



Subject: Potentially Hazardous Materials – Hazard Communication Standard

Responsible Office: Safety & Mission Assurance Office

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PREFACE

P.1 PURPOSE

- a. The purpose of this Langley Procedural Requirement (LPR) is to define organizational requirements and procedures for the safe use of potentially hazardous materials (PHM) and to facilitate compliance with regulations promulgated by the Occupational Safety and Health Administration (OSHA) and other consensus standards, as appropriate, at Langley Research Center (LaRC).
- b. This LPR implements the requirements of 29 Code of Federal Regulations (CFR) 1910.1200. It outlines the procedures to be followed to obtain and maintain information on PHM and the requirements for training personnel on the use of this information.
- c. Organizational responsibilities and administrative procedures for the acquisition and use of PHM are stated within this LPR, including the requirement that a permit system shall be used for PHM including carcinogens and highly toxic gases.
- d. General and specific health and safety information for various classes of PHM is included in these procedural requirements, which is intended to be used as a general reference and is not intended to necessarily furnish all information required to plan and execute the safe operation for a given material. A list of sources of additional information is maintained by the Safety and Facility Assurance Branch (SFAB), Safety and Mission Assurance Office (SMAO).
- e. The intent of this procedural requirement is not to address all procedures and laws pertaining to PHM, such as the Department of Transportation (DOT) shipping regulations for PHM sent off LaRC. For technical assistance in this area, personnel shall contact LaRC Transportation Officer, Logistics Management Office (LMO), or Center Operations Directorate (COD).
- f. Environmental laws and requirements concerning the use, manufacture, emission, and disposal of hazardous materials are not detailed in this LPR, but are presented in LPR 8500.1. For technical assistance on environmental requirements contact the Standard Practice and Environmental Engineering Branch (SPEEB), COD.

P.2 APPLICABILITY

- a. This Langley Procedural Requirement (LPR) is applicable to all NASA LaRC organizations and all federal civil service personnel on Center.
- b. This LPR is applicable to contractors, grant recipients, or parties to agreements only to the extent specified or referenced in the appropriate contracts, agreements, or grants.
- c. Noncompliance with the requirements of this LPR may result in appropriate disciplinary action against civil service personnel or sanctions against contractors in accordance with the terms of their contracts.

- d. In this directive, all mandatory actions (i.e., requirements) are denoted by statements containing the term “shall.” The terms “may” denotes a discretionary privilege or permission, “can” denotes statements of possibility or capability, “should” denotes a good practice and is recommended, but not required, “will” denotes expected outcome, and “are/is” denotes descriptive material.
- e. In this directive, all document citations are assumed to be the latest version, unless otherwise noted.

P.3 AUTHORITY

- a. General Requirements, 29 CFR Subpart I §1910.132.
- b. Hazard Communication, 29 CFR §1910.1200.
- c. Hazardous Materials Regulations, 49 CFR pts. 171-180.
- d. Occupational Exposure to Hazardous Chemicals in Laboratories, 29 CFR §1910.1450.
- e. American National Standards Institute (ANSI) Z87.1, American National Standard for Emergency Eyewash and Shower Equipment.
- f. ANSI Z400.1, Hazardous Workplace Chemicals – Hazard Evaluation and Safety Data Sheet and Precautionary Labeling Preparation.
- g. National Fire Protection Association (NFPA) 30, Flammable and Combustible Liquids Code.
- h. NFPA 77, Recommended Practice on Static Electricity.
- i. NFPA 704, Standard System for the Identification of the Hazards of Materials for Emergency Response.

P.4 APPLICABLE DOCUMENTS AND FORMS

- a. Hazard Communication, 29 CFR §1910.1200.
- b. Occupational Exposure to Hazardous Chemicals in Laboratories, 29 CFR §1910.1450.
- c. Additional Requirements for Facilities Transferring or Receiving Select Agents, 42 CFR §72.6.
- d. HHS Select Agents and Toxins, 42 CFR §73.3.
- e. Overlap Select Agents and Toxins, 42 CFR §73.4.
- f. Hazardous Materials Regulations, 49 CFR pts. 171-180.
- g. NPR 1800.1, NASA Occupational Health Program Procedures.

- h. Langley Policy Directive (LAPD) 1150.2, Councils, Boards, Panels, Committees, Teams, and Groups.
- i. LAPD 1700.1, Safety Program.
- j. LAPD 1700.2, Safety Assignments and Responsibilities.
- k. LPR 1710.5, Ionizing Radiation.
- l. LPR 1710.7, Safety Program for the Handling and Use of Explosives at Langley Research Center.
- m. LPR 1710.13, Chemical Hygiene Plan.
- n. LPR 1740.6, Personnel Safety Certification.
- o. LPR 1800.1, Langley Research Center Occupational Health Program.
- p. LPR 8500.1, Environmental and Energy Program Manual.
- q. LPR 8715.12, LaRC Integrated Spill Contingency Plan.
- r. Langley Management System Center Procedure (LMS-CP) 1710, Temporary Non-Civil Servant Student/Researchers Process.
- s. LMS-CP-4505, Purchase Requisition (PR) Initiation/Modification/Cancellation and Supporting Documentation.
- t. LMS-CP-4759, Acquisition of Hazardous Materials.
- u. LMS-CP-4760, Reporting Injuries, Illnesses, and Compensation Claims.
- v. NASA Form (NF) 1707, Special Approvals and Affirmations of Acquisitions.
- w. Langley Form (LF) 44, Hazardous Material – Procurement, Inventory, and Storage Record.
- x. LF 52, Shipping/Transfer Document.
- y. LF 62, Chemical Worker's Certification Card.
- z. LF 66, Worker Appointment and Certification Form.
- aa. LF 118, Safety Permit Request – Hazardous Material.
- ab. LF 163, Waste Material Data Sheet.
- ac. LF 175, Safety Data Sheet Review Request.
- ad. LF 180, Biological Agent Approval Form.
- ae. LF 367, Safety Data Sheet.
- af. LF 381, Laboratory Specific Chemical Hygiene Plan (CHP).
- ag. LF 498, Safety Permit.
- ah. NASA STD 8719.12, Safety Standard for Explosives, Propellants, and Pyrotechnics.
- ai. NASA Office of Procurement, NASA Purchase Card Procedures and Instructions.

- aj. American Conference of Governmental Industrial Hygienists (ACGIH), Industrial Ventilation: A Manual of Recommended Practice for Design.
- ak. Centers for Disease Control (CDC) and Prevention and National Institutes of Health (NIH), Biosafety in Microbiological and Biomedical Laboratories (BMBL)¹.
- al. International Agency for Research on Cancer (IARC), Monographs on the Identification of Carcinogenic Hazards to Humans (latest editions)².
- am. National Institutes of Health (NIH), NIH Guidelines for Research Involving Recombinant or Synthetic Nucleic Acid Molecules³.
- an. National Toxicology Program (NTP), Report on Carcinogens (latest edition)⁴.
- ao. NFPA 704, Standard System for the Identification of the Hazards of Materials for Emergency Response.
- ap. U.S. Environmental Protection Agency (EPA), Toxic Substances Control Act (TSCA) Chemical Substances Inventory⁵.

P.5 MEASUREMENT/VERIFICATION

Compliance with these requirements is accomplished through annual Industrial Hygiene and Safety audits, through the issuance and periodic review of Potentially Hazardous Materials safety permits, and through triennial occupational health audits conducted by the NASA Office of the Chief Health and Medical Officer (OCHMO).

P.6 CANCELLATION

LPR 1710.12 I-1, dated April 26, 2017.

/s/ David Young May 11, 2022

Title

Date

Distribution:

Approved for public release via the Langley Management System; distribution is unlimited.

¹ <https://www.cdc.gov/labs/BMBL.html>

² <https://publications.iarc.fr/Book-And-Report-Series/Iarc-Monographs-On-The-Identification-Of-Carcinogenic-Hazards-To-Humans>

³ https://osp.od.nih.gov/wp-content/uploads/NIH_Guidelines.pdf

⁴ <https://ntp.niehs.nih.gov/go/roc14>

⁵ <https://www.epa.gov/tsca-inventory>

CHAPTER 1: INTRODUCTION

1.1 Potentially Hazardous Materials (PHM) Definition

1.1.1 PHM are defined as any substance having intrinsic properties that can pose a risk of injury or illness to personnel or of destruction to property. That is, any material that is a health or physical hazard. Specifically, provisions of these procedural requirements are applicable to materials having toxic, flammable, corrosive, cryogenic, or asphyxiation properties. Radioactive and explosive materials are not included as they are covered in LPR 1710.5, LPR 1710.7, and NASA-STD-8719.12.

1.2 PHM OSHA Definition

1.2.1 PHM include those substances defined by the Occupational Safety and Health Administration (OSHA) as hazardous chemicals. In 29 CFR 1910.1200(c), "Hazard Communication," OSHA defines a hazardous chemical as "any chemical which is classified as a physical hazard or a health hazard, a simple asphyxiant, combustible dust, pyrophoric gas, or hazard not otherwise classified."

1.3 Records

1.3.1 The following forms are completed when implementing requirements:

- a. LF 44, "Hazardous Material - Procurement, Inventory, and Storage Record."
- b. LF 52, "Shipping/Transfer Document."
- c. LF 62, "Chemical Worker's Certification Card."
- d. LF 66, "Worker Appointment and Certification Form."
- e. LF 118, "Safety Permit Request - Hazardous Material."
- f. LF 163, "Waste Material Data Sheet."
- g. LF 175, "Safety Data Sheet Review Request."
- h. LF 498, "Safety Permit."

CHAPTER 2: RESPONSIBILITIES

2.1 Potentially Hazardous Materials Committee

2.1.1 The Potentially Hazardous Materials Committee (PHMC) is established under the authority of LAPD 1700.1 and LAPD 1150.2.

