihood of a hazardous exposure.

6.5 The following information must be provided to the physician:

6.5.1 The identity of the hazardous chemical to which the employee may have been exposed;

6.5.2 A description of the conditions under which the exposure occurred, including quantitative exposure data, if available; and

6.5.3 A description of the signs and symptoms of exposure that the employee is experiencing, if any.

6.6 The Center will maintain a written report from the physician in the employee's medical file which includes:

6.6.1 The results of the medical examination and any associated tests;

6.6.2 Any recommendation for further medical follow-up;

6.6.3 Any medical condition which may be revealed which may place the employee at increased risk as a result of a hazardous chemical found in the workplace; and

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

6.7 It may be appropriate to conduct an "exposure evaluation" when there is a complaint of a possible hazardous exposure. The basic steps of this evaluation are:

6.7.1 Interviewing the person initiating the complaint and the victim, if it is not the same person;

6.7.2 Listing the essential information about the circumstances of the complaint, including:

6.7.2.1 Chemical of suspicion;

6.7.2.2 Other chemicals in use by the victim;

6.7.2.3 Other chemicals being used by others in the immediate area;

6.7.2.4 Other chemicals stored in that area;

6.7.2.5 Signs and symptoms being experienced;

6.7.2.6 If control measures, such as fume hoods and personal protective equipment, were used and if these control measures were functioning properly;

6.7.2.7 If any air sampling or monitoring devices were in place or available;

6.7.3 Requesting sampling of the area for suspect chemicals;

6.7.4 Determining how the signs and symptoms being experienced compare with the information on the MSDS for the chemicals involved;

6.7.5 Deciding whether to send the employee for medical evaluation; and

6.7.6 Reviewing the present control measures and safety procedures.

INSERT HERE:

SPECIFIC INFORMATION ABOUT PERSONNEL

AND PROCEDURES INVOLVED IN

THIS FACILITY'S MEDICAL PROGRAM

(MPG 1810.1, "OCCUPATIONAL MEDICINE PROGRAM" IS ONE SUGGESTION)

CHAPTER 7

GUIDELINES for INFORMATION AND TRAINING

7.1 Information and training is a key part of this Chemical Hygiene Plan. The training and education program must be a regular and ongoing activity. Information should be updated continuously and refresher training in all areas should be conducted regularly.

7.2 Information Requirements

7.2.1 The employees of the laboratory must have the information to ensure that they know and understand the hazards of the chemicals in their work area.

7.2.2 This information must be provided at the time of an employee's initial assignment to a work area where hazardous chemicals are present, and before assignments involving new exposure situations.

7.2.3 Employees must be informed of:

7.2.3.1 The location, availability, and contents of this written Chemical Hygiene Plan;

7.2.3.2 The location, availability, and contents of the "Occupational Exposures to Hazardous Chemicals in Laboratories" OSHA Standard;

7.2.3.3 Information on the PELs for applicable OSHA regulated substances or other recommended limits in the absence of an OSHA standard;

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

7.2.3.5 The location and availability of standard reference material on the hazards, safe handling, storage, and disposal of the hazardous chemicals in the laboratory. This reference material includes, but is not limited to, the MSDS from the manufacturers.

7.3 Training Requirements

7.3.1 Methods and observations that may be used to detect the

presence or release of a hazardous chemical, such as

7.3.1.1 Monitoring conducted by the employer,

7.3.1.2 Continuous monitoring devices, or

7.3.1.3 Appearance or odor of hazardous chemicals when released;

7.3.2 Training about the physical and health hazards of chemicals in the work area, and how to protect themselves from those hazards; also,

7.3.3 Appropriate laboratory personnel should be trained in the proper use of emergency equipment and procedures.

INSERT HERE, AS APPROPRIATE:

MSFC RESPIRATORY PROTECTION PROGRAM (MPD 1840.3)

MSFC EVACUATION PLAN INCLUDING:

EVACUATION PROCEDURES, MAPS, AND DIAGRAMS OF THE FACILITY, INFORMATION ON LOCATION OF VARIOUS HAZARDOUS CHEMICALS

PERMISSIBLE EXPOSURE LIMITS AND THRESHOLD LIMIT VALUES OF REGULATED SUBSTANCES

LIST OF SELECT CARCINOGENS USED OR STORED IN YOUR FACILITY

ANY OTHER DOCUMENTS THAT ARE RELEVANT TO HEALTH AND SAFETY IN YOUR LABORATORY

Appendix A

Occupational Safety and Health Administration (OSHA), 29 CFR 1910.1450

CHEMICAL HYGIENE STANDARD SUMMARY

The "Occupational Exposures to Hazardous Chemicals in Laboratories" Standard establishes a wide range of requirements for laboratories to ensure that occupational exposure to hazardous chemicals in the laboratory environment is reduced or eliminated as far as possible.

The new Standard differs from any OSHA health standards in that it does not establish new exposure limits, but sets other performance provisions designed to protect laboratory workers from potential hazards in their work environment. By permitting a greater degree of flexibility to laboratories in developing and implementing employee safety and health programs, OSHA expects benefits to result from increased worker awareness of potential risks, improved work practices, appropriate use of existing personal protective equipment, and greater use of engineering controls. Given the flexibility to design and implement innovative measures to reduce employee exposure to hazardous substances, employers also will reap rewards in terms of lower property damage costs, lower turnover costs, less absenteeism and, in general, increased productivity. Finally, the potential decrease in acute and chronic health problems will result in overall benefits to society through the associated reduction in medical and productivity costs.

The following brief quote from the preamble summarizes the basic goals and approach of this Standard. “A substantial amount of evidence in this record indicates that laboratory workers are at risk to serious and even life threatening occupational hazards. Several companies with good work practice programs, however, indicated that these hazards can be overcome through sound safety practices, and submitted evidence of the magnitude of the benefits to be attained from this Standard.” It is primarily a performance standard, giving wide latitude to individual laboratories in how to attain the desired results.