2.1.1.1 Any member of this committee is authorized to investigate any questionable use of PHM, act in the name of the Center Director to stop work or to prevent use of a material that is considered unsafe, and initiate action to eliminate the unsafe condition. The Committee applies relevant reference materials as needed when assessing processes involving PHM (see Appendix C for references).

2.1.1.1.1 Such action shall be documented within 24 hours by formal letter to the Chairperson, PHMC.

2.1.1.1.2 If line management is not in agreement with the corrective action recommended by the official who stopped the work, these reasons shall be submitted to the Chairperson of the Executive Safety Council (ESC).

2.1.1.1.3 The Chairperson, ESC shall make an appropriate review.

2.1.1.1.4 In these cases, work shall not resume without the approval of the Chairperson, ESC.

2.1.2 Due to the need for the PHMC to maintain an overview of operations at LaRC involving PHM, a review system has been established.

2.1.2.1 This review system includes LF 498, which is described in Chapter 5 of this procedural requirement.

2.1.2.2 LF 498s shall be completed before operations commence.

2.1.2.3 The PHMC shall also overview the activities of the Explosives Safety Officer for control of pyrotechnic materials.

2.1.3 Structure and Organization

2.1.3.1 The PHMC functions as a committee of the ESC. Its position in the organization for control of PHM is shown in Figure 2.1.

2.1.3.2 Committee members, including the Chairperson, shall be appointed by the ESC, by virtue of their technical and/or educational expertise in such areas as chemistry, hazardous gases, and compatibility of materials.

2.1.3.3 Members are appointed to serve for a 3-year term.

2.1.3.4 Representatives of the Safety and Facility Assurance Branch (SFAB), Safety and Mission Assurance Office (SMAO) shall serve as members of the committee.

2.1.3.5 This representation shall consist of the SFAB Industrial Hygiene (IH) staff and the LaRC Safety Manager or his/her designated representative.

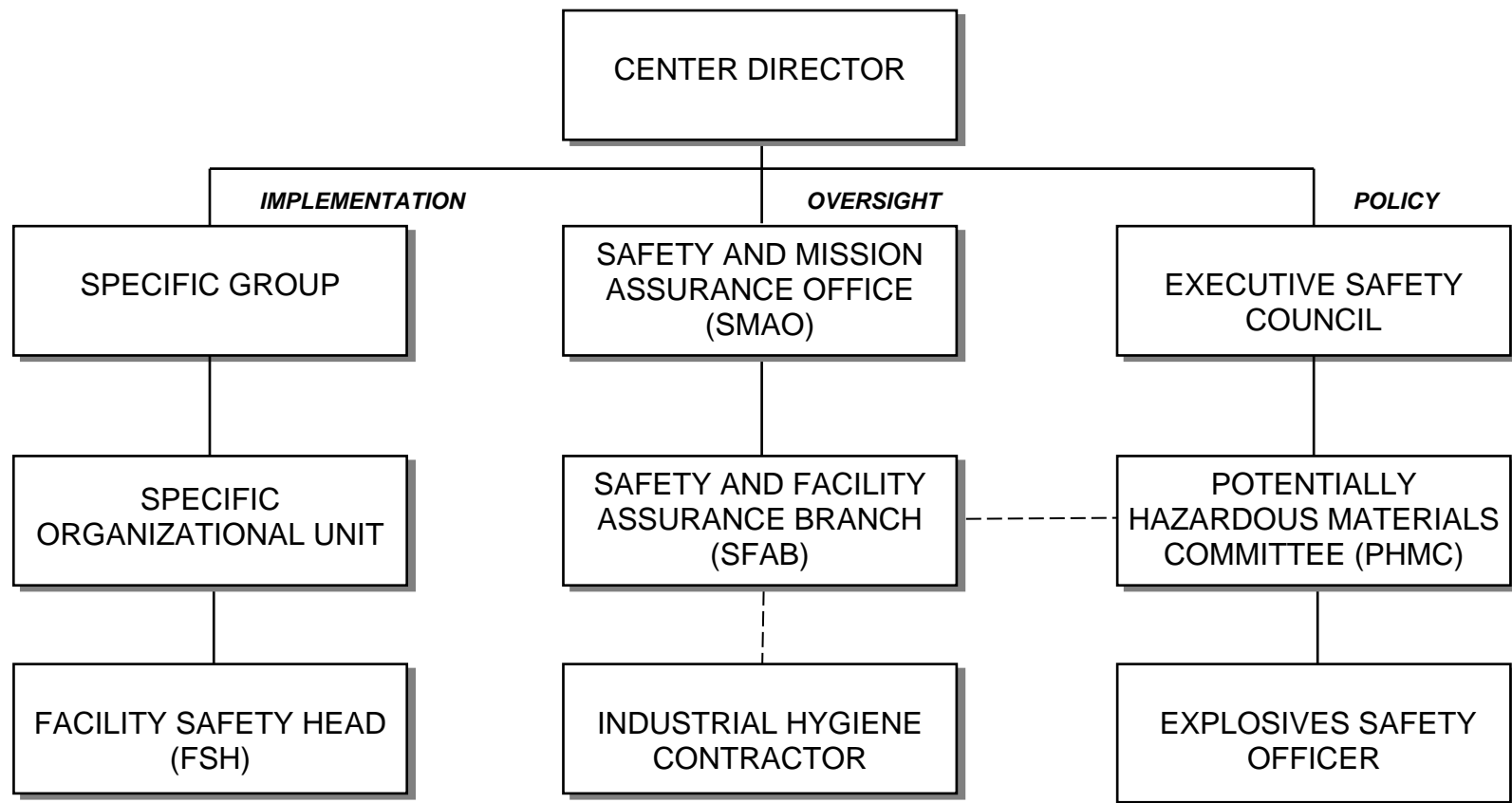


Figure 2.1, LaRC Organization for Control of Potentially Hazardous Materials.

2.1.4 Duties and Responsibilities

2.1.4.1 The duties and responsibilities of the PHMC are set forth in LAPD 1150.2.

2.1.4.2 The PHMC functions as a review and guidance body providing recommendations in applicable areas, as required.

2.1.4.3 The PHMC shall:

- a. Prepare and distribute minutes of committee meetings, which shall contain, as a minimum, a record of persons present; a description of matters discussed and conclusions reached, including the opinions of dissenting members; and copies of all reports issued or approved by the committee.
- b. Distribute minutes to all members; the affected operations personnel; the Chairperson, ESC; and the Director, SMAO.
- c. Carry on official correspondence for the committee, as needed.

2.1.4.4 PHMC members shall:

- a. Be cognizant of matters pertaining to use of PHM at LaRC. This is chiefly, but not entirely, achieved by attending the committee meetings and participating in the decisions made by the committee.
- b. Serve on ad hoc committees, which are appointed by the Chairperson, as needed.

2.2 Safety and Health Functions

2.2.1 The primary responsibility for the safe use of PHM lies with the individual user. Although this responsibility cannot be delegated, various LaRC functions provide planning, management, and assistance.

2.2.2 Facility Safety Head (FSH)

2.2.2.1 The primary responsibilities of the FSH are the safe operation of the research apparatus and maintenance of a safe working environment.

2.2.2.2 The basic responsibilities of the FSH are described in LAPD 1700.2.

2.2.2.3 FSHs shall:

- a. Be responsible for:
 - (1) The establishment and use of normal and emergency operating procedures.
 - (2) Configuration control.
 - (3) Safety training.
 - (4) Preventative maintenance.
 - (5) Other traditional institutional types of safety considerations.
- b. Be thoroughly familiar with all operations involving PHM in their facilities.
- c. Be familiar with any LF 498s issued for their facilities.

- d. Establish and review normal and emergency operating procedures in accordance with LPR 1710.13, LPR 8500.1, and this LPR.
 - (1) These procedures shall include cleanup of small spills (within the capability of the researcher) by facility personnel.
 - (2) All large spills (beyond the capability of the researcher) shall be reported to the LaRC Emergency Dispatcher to initiate spill response in accordance with LPR 1710.13 and LPR 8500.1.
 - (3) The Emergency Dispatcher will then notify the LaRC Fire Chief who shall make notifications to other departments (including the LaRC Safety Manager), as appropriate.
 - (4) Electronic copies of Safety Data Sheets (SDSs) shall be submitted to the LaRC Material Safety Data Sheet (MSDS)/SDS online library in accordance with Chapter 4 of this LPR and LPR 8500.1.
- e. Supervise and coordinate the procurement, use, storage, and disposal of PHM. Requirements for the initial identification and procurement of hazardous materials is contained in this chapter. Disposal is covered in detail in LPR 8500.1 and is mentioned in Chapter 6 of this LPR.
- f. Review and approve or reject LF 44s as part of the procurement process.
- g. Maintain an inventory of hazardous materials using the Center's web-based Chemical Material Tracking System (CMTS). Specific requirements are covered in LPR 8500.1.
 - (1) The primary file of MSDSs/SDSs shall be located in the CMTS.
 - (2) Each potentially hazardous chemical present shall require a MSDS/SDS.
 - (a) This MSDS/SDS requirement includes vendor samples as well as LaRC research and development test chemicals in use outside of their manufacturing location (e.g., laboratory hood, batch processor).
 - (b) The MSDS/SDS shall be accessible to all personnel working in the facility.
 - (c) Hazardous materials, including research and development chemicals produced for processing or evaluation in facilities other than the point of manufacture, shall have a MSDS/SDS completed, with a copy being forwarded for hazard review to the SFAB IH staff for PHMC and SFAB review (see Chapter 4).
- h. Ensure that all personnel who routinely work in the facility are aware of the physical or chemical hazards of the materials with which they routinely work, and other hazardous materials in the facility that they may encounter in any foreseeable emergency.
 - (1) For facilities with highly toxic substances in use or in storage, visitors shall be apprised of special facility emergency procedures in the event of leaks or spills.

- (2) For example, if warning lights are used to indicate hazardous conditions, visitors (including other on-site LaRC personnel who may periodically enter the facility) shall be informed of the meaning of the warning lights and appropriate actions.
- (3) Warning lights, bells, and so forth, shall include signs indicating the purpose of the alarm (e.g., "Fluorine Gas Alarm").
 - i. Provide or acquire periodic refresher training for personnel whenever significant changes occur for chemicals in use in the facility.
 - j. Maintain a current list of personnel in the organization who are trained and certified to use materials under LF 498 (Chapter 5).
 - k. Accompany SFAB personnel and representatives during all surveys and audits of the organization.

2.2.2.4 For laboratories operating under a Chemical Hygiene Plan (CHP), the FSH shall be the Chemical Hygiene Officer (CHO).

2.2.2.5 The CHO is an individual who is qualified by training or experience to provide technical guidance in the development and implementation of the provisions of the CHP and applicable LF 498s. Guidance on development of a CHP is in LPR 1710.13.

2.2.2.6 The FSH of the facility where the PHM are to be used shall be the first point of contact for the individual who has the need for the procurement, use, storage, or disposal of the PHM.

2.2.2.7 The first point of contact for the FSH for assistance with use of PHM shall be the SFAB IH staff.

2.2.3 Facility Coordinator (FC)

2.2.3.1 In the absence of the FSH, the FC shall accompany SFAB personnel during surveys and audits of the organization.

2.2.4 SFAB Industrial Hygiene Staff

2.2.4.1 The SFAB IH staff has specific responsibilities with regard to PHM. The SFAB IH staff shall be comprised of individuals who are certified industrial hygienists by the American Board of Industrial Hygiene.

2.2.4.2 The SFAB IH staff reports directly to the LaRC Safety Manager and serves on the PHMC. The SFAB IH staff shall be the primary committee contact for on-site users of PHM.

2.2.4.3 The SFAB IH staff shall:

- a. Provide technical and administrative guidance to LaRC personnel for the safe use of PHM where such material may pose a health hazard.
 - b. Assist personnel in the interpretation of MSDS/SDS technical data.
 - c. Provide monitoring services to document personnel exposures.
- (1) Results of these surveys shall be provided to the individual (or to the facility for posting) within 15 business days of receipt of results of laboratory analysis.

- d. Perform pre-operational surveys to identify potential health hazards and recommend control procedures.
 - (1) This shall include assisting in the determination of industrial ventilation to control health hazards.
- e. Perform periodic inspections to assure the effectiveness of control procedures and identify the need for an LF 498.
 - (1) Ventilation systems (e.g., fume hoods and paint booths) used to control health hazards shall be surveyed annually.
 - (2) Audit all LF 498s at least annually for compliance.
- f. Provide training for personnel in health hazard control measures such as personal protective equipment (PPE) (e.g., respirators, gloves).
- g. Review PHM purchase requisitions (PRs) for compatibility with approved policies and procedures and to help identify changes in use, which may require new or additional health hazard control measures.
- h. Advise the LaRC Safety Manager of non-health related hazards associated with the use of PHM.
- i. Advise the PHMC, the Langley Occupational Health Clinic, and SFAB of developments in statutory requirements and standards of good practice for the control of PHM where such materials may pose health hazards.
- j. Assist in the acquisition and technical interpretation of proprietary or trade secret MSDS/SDS information.
- k. Review and approve or reject LF 44s as part of the PHM procurement process.

2.2.5 LaRC Safety Manager (Branch Head, SFAB, SMAO)

2.2.5.1 The LaRC Safety Manager has specific responsibilities with regard to PHM.

2.2.5.2 The responsibilities of the LaRC Safety Manager are described in LAPD 1700.2.

2.2.5.3 The LaRC Safety Manager shall:

- a. Report directly to the Director, SMAO.
- b. Serve on the PHMC as a member (or assign a designee).
- c. Be the principal LaRC contact with federal safety and health regulatory agencies.
- d. Provide technical and administrative guidance for the safe storage and use of PHM where such material poses hazards not primarily health related.
- e. Ensure the SFAB IH staff conducts pre-operational reviews of new PHM activities to identify hazards and their control procedures.
- f. Use annual facility safety and health audits to assure the effectiveness of the LF 498 control measures.

- g. Review training data and/or provide training of personnel through the SFAB IH staff, as needed, to assure understanding of the LaRC hazard communication requirements.
- h. Serve as the final reviewing and/or certifying authority for the following:
 - (1) LF 66,
 - (2) LF 44, and
 - (3) LF 498.
- i. Provide assistance to facility personnel in Class II spills control (Class II spills are environmentally reportable) through the use of supplies and manpower available on-site or through prior planning and arrangements by SFAB with off-site response teams. These activities are outlined in LPR 8715.12 and LPR 8500.1.

2.2.6 LaRC Safety Manager Designated Representative

2.2.6.1 In the absence of the LaRC Safety Manager in matters regarding PHM, full signature authority shall be granted to the LaRC Safety Manager's designated representative.

2.2.7 Occupational Health Services

2.2.7.1 The Safety and Mission Assurance Office through the Occupational Health Officer (OHO) and the Langley Occupational Health Clinic shall be the primary contact for LaRC personnel for matters relating to occupational health. Responsibilities are described in LAPD 1700.2.

2.2.7.2 The LaRC Chief Medical Officer shall implement these responsibilities for the safe use of PHM:

- a. Recommend and implement medical surveillance of users of PHM.
- b. Maintain appropriate records of such surveillance.
- c. Serve as a qualifying official on LF 66.
- d. Stay alert for adverse health incidents involving PHM, such as possible chemical related contact dermatitis.

2.2.8 Logistics Management Office (LMO)

2.2.8.1 The LMO shall:

- a. Maintain an electronic file of MSDSs/SDSs for all materials available through the stores stock.
- b. Transmit a copy of the MSDS/SDS provided by suppliers for materials obtained by PR to users.
- c. Issue only store stock items that have an approved LF 44.

2.2.9 Personnel

2.2.9.1 Personnel shall:

- a. Participate in training.

- (1) The Langley Human Resources Office (HRO) shall incorporate basic hazard communication training information into its NASA LaRC personnel entry on duty training program.
- b. Review MSDSs/SDSs prior to using PHM.
- (1) New MSDSs/SDSs on existing materials from vendors shall be changed when the ingredients are changed or technical information is changed.
- (2) New MSDSs/SDSs shall be reviewed when received.
- c. Neither cover nor mark any warning labels used on containers or products received or in use. For transfers to other containers, personnel shall label or legibly mark the containers with an NFPA 704 warning label and the name of the PHM.

Note: This marking is not required if the transfer container is used immediately. "Immediate use" means that the hazardous chemical will be under the control of and used by the person who transfers it from a labeled container and only within the work shift in which it is transferred.

2.2.10 Supervisor Responsibilities

2.2.10.1 Supervisors shall:

- a. Inform personnel through training programs of the risks associated with workplace hazards, MSDS/SDS, and chemical labeling.
- b. Enforce the use of engineering controls, administrative controls, and PPE, as appropriate.

2.3 Off Standard Hours Laboratory Work

2.3.1 Standard-shift working hours for laboratory areas are between 6:00 am and 6:00 pm, Monday through Friday, excluding holidays.

2.3.1.1 During off standard hours, personnel shall not work alone (see Appendix A). Working alone may be allowed in specific situations with approval from the FSH and supervisor.

CHAPTER 3: ACQUISITION, RECEIPT, AND DELIVERY OF PHM

3.1 Procurement, Acquisition, and On-Site Transfer of PHM

3.1.1 PHM may be brought on site and stored or used in facilities after approval of the LF 44. Procedures for the storage of PHM at LaRC and for the shipment of PHM off-site are briefly outlined in Chapter 6 of this LPR. A non-exhaustive list of materials requiring an LF 44 is included in Appendix D.

3.2 Acquisition and Transfer of PHM

3.2.1 Refer to LMS-CP-4505 for specific instructions for NASA purchase requisitions, the NASA Purchase Card Procedures and Instructions (PCPI) for specific guidance on NASA Purchase Card (P-Card) orders, NF 1707 for specific instructions for review of purchase requisitions by SMAO, and LMS-CP-4759 for specific instructions on obtaining procurement permission and for material tracking. These requirements shall be followed for all PHM brought on-site including purchasing from commercial sources, through contractor sources, research and development engineering samples, and commercial product samples.

3.2.2 All PHM brought on-site shall have an SDS.

3.2.2.1 An electronic copy of each SDS shall be submitted to the LaRC MSDS/SDS online library and tracked in CMTS in accordance with LPR 8500.1 and LMS-CP-4759.

3.2.2.2 If new containers of existing materials/products from vendors are obtained and include a change in formulation or technical information, a new SDS shall be collected and associated with the new container. Older containers shall remain associated with the MSDS/SDS version with which they came.

3.2.2.3 Electronic LF 44s and MSDSs/SDSs shall not be required for the transfer of maintenance or custodial PHM between the main point of use and individual job sites.

3.2.2.4 Support contractors shall provide appropriate PHM MSDSs/SDSs for materials in use or stored in the facility to FSHs or their representatives, if the materials will remain in the facility.

3.3 Contractor Purchase

3.3.1 Contractor order, procurement, handling, and disposal of PHM shall be done in accordance with the Statement of Work (SOW), the terms/conditions of the contract, and the requirements in this section.

CHAPTER 4: SAFETY DATA SHEETS (SDS)

4.1 Technical Assistance for SDSs

4.1.1 This chapter contains information for technical assistance in the preparation of SDSs. All LaRC-created MSDSs/SDSs shall be entered in the CMTS. LaRC-created MSDSs/SDSs shall be sent to the CMTS Administrator at LaRC-DL-CMTS@mail.nasa.gov.

4.2 MSDSs/SDSs Are Required for All PHM

4.2.1 A copy of the MSDS/SDS for each PHM used in facility research or maintenance operations shall be readily accessible to personnel in that facility.

4.3 PHM for LaRC Supply Stock

4.3.1 For PHM requested by the facility from the LaRC supply stock, MSDS/SDS information shall be maintained and forwarded by supply personnel when requested by the facility.

4.3.2 An LF 44 shall be noted in the supply catalog when required.

4.4 Trade Secret and Proprietary MSDSs/SDSs

4.4.1 Trade secret and proprietary MSDSs/SDSs exist, and their access and distribution are limited (under OSHA regulations) to medical and other selected personnel.

4.4.2 In these situations, the SFAB IH staff shall be contacted to acquire the necessary information to assist in working with authorized personnel to determine safe use of the materials.

4.4.3 MSDSs/SDSs so acquired shall be maintained by the SFAB IH staff.

4.5 Preparation of SDSs for Center-Developed Materials

4.5.1 Although a complete SDS is not required for materials transferred between facilities on Center, communication of basic hazard warning information shall be provided.

4.5.2 OSHA standard 29 CFR 1910.1200 defines the requirements by which SDSs shall be prepared for chemicals or mixtures of chemicals that are hazardous.

4.5.3 SDSs shall be prepared for all hazardous materials.

4.5.4 Because the information included in a SDS is from many diverse areas, a team approach shall be used to produce the SDS, with researchers and engineers collaborating with the SFAB IH staff, occupational physicians, environmental and fire safety engineers, and the shipping officials who have regulatory knowledge in their appropriate fields.

4.5.5 The generator (or responsible researcher) of the material shall have primary responsibility for the initiation and review of the SDS with contributions made from a number of different individuals.

4.5.6 SDSs shall be forwarded to the LaRC Safety Manager to start this process.

4.5.7 A SDS template, LF 367, has been developed to standardize the SDSs being produced at LaRC. Unknown or unavailable information or data shall be indicated as such.

4.5.8 When the final document is completed, an LF 175 shall be attached to the document and sent for approval to the Chairperson of the PHMC.

4.5.9 All SDSs prepared shall be reviewed by SFAB IH staff, the LaRC Safety Manager, and the PHMC.

4.5.10 Because review of a SDS may take up to 30 calendar days, it is necessary for researchers and engineers to anticipate the need for SDSs prior to shipment of their product off-site.

4.5.11 SDSs shall be prepared in advance for materials that may be needed for technology transfer operations.

4.5.12 These SDSs shall be shipped with the material, in compliance with OSHA standards 29 CFR 1910.1200 and 29 CFR 1910.1450.

4.5.13 SDSs shall be required to transfer materials off-site regardless of quantity

4.5.14 The 24-hour emergency point of contact required by OSHA for SDSs shall be the Emergency Dispatch Officer at the Fire Department.

4.5.15 The Fire Department provides a telephone service only and shall forward emergency calls to the SDS preparer (SFAB IH staff or responsible researcher) on the item.

4.6 NASA LaRC MSDS/SDS Library

4.6.1 The Standard Practice and Environmental Engineering Branch (SPEEB) shall maintain an electronic library of MSDSs/SDSs for all known PHM at the Center through the CMTS.

4.6.1.1 Information from MSDSs/SDSs along with inventory information collected in the CMTS shall be used to perform calculations for regulatory reports.

4.6.2 Accessing and Searching the MSDS/SDS Library

4.6.2.1 The MSDS/SDS Library can be accessed by anyone at the Center online at <https://emis.ndc.nasa.gov/cmts/index.htm>.

4.6.2.2 Instructions on how to use the Library are online or you may contact the CMTS Administrator at the following e-mail address LaRC-DL-CMTS@mail.nasa.gov.

4.6.3 Adding SDSs to the Library

4.6.3.1 LaRC continues to purchase new items to accomplish its research mission. In order to keep the Center's SDS Library up-to-date, Center personnel shall ensure that SDSs for new materials are submitted to SPEEB for entry prior to the purchase of a new PHM.

4.6.3.2 An SDS shall be submitted for entry to the SDS Library in one of the following ways:

- a. Mail a copy of the SDS to the CMTS Administrator at MS 136.

- b. E-mail an electronic copy of the SDS to the CMTS Administrator at LaRC-DL-CMTS@mail.nasa.gov.

CHAPTER 5: PHM PERMIT PROCESS

5.1 Preparation of LF 498s (Safety Permits)

5.1.1 Safety permits (LF 498s) issued for PHM shall be one of the administrative controls available to identify the personnel and procedures in use for higher risk PHM operations.

5.1.1.1 The need for and use of a safety permit (LF 498) shall be determined by the FSH, the LaRC Safety Manager, or the PHMC, and is initiated through the LF 118.

5.1.2 The following materials shall be considered for a PHM safety permit (LF 498):

- a. Materials which are regulated by OSHA as carcinogens; and
- b. Materials which OSHA considers “particularly hazardous substances” as defined in 29 CFR 1910.1450(e)(3)(viii), which include select carcinogens, reproductive toxins, and substances which have a high degree of acute toxicity.

5.1.2.1 Conditions of use, storage, and quantity of material used shall be considered when determining the need for a PHM permit.

5.1.2.2 Other potentially high-risk PHM where an LF 498 shall be needed are those materials for which data are not fully available.

5.1.2.3 These include research and development material where toxicity data are limited (which can include pre-preg material still under research and development and laser dyes). Further information on high-hazard material is presented in Chapter 6 of this LPR and LPR 1710.13.

5.1.3 CHPs shall be used in all laboratories that routinely synthesize chemicals. Laboratory-specific CHPs shall be developed in accordance with LPR 1710.13.

5.1.3.1 Process controls and procedures, rather than PHM-specific SDSs, shall be used to manage the risks from the PHM and their chemical intermediaries.

5.1.4 LF 498s shall be used to standardize procedures and identify training and personnel involved with high-risk operations associated with PHM.

5.1.5 The FSH or designated representative shall:

- a. Ensure the completion of an LF 118.
- b. Ensure the completion of an LF 66 for each individual actively involved in the operation.

5.1.5.1 After completion of any special training or medical requirements, these personnel shall be certified as “Chemical Workers” under LF 498.

5.1.6 After review and approval, LF 498 shall be issued to the facility.

5.1.6.1 A Chemical Worker's certification card (LF 62) shall be issued to each qualified individual.

5.1.6.2 The cards shall be revalidated annually by the SFAB IH staff, immediate supervisor, and the LaRC Safety Manager.

5.1.7 LF 118 shall be prepared by the FSH with the lead test engineer, and/or the researcher performing the work.

5.2 Elements Required to Obtain a Safety Permit (LF 498)

5.2.1 A summary of topics to consider during the preparation of LF 118 are as follows:

- a. The title of the project and a description of the operation.
- b. Procedures to be used during the process including all safety precautions.
- c. Type and amounts of material present (maximum at site).
- d. The amount of material in use during the process including hazardous material quantity, application rate, and flow.
- e. List of all personnel who will be working under the PHM Permit.
- f. Training planned for use of PHM named on LF 498.
- g. Additional information including:
 - (1) LF 66 for each civil servant listed on the LF 118.
 - (2) For each individual added after the issuance of an LF 498, forward an additional LF 66.
 - (3) Non-NASA personnel required to operate under the LF 498 shall forward equivalent requests through the FSH to SFAB.

5.2.2 A narrative shall be attached that details how the hazards of the PHM are to be controlled through operational procedures and hazard awareness by personnel. The goal of the narrative is to describe controls to reduce personnel and facility risks.

5.2.2.1 Narratives submitted with the LF 118 shall address the following topics as applicable:

- a. How the PHM is to be used and controlled.

Note: Use PHM with lower fire or health hazards where possible.
- b. Planned schedule of operations and estimated frequency of operations. Include comments on weekend operations and overnight or continuous process schedules, if applicable. These affect risk control procedures. Standard operations shall involve operators always present during normal day shifts unless otherwise noted.
- c. Ventilation system use, if needed (including laboratory hoods exhausting to outside with flow monitoring devices, dedicated exhaust systems, and low flow alarms).
 - (1) Ventilation alarm device descriptions shall state whether they alarm locally only or to other Center control points (e.g., Duty Officer, Fire Department).
 - (2) Responsibilities for calibration of monitoring devices shall be specified.
- d. Procedural controls planned (e.g., will hazardous gas piping systems be tested with inert gases for leaks prior to using toxic or flammable gases? Are gas

systems to be vented and shut off after each use or remain pressurized? Where will low-use PHM, such as calibration gases or materials, be stored during prolonged non-use periods?)

- e. PPE planned for routine operations.
- f. Warning alarms and monitoring devices planned for use in control of leak detection procedures (e.g., hydrogen gas alarm, hydrofluoric acid (HF) gas alarm for fluorine gas).
 - (1) Plans shall include how these alarms will be used to alert operators, other facility personnel, and/or the Fire Department.
 - (2) System shutdown or facility evacuation procedures shall be addressed in conjunction with these alarm set points.
- g. PHM spill or leak procedures shall be addressed.
 - (1) Minor spills, which are within the capability of the researcher to address, shall be handled by the researcher.
 - (2) Large spills shall be cleaned up following the guidelines in LPR 1710.13 and LPR 8500.1.
- h. Sketches of the operational area, the experimental layout, including piping and valve controls, as applicable.

5.3 LF 498 Approvals, Duration, and Renewals

5.3.1 The PHMC shall determine the approval duration of an LF 498.

5.3.1.1 Normally, FSHs shall request approvals for the duration of the research and development activity, if known.

5.3.1.2 Initial approvals shall be for a maximum of one year, and the FSH/project engineer shall reapply for LF 498.

5.3.1.3 Reapplications to continue work shall be submitted to a PHMC representative (normally, the SFAB IH staff) at least 30 days before expiration.

5.3.1.4 Maximum renewal periods for existing LF 498s shall be determined by the PHMC and shall not exceed four years.

5.3.2 Modification to existing LF 498s can be submitted at any time during the issuance.

5.3.2.1 When reviewed and approved, the PHMC shall issue a modified form.

5.3.2.2 A PHMC representative from SFAB or the SFAB IH staff, shall do initial reviews of new and renewal LF 498s.

5.3.2.3 Final approval of LF 498 shall be conducted by the PHMC and the LaRC Safety Manager.

5.4 Worker Training and Certification

5.4.1 The LF 498 process shall include a determination of and requirements for PHM personnel training and certification including hazard communication, CHP, periodic refresher, and medical surveillance.

5.4.1.1 Personnel training and certification shall be conducted in accordance with LPR 1740.6.

5.4.2 Hazard Communication Standard Training

5.4.2.1 All personnel who handle or are affected by PHM shall receive hazard communication standard training.

5.4.2.2 NASA personnel shall receive hazard communication standard training as soon as practical after being hired through courses provided by SFAB.

5.4.2.3 Contractors shall provide an equivalent program for on-site operations.

5.4.2.4 Hazard communication standard training shall cover the following topics:

- a. Means of identification of PHM (e.g., labeling on received containers, the workplace labeling system, and SDSs);
- b. Health hazard data;
- c. Fire, explosion, and reactivity data;
- d. Precautions for safe use, handling, storage, and disposal;
- e. Required protective clothing and equipment;
- f. Emergency and first aid procedures; and
- g. Methods and observations that may be used to detect the presence or release of a hazardous chemical in the work area.

5.4.2.5 Personnel shall be cognizant of this information prior to actually handling the PHM.

5.4.3 Chemical Hygiene Plan Training

5.4.3.1 Training for laboratory personnel operating under a CHP is in addition to the preceding requirements.

5.4.3.2 All personnel involved in processes conducted under a CHP shall be familiar with LPR 1710.13, LF 381, and LF 498 procedures for their operation and/or facility.

5.4.3.3 This training shall be the responsibility of the designated CHO.

5.4.3.4 Support shall be provided by the SFAB IH staff, as appropriate.

5.4.4 Periodic Refresher Training

5.4.4.1 Periodic refresher training shall be required if the hazardous materials change or the processes generating hazardous materials change.

5.4.4.2 This training shall be the responsibility of the FSH/CHO, with SFAB assistance, as needed.

5.5 Medical Surveillance

5.5.1 Medical monitoring of civil service personnel at risk from exposure to PHM shall be done by the Langley Occupational Health Clinic located at 17 Langley Blvd, Building 1216.

5.5.1.1 The requirements for medical surveillance are identified by Occupational Medical Examination Protocols (OMEPS) determined by the Langley Occupational Health Clinic and assessments of risk by the LaRC Safety Manager and his/her staff through periodic audits or special surveys of workplaces when requested by FSHs.

5.5.1.2 Other site or OSHA requirements, such as those determined in past labor management agreements or specific OSHA standards, shall also be used in determining the need for, and procedures in, examinations.

5.5.1.3 Medical surveillance requirements for contractor personnel shall be the responsibility of the contracting company and shall meet the requirements in NPR 1800.1.

5.5.1.4 The SFAB IH staff shall perform assessments of site PHM health risks and report these to FSHs and the LaRC Safety Manager.

5.5.2 FSHs and their designated representatives shall establish procedures for periodic reviews of their at-risk personnel population for the use of PHM.

5.5.2.1 At-risk personnel shall be identified to the Langley Occupational Health Clinic at the time of initial assignment to work with PHM through the use of LF 66.

5.5.2.2 Pre-certification and annual examinations, as well as examinations required due to exposure, shall be scheduled and conducted by the Langley Occupational Health Clinic in accordance with the applicable OMEP.

5.5.2.3 The completed LF 66s shall be maintained in individual medical records at the Langley Occupational Health Clinic.

5.5.3 The determination of the need for periodic medical surveillance of personnel shall depend on several factors, including the PHM in use, toxicity, manner, and duration of use, and potential routes of entry into personnel.

5.5.3.1 Depending on the nature of the hazards, medical surveillance may be recommended.

5.5.3.2 FSHs shall request assistance from the SFAB IH staff in the risk assessments as needed.

Note: Occasionally, such as in the use of research and development mutagenic material, additional input from the Langley Occupational Health Clinic may be needed to determine OMEP needs.

5.5.4 FSHs shall identify temporary or transient personnel (civil servant and contractor) who periodically come into their facility to work with PHM. Refer to LMS-CP-1710 for specific instructions for the temporary non-civil servant student/researchers process and respective mentor/supervisor, FSH/FC, and researcher responsibilities. For example, an engineer may come into their laboratory for 5 days per month over a 6-month period to perform “hands-on” work in PHM research and development of a new process.

5.5.4.1 If the risks warrant clinical monitoring, these temporary or transient personnel shall be identified to the Langley Occupational Health Clinic using LF 66 or equivalent contractor forms.

5.5.4.2 As a general rule, if other personnel receive clinical examinations for exposure for their daily work with low to moderately toxic material, these temporary personnel shall also be referred to the Langley Occupational Health Clinic for monitoring if they receive more than one month's (i.e., 20 working days) exposure in a year.

5.5.5 All personnel named on LF 498 shall be considered Chemical Workers.

5.5.5.1 Specific clinical examinations for Chemical Workers shall be determined by the Langley Occupational Health Clinic.

5.5.5.2 Procedures for the use of LF 498, LF 62, and clinical examinations are presented in LPR 1740.6.

5.5.5.3 Chemical Workers shall be the personnel who physically use the material or are, or could be, involved in the permitted operations.

5.5.5.4 Administration and management personnel shall not be considered Chemical Workers unless they actually work with the material named.

5.5.6 Reviews or updates to identify personnel needing, or no longer needing, PHM-related clinical examinations shall be conducted by FSHs after consultation with facility personnel, as circumstances warrant.

5.5.6.1 These clinical examination-listing updates shall be conducted by the SFAB IH staff during periodic industrial hygiene audits of facility operations.

5.5.7 The Langley Occupational Health Clinic shall, as circumstances warrant, notify the LaRC Safety Manager and FSHs on trends seen in the personnel population monitored through its OMEP program.

5.5.8 Clinical examinations required because of workplace exposures to PHM can be either recommended or required by a particular standard.

5.5.8.1 If medical surveillance is recommended and the individual declines to participate, the Langley Occupational Health Clinic shall obtain a statement, which shall be included in the individual's medical records.

5.5.8.2 The statement shall indicate that the individual understands the risk involved with declining to participate in the surveillance program.

5.5.8.3 The LaRC Safety Manager and FSHs shall be notified of concerning trends and when personnel decline to participate in the surveillance program.

5.5.9 If the medical examination is required by a particular standard, appropriate personnel (including supervisors and FSHs) shall be notified if the individual fails to complete medical monitoring examinations for the workplace PHM exposure.

CHAPTER 6: USE, HANDLING, STORAGE, AND LABELING OF PHM

6.1 Initial Acquisition or Transfer of PHM

6.1.1 Prior to initial acquisition or transfer of PHM, FSHs shall make the initial decision on the use of a particular PHM or PHM process in their facility.

6.1.1.1 The decision shall include the amount to be stored in the facility and the initial assessments for further safety and process control measures.

6.1.1.2 In cases where PHM pose a significant hazard because of their toxicity, flammability, or other potentially hazardous properties, control procedures and other operational details shall be documented and approved through the LF 498 process. The LF 498 process is discussed in Chapter 5 of this procedural requirement.

6.1.1.3 Assistance can also be provided by the LaRC Safety Manager, his/her staff, the PHMC, other LaRC committees, and other technical area experts.

6.2 Laboratory Operations

6.2.1 Laboratory operations and the production of PHM include chemical synthesis in laboratories and the transfer of test chemicals.

6.2.1.1 Laboratories performing these processes shall have a CHP as required by LPR 1710.13.

6.2.1.2 Laboratories operating under a CHP shall not be required to have MSDSs/SDSs for each chemical intermediary involved in the chemical process.

Note: Federal law requires an annual review of the CHP.

6.2.2 Transfer of Test Chemicals

6.2.2.1 On-site operations that produce test specimens of PHM for use in other facilities and/or special projects shall provide SDSs for use by other personnel working with the material.

Note: The LaRC SDS template is discussed in Chapter 4 of this procedural requirement.

6.2.2.2 SDSs produced shall be forwarded to the SFAB IH staff for review and submittal to the PHMC and LaRC Safety Manager.

6.3 Warning Labels and Hazard Information

6.3.1 Original Manufacturers' Containers (Primary Containers)

6.3.1.1 The material or its container shall be clearly labeled to identify the material (chemical or trade name) and to provide precautionary statements required by regulatory agencies or LaRC. OSHA standard 29 CFR 1910.1200 requires manufacturers, importers, and distributors to label each container of hazardous chemicals.

6.3.1.2 Each container of PHM received on Center shall have existing manufacturers' labels and the labels shall not be defaced.

6.3.1.3 All PHM used and stored on Center shall have a CMTS label with its inventory record number and MSDS/SDS Library part number.

6.3.1.4 Detailed information on CMTS labels is available online at <https://emis.ndc.nasa.gov/cmts/instruct/manuals/index.htm>. CMTS labels are generated after PHM are added to a facility's CMTS inventory.

6.3.2 Secondary Containers

6.3.2.1 If PHM are transferred into unmarked containers, these containers shall bear the name of the chemical, along with the diamond symbol of the National Fire Protection Association (NFPA) in accordance with NFPA 704 (Figure 6.1). This symbol indicates the severity of the hazard on a numerical scale of 0 to 4, and the type of hazard (i.e., health, flammability, or reactivity) according to a color code. The ranking of severity of the health hazard is based upon acute exposures, and therefore, may not adequately reflect the actual hazard associated with chronic exposures to relatively small quantities of the material. This labeling requirement also applies to bulk liquid storage and process tanks.

6.3.2.2 LaRC shall use the NFPA diamond as a warning symbol to increase personnel awareness of hazardous materials. For example, a laboratory squeeze bottle used to hold the cleaning solvent methyl ethyl ketone will have an NFPA diamond label with numbering for "HEALTH = 2," "FLAMMABILITY = 3," and "REACTIVITY = 0," along with the name "methyl ethyl ketone" or "MEK".

6.3.2.3 Any material subject to a specific OSHA labeling standard shall be labeled in accordance with those requirements in addition to those given above.

6.3.2.4 Figure 6.1 shows the diamond label and the rationale for assigning codes. Codes for several chemicals are found in NFPA 704. Personnel can also find these codes on an approved LF 44 or on CMTS by searching the inventory, as NFPA codes are entered into CMTS during IH PHM reviews. Assistance in assigning these codes may be obtained from the SFAB IH staff.

6.3.2.5 The diamond code information shall be entered on LF 44 when the request for PHM is submitted.

6.3.2.6 Labeling of all containers of experimental chemical materials shall be in compliance with OSHA standard 29 CFR 1910.1450.

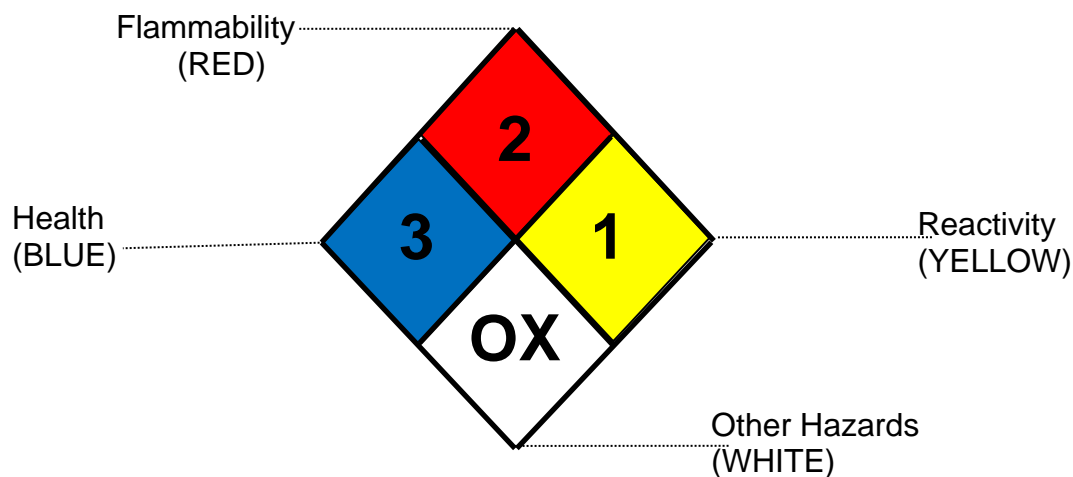
6.3.2.7 Samples that will be transferred outside the laboratory, or that may be handled by individuals not generally familiar with the type of material involved, shall be labeled as completely as possible, including the name, address, and telephone number of the sender and recipient for samples in transit.

6.3.3 Hazard Survey Information

6.3.3.1 The NFPA diamond symbol is intended to increase personnel awareness of the presence of PHM (see Figure 6.1). The actual hazard from a material depends on how it is used. Periodic audits and surveys shall be conducted by the SFAB IH staff to determine actual health hazards from hazardous material operations.

6.3.3.1.1 The results of these audits shall be reported back to the facilities.

Note: Personnel can request information on past surveys by contacting their supervisors, the LaRC Safety Manager, or the SFAB IH staff.



Identification of Health Hazards Color Code: BLUE		Identification of Flammability Color Code: RED		Identification of Reactivity Color Code: YELLOW	
Signal	Type of Possible Injury	Signal	Susceptibility of Materials to Burning	Signal	Susceptibility to Release of Energy
4	Materials, which on very short exposure could cause death or major residual injury even though prompt medical treatment, is given.	4	Materials, which will rapidly or completely, vaporized at atmospheric pressure and normal ambient temperature, or which are readily dispersed in air and	4	Materials, which in themselves are readily capable of detonation or of explosive decomposition or reaction at normal temperatures and pressures.
3	Materials, which on short exposure could cause serious temporary or residual injury even though prompt medical treatment, is given.	3	Liquids and solids that can be ignited under almost all ambient temperature conditions.	3	Materials which in themselves are capable of detonation or explosive reaction, but require a strong initiating source or which must be heated under confinement before initiating, or which react explosively with water.
2	Materials, which on intense or continued exposure could cause temporary incapacitation or possible residual injury unless prompt medical treatment,	2	Materials that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur.	2	Materials, which in themselves are normally unstable and readily undergo violent chemical change but do not detonate. Also materials, which may react violently with water or which may form potentially explosive mixtures
1	Materials, which on exposure could cause irritation but only minor residual injury, even if no treatment is given.	1	Materials that must be preheated before ignition can occur.	1	Materials, which in themselves are normally stable, but which can become unstable at elevated temperatures and pressures, or which may react with water with some, release of energy, but not violently.
0	Materials, which on exposure under fire conditions, would offer no hazard beyond that of ordinary combustible materials.	0	Materials that will not burn.	0	Materials, which in themselves are normally, stable, even under fire exposure conditions, and which are not reactive with water.

Other Hazards - Color Code: WHITE

Ox - Oxidizer

W - Use no water

Credit: NFPA 704

Figure 6.1, National Fire Protection Association Symbols.

6.4 Storage and Posting Areas with PHM

6.4.1 Before planning and conducting new operations involving PHM, the individuals shall incorporate all statutory storage requirements as promulgated by OSHA and any other national consensus standards.

Note: These include recommendations of the NFPA, Compressed Gas Association (CPA), and American National Standards Institute (ANSI).

6.4.1.1 Requirements for the storage of flammable materials are addressed in this chapter. Contact the LaRC Safety Manager or the LaRC Fire Chief if assistance is needed in determining flammable storage needs and requirements.

6.4.2 Storage of PHM

6.4.2.1 The requirements for the storage of PHM in a facility, or adjacent to a facility, are to minimize risks in the event of a fire or an accident. Technical guidance for gases is detailed in LPR 1710.13. Material quality storage requirements, such as the use of refrigerated storage to prolong the quality of the substance, are not considered or detailed in this chapter. For storage of environmentally regulated hazardous wastes, consult LPR 8500.1.

6.4.2.2 Fire codes for the storage of flammable materials in facilities have been incorporated into OSHA standards. These mandatory OSHA requirements are included in this chapter. For assistance in interpreting these laws, contact the LaRC Safety Manager or the LaRC Fire Chief.

6.4.3 Flammable and Combustible Liquids Storage

6.4.3.1 This section applies to the storage of flammable or combustible liquids in drums or other containers not exceeding 60 gallons of individual capacity and portable tanks not exceeding 660 gallons individual capacity. For further interpretation, contact SFAB.

6.4.3.2 Flammable or combustible liquids storage sites shall be inspected on a routine basis.

6.4.3.2.1 The inspections shall include, but not be limited to:

- a. Checking for expired chemicals.
- b. Leaking or corroded containers.
- c. Cleanliness of the site. There shall be no debris, especially flammable debris.
- d. Ensure all chemical containers are appropriately labeled
- e. There shall be no chemicals other than flammables and combustibles in the storage cabinet or storage area.
- f. Discrepancies shall be reported to the appropriate personnel: the FSH, FC, or the Facility Environmental Coordinator (FEC) for correction and/or disposal.

6.4.4 Design and Capacity of Containers

6.4.4.1 Only approved containers and portable tanks shall be used.

6.4.4.2 Metal containers and portable tanks meeting the requirements of and containing products authorized by Department of Transportation (DOT) standard 49 CFR pts. 171-180, shall be deemed to be acceptable.

6.4.4.3 The LaRC Fire Chief can provide guidance in these areas.

6.4.4.4 The SFAB IH staff can be contacted for guidance on the proper storage of laboratory chemicals at 4-SAFE (4-7233).

6.4.5 Peroxidizable Compounds

Note: Some chemicals form peroxides upon prolonged storage and/or contact with air.

6.4.5.1 A peroxide is a chemical that contains a peroxy unit (O-O), one that has the chemical formula O_2^{2-} . When the peroxide group is formed, these materials are heat-, shock-, friction-, and in some cases, light-sensitive. Peroxides can form even when these materials are refrigerated or inhibited. A list¹ of some of these chemicals is provided in Figure 6.2.

6.4.5.2 Personnel shall:

- a. Display prominently the date the container is opened on the container to ensure that the storage time limit of the peroxide-forming compound is not exceeded.
- b. Test quarterly containers of peroxide-forming compounds that have been opened for peroxides and label the container accordingly.
- c. Dispose of expired chemicals immediately. When possible, order peroxidizable compounds containing an inhibitor to slow the formation of peroxides. Be aware, however, that inhibitors can be consumed or degraded over time, resulting in an uninhibited peroxide compound.
- d. Notify the FSH prior to ordering unstabilized solvents required for research.
- e. Notify the FSH prior to the distillation or purification of a peroxidizable compound, either stabilized or unstabilized.
- f. Distill or purify only the amount of solvent that will be immediately used. **Do not distill to near dryness as this will lead to an explosive condition due to concentration of the peroxide.**
- g. Not store distilled or purified peroxidizable solvents.
- h. Not store peroxides in the refrigerator or freezer unless specifically recommended by the manufacturer.
- i. Exercise extreme caution and notify the FSH and LaRC Safety Manager for assistance as soon as possible if crystals are noticed on a container of peroxidizable compounds. On-site treatment of a peroxidizable compound is strictly prohibited.

¹ List from the National Research Council (US) Committee on Prudent Practices in the Laboratory's Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards, Updated Version (2011).

**CLASS A: SEVERE PEROXIDE HAZARD
SPONTANEOUSLY DECOMPOSE AND BECOME EXPLOSIVE WITH EXPOSURE
TO AIR WITHOUT CONCENTRATION
DISCARD 3 MONTHS AFTER THE CONTAINER HAS BEEN OPENED**

Isopropyl ether	Sodium amide (sodamide)
Butadiene (liquid monomer)	Tetrafluoroethylene (liquid monomer)
Chlorobutadiene (chloroprene) (liquid monomer)	Divinyl acetylene
Potassium amide	Vinylidene chloride
Potassium metal	

**CLASS B: PEROXIDE HAZARD ON CONCENTRATION
(DISTILLATION/EVAPORATION)
FORM EXPLOSIVE PEROXIDES WHEN DISTILLED, EVAPORATED, OR
OTHERWISE CONCENTRATED
DISCARD 1 YEAR AFTER THE CONTAINER HAS BEEN OPENED**

Acetal	Ethylene glycol dimethyl
Cumene	Ether (glyme)
Cyclohexene	Furan
Cyclooctene	Methyl acetylene
Cyclopentene	Methyl cyclopentane
Diaactylene	Methyl-isobutyl ketone
Dicyclopentadiene	Tetrahydrofuran (THF)
Diethylene glycol dimethyl ether (diglyme)	Tetrahydronaphthalene (tetralin)
Diethyl ether	Vinyl ethers
Dioxane (p-dioxane)	

**CLASS C: SHOCK AND HEAT SENSITIVE
HIGHLY REACTIVE AND CAN AUTO-POLYMERIZE AS A RESULT OF INTERNAL
PEROXIDE ACCUMULATION. PEROXIDES FORMED ARE EXTREMELY SHOCK
AND HEAT SENSITIVE***

DISCARD 1 YEAR AFTER THE CONTAINER HAS BEEN OPENED

Acrylic acid	Styrene
Butadiene (1,3-butadiene gas)	Vinyl acetate
Chlorotrifluoroethylene	Vinyl chloride
Ethyl acrylate	Vinyl pyridine
Methyl methacrylate	

*Under conditions of storage in the liquid state, the peroxide-forming potential increases and certain of these monomers (especially butadiene, chloroprene, and tetrafluoroethylene) should then be considered as A-list compounds.

Figure 6.2, Storage Time Limits of Peroxidizable Compounds

6.5 Off-Site and On-Site Transport of PHM Requirements

6.5.1 PHM Transportation Off-Site

6.5.1.1 PHM shall not be introduced into interstate commerce unless in full compliance with applicable regulations of 49 CFR parts 171-177, "Hazardous Materials Regulations."

6.5.1.2 Contact the LMO for assistance on shipment and for restrictions on the movement of PHM off-site.

6.5.1.3 PHM transported off-site shall be accompanied by an LF 44 and the appropriate MSDS/SDS.

6.5.1.4 The LF 44 shall be used to track transfers of LaRC PHM both on and off Center.

6.5.2 PHM Transportation On-Site

6.5.2.1 The on-site transportation of PHM shall be conducted by personnel trained in hazardous material transportation.

6.5.2.1.1 Contact the LMO for assistance in hazardous material transfer.

6.5.2.1.2 NASA personnel may use NASA vehicles for the limited on-site transfer of PHM. An example would be an emergency transfer of hydraulic fluid from stock or another on-site facility to support pump repair work for a wind tunnel.

6.5.2.1.3 PHM shall not be transferred using privately owned vehicles.

6.6 Hierarchy of Use of PHM, Accidents Involving PHM, and Disposal of Waste PHM

6.6.1 Users shall consider the use of alternative materials, ventilation, and PPE in all processes.

6.6.1.1 Whenever possible, the least hazardous materials shall be used.

6.6.1.2 If substitution is not possible, process ventilation shall be used to minimize hazards.

6.6.1.3 Ventilation design guidelines, as found in the American Conference of Governmental Industrial Hygienists' (ACGIH), "Ventilation Manual," shall be used.

6.6.1.4 As a last resort, PPE shall be relied on to minimize risks from PHM. Procedures for obtaining individual PPE (e.g., gloves, eyewear, respirators) are presented in LPR 1800.1.

6.6.1.5 FSHs may contact the SFAB IH staff for recommendations.

6.6.2 Emergencies

6.6.2.1 Reporting

6.6.2.1.1 All emergencies shall be reported by dialing 911 from any Center telephone or (757) 864-2222 from a cellular telephone.

Note: Dialing 911 from a cell phone at LaRC will direct calls to Hampton's emergency dispatch, not LaRC's emergency dispatch.

6.6.2.2 First Aid – Chemical Exposure

6.6.2.2.1 Basic first aid procedures shall be used as follows:

- a. Eye Contact
 - (1) Promptly flush eyes at an eyewash station for at least 15 minutes.
 - (2) Be sure to open lids while flushing.
- b. Skin Contact
 - (1) Promptly flush and wash the affected area with soap and water.
 - (2) If only the face is involved, the eye/face wash fountains can be used to flush the area with water.
 - (3) Remove all contaminated clothing in a manner that avoids further skin contact.
- c. Inhalation
 - (1) Immediately exit from the exposure area to seek fresh air. If water reactive chemicals are inhaled, symptoms may be delayed. Medical attention should be sought immediately.

Note: Always check the SDS for appropriate first aid response procedure prior to handling any chemical.

6.6.2.2.2 After the appropriate first aid has been applied, the affected personnel shall remain in a safe area and not leave the scene until emergency personnel have arrived and assessed the situation.

6.6.2.3 Accidents – Non-Chemical Exposure

6.6.2.3.1 In the event of a minor injury or illness, the injured person shall, with an escort, proceed immediately to the LaRC Clinic located at 17 Langley Boulevard (Building 1216) for treatment.

6.6.2.3.2 In the event of a serious injury or illness, dial 911 from any Center telephone or (757) 864-2222 from a cellular telephone.

6.6.2.3.3 All incidents shall be reported to the FSH and supervisor as soon as possible after receiving medical evaluation.

6.6.2.3.4 The FSH shall be responsible for notifying SFAB as soon as possible of all accidents, close calls, health-related incidents, or spills that could cause serious health hazards.

6.6.2.4 Chemical Spills

Note: Spill responses are detailed in Chapter 14 of LPR 8500.1.

6.6.2.4.1 A small-scale spill that can be safely cleaned by the user, shall be neutralized and absorbed or otherwise managed by the user. The user shall, immediately after cleanup, report the spill to the FSH or his/her designee.

6.6.2.4.2 All laboratory personnel working with chemicals shall be knowledgeable in the proper use of spill kits (as defined in LPR 8500.1) and their location.

6.6.2.4.3 For spills that cannot be safely managed by the user, the contaminated area shall be cleared of all personnel, and the Fire Department notified immediately either by dialing 911 from any Center telephone or by dialing (757) 864-2222 from a cellular telephone.

6.6.2.4.4 After emergency personnel, including the FSH or his/her designee or alternate are contacted, the chemical user shall secure the area until further instructions are issued.

6.6.2.4.5 In addition to notifying the FSH or his/her designee or alternate, SPEEB shall be notified at (757) 864-3500, in the event of a toxic chemical or oil spill that has the potential to contaminate the environment or represents a serious health hazard.

6.6.2.4.6 User responsibilities as outlined in this LPR shall be to maintain containment and clean-up supplies, identify the spilled material, estimate the volume, and clean up small-scale spills.

6.6.2.4.7 This LPR does not supersede LPR 8500.1 or other LaRC directives and procedural requirements concerning spill control.

6.6.2.5 Unscheduled Power Outage

6.6.2.5.1 All laboratories shall plan to safely secure operations in the event of an unscheduled power outage. Steps may include, but are not limited to:

- a. Ceasing all chemical reactions/experiments if possible.
- b. Turning off all heat sources.
- c. Ensuring that all electrical sources are in the "OFF" position.
- d. Leaving on all purges and cooling systems.
- e. Closing all laboratory hood sashes.

6.6.3 Waste PHM disposal shall be in accordance with federal, state, and local regulations, and LaRC procedural requirements presented in LPR 8500.1. Contact SPEEB for more information.

6.7 Carcinogens, Reproductive Hazards, and Other Materials

6.7.1 Materials that OSHA considers "particularly hazardous substances," as defined in 29 CFR 1910.1450(e)(3)(viii), which include select carcinogens, reproductive toxins, and substances which have a high degree of acute toxicity, shall be given specific considerations to include the following provisions where appropriate:

- a. The establishment of a designated area,
- b. The use of contamination control devices such as fume hoods or glove boxes,
- c. Procedures for the safe handling of contaminated waste, and
- d. Decontamination procedures.

6.7.1.1 Depending on the materials handled and the frequency and duration of the operation, these processes may require a PHM permit.

6.7.1.2 A "select carcinogen" is any substance that meets one of the following criteria:

- a. It is regulated by OSHA as a carcinogen; or
- b. It is listed under the category "known to be carcinogens" in the "Report on Carcinogens," published by the National Toxicology Program (NTP) (latest edition); or
- c. It is listed under Group 1 ("carcinogenic to humans") in "Monographs on the Identification of Carcinogenic Hazards to Humans," published by the International Agency for Research on Cancer (IARC) (latest editions); or
- d. It is listed in either Group 2A or 2B by the IARC or under the category "reasonably anticipated to be carcinogens" by the NTP and causes statistically significant tumor incidence in experimental animals.

6.7.1.2.1 Reproductive toxins are chemicals that affect the reproductive capabilities including adverse effects on sexual function and fertility in adult males and females, as well as adverse effects on the development of offspring. Chemicals classified as reproductive toxins in accordance with the Hazard Communication Standard (§1910.1200) shall be considered reproductive toxins for purposes of this LPR.

6.8 Biological Agents

6.8.1 Scope and Application

6.8.1.1 All operations requiring the use of biological agents at LaRC shall be in accordance with the Centers for Disease Control's guidance Biosafety in Microbiological and Biomedical Laboratories (BMBL).

6.8.1.2 All operations requiring the use of biological agents at LaRC shall obtain permits through the PHMC. The PHMC shall review the Standard Operating Procedure (SOP) drafted by the researcher for the control and use of biological agents as part of the permit process.

6.8.1.3 This SOP shall:

- a. Identify hazards.
- b. Specify standard and specific micro bacterial laboratory techniques.
- c. Create regulated areas.
- d. Provide for personnel training and medical monitoring.
- e. Detail the requirements for exposure monitoring.
- f. List the required PPE.
- g. Specify the proper procedures for the disposal of wastes.
- h. Anticipate spills and emergency response actions that may be required.

6.8.2 Principles of Biosafety

6.8.2.1 Levels of protection based on the relative ability of the organism to cause disease in normal healthy adult humans and the potential for transmission during laboratory manipulation are assigned to all biological agents.

6.8.2.2 Biosafety Level of 1 (BSL-1) is suitable for work involving well-characterized agents not known to cause disease in healthy adult humans. These agents are of minimal potential hazard to laboratory personnel and the environment.

6.8.2.3 Biosafety Level of 2 (BSL-2) is suitable for work involving agents of moderate potential hazard to personnel and the environment. These agents are associated with human disease and hazards exist from percutaneous injury, ingestion, and mucous membrane exposure to the agent.

6.8.2.4 No research shall be conducted using biological agents at levels higher than Biosafety Level of 1 (BSL-1).

6.8.2.5 Laboratories using biological agents shall be designed, built, and maintained at a Biosafety Level of 2 (BSL-2).

6.8.3 Addition of Biologically Active Materials to a Permitted Operation

6.8.3.1 New biological agents shall be added by the principal investigator and the FSH by submitting an LF 180, "Biological Agent Approval Form," to the PHMC.

6.8.4 A list of Certified Workers shall be included in each permit.

6.8.5 The recordkeeping requirements for Biological Agent Operations are:

- a. The laboratory shall keep a copy of the current permit and approved LF 180s in the laboratory.
- b. These forms shall be amended as required and submitted to the PHMC for review.

6.8.5.1 Biological agent permits shall be reviewed annually during the SFAB IH audit.

6.9 Storage, Use, and Disposal of "Sharps"

6.9.1 Exposure to chemicals and biological agents can occur by several different routes including inhalation, ingestion, absorption through skin or eyes, and injection. The purpose of this section is to control exposures caused by injecting chemicals or biological agents through the skin barrier.

6.9.2 Exposure to toxic agents by injection does not happen frequently in the laboratory, but it can occur inadvertently by mishandling "sharps" such as glass, syringes, or metals contaminated with toxic agents. The intravenous route is especially dangerous because it introduces the toxicant directly into the bloodstream, eliminating the process of absorption. Non-laboratory personnel such as custodial or maintenance staff, as well as laboratory personnel shall be protected from this form of exposure.

6.9.3 Hand injuries are the most common injuries in laboratories. Keeping all cutting and puncturing devices fully protected and employing utility knives instead of single edge razor blades as cutting tools can prevent many of these injuries.

6.9.3.1 Syringes with needles shall be used once, if possible, and then placed in a suitable disposal container. Injuries are more likely if the syringes are used more than once.

6.9.3.2 Kevlar gloves of different thicknesses shall be made available and shall be used when handling sharp objects, such as metal foil or picking up broken glass.

6.9.4 When using razor blades, foil, and syringes with needles, personnel shall:

- a. Order only the amount that will be used in the project and not stockpile these materials.
- b. Store razor blades, foil, and syringes with needles in protective boxes out of sight.
- c. Store razor blades, foil, and syringes with needles inside drawers or cabinets.
- d. Not leave razor blades, foil, or syringes with needles out on countertops or workstations where they could cause injury to others.
- e. Order special holding devices if the needles are required to be used repeatedly.
- f. Always order the blunt tip needles for laboratory work, if possible.
- g. Pay special attention to the storage of disposable sterile hypodermic syringes that could be pilfered for illegal uses.

6.9.5 The janitorial/custodial staff shall not pick up glass, even unbroken glass drink containers, from the regular trash. Use large cardboard disposal boxes to dispose of clean broken glass, bottles, capillary tubes, and Pasteur pipettes.

6.9.5.1 These boxes shall be:

- a. Purchased specifically for this purpose.
- b. Printed on the exterior of the box with "broken glass" warnings.
- c. Taped shut when full.
- d. Labeled with a "trash for disposal" sign and placed in the hallway for pickup.

6.9.6 Contaminated glass shall be disposed of in accordance with LPR 8500.1.

6.9.7 There are two types of "sharps" containers that may be found in the work area: those labeled with the universal biohazard label and those not so labeled.

- a. Chemically contaminated sharps shall be:
 - (1) Collected separately from the biologically contaminated sharps.
 - (2) Placed in a puncture proof "sharps" labeled container.
 - (3) Submitted on an LF 163 for disposal through Environmental. Contact Environmental for further guidance.
- b. Biologically contaminated sharps shall:
 - (1) Never be placed inside the cardboard "broken glass" boxes.
 - (2) Collected separately in a labeled "biological sharps" container.
 - (3) Disposed of through a vendor specializing in biological waste disposal.

6.9.8 Razor blades and scalpels shall be placed in the "sharps" containers after use, and they shall not be left out on countertops in the work area.

6.9.9 Do not overfill "sharps" containers as this increases the possibility of accidental injury.

6.10 Nanotechnology

6.10.1 Nanotechnology is the engineering and manipulation of materials at the nanoscale level. It is an emerging field that offers the potential for new and better materials and products; however, the impacts of nanomaterials and nanoproducts on the environment and human health are unknown.

6.10.1.1 Nanomaterial, as currently defined by the National Institute of Occupational Safety and Health (NIOSH), may pose an unusual risk to human health due to their unique composition, reactivity, size, and ability to cross membranes. All work with manufactured nanomaterial shall be prudently conducted in a manner that is responsible and safe.

6.10.1.2 All operations requiring the use and manufacturing of engineered nanomaterials at LaRC shall comply with NPR 1800.1.

6.10.1.2.1 Nanomaterials, nanoparticles, and nanotubes are classified as hazardous materials and require an LF 44 for procurement.

6.10.1.2.2 The nanomaterial properties (e.g., size, flammability, toxicity), the quantity of material being used or manufactured and the working conditions (e.g., airborne, encapsulated in a liquid or solid) will determine whether the process will require a PHM permit.

6.10.1.3 Transportation, storage, use, and disposal of manufactured nanomaterials shall be conducted in accordance with all federal, state, and local requirements.

6.10.1.4 Use of any manufactured nanomaterials that are defined as "chemical substances" under the Toxic Substances Control Act (TSCA) and which are not on the TSCA Chemical Substances Inventory shall be reported to the U.S. Environmental Protection Agency (EPA). A pre-manufacture notice shall be submitted to the EPA by anyone intending to manufacture or import a chemical substance that is not on the TSCA Chemical Substances Inventory.

6.10.1.5 Hazard assessments shall be conducted prior to beginning work with manufactured nanomaterials by the SFAB IH staff to identify appropriate work procedures, engineering controls, administrative controls, and PPE to ensure personnel safety. The assessment shall evaluate several factors, including, but not limited to, the physical and chemical properties of the nanomaterial, the process by which the material will be generated and/or used, and existing engineering controls (e.g., fume hood, glove box).

6.10.1.6 All exposures to manufactured nanomaterials shall be minimized to As Low As Reasonably Practicable (ALARP) levels, with the exception of material in solution or embedded in substrate where it cannot become airborne, by utilizing the basic hierarchy of controls described below:

- a. Engineering. In order to provide a safe work environment for faculty, staff, students, and visitors, engineering controls shall be maintained wherever manufactured nanomaterials are used or stored. These controls may include local exhaust ventilation and localized filtration.

- b. Administrative. Incorporate administrative controls into nanomaterial operations because, although traditional Permissible Exposure Limits (PELs) exist for many of the substances that manufactured nanomaterials are made from, the PEL for a nanomaterial of these substances is not yet clear. The incorporation of good work practices helps to minimize exposure to manufactured nanoparticles
- c. PPE. Typical chemistry laboratory apparel and PPE shall be worn when working with manufactured nanomaterials. This includes long pants, shirts, socks, and shoes, as well as safety glasses, laboratory coats, and gloves. Open sandals, shorts, and skirts are prohibited. When local exhaust ventilation and filtration is not available or feasible for work involving manufactured nanomaterials, respiratory protection shall be utilized. However, the preferred method for manipulating manufactured nanomaterials is in solution, and every effort shall be made to design and implement effective engineering controls for any operation where manufactured nanomaterials are used

6.10.1.7 Supervisors shall:

- a. Inform laboratory personnel of the risks associated with workplace hazards through training programs, MSDSs/SDSs, and labeling and signage.
- b. Request nanomaterial hazard evaluations.
- c. Enforce the use of engineering and administrative controls, including PPE.

6.10.1.8 Researchers shall:

- a. Develop written SOPs that include an exposure control plan with site-specific safety practices for nanomaterials; include the plan with the laboratory-specific Chemical Hygiene Plan (CHP) (LF 381) or as an SOP in the safety permit process, where applicable.
- b. Ensure that materials be used in accordance with this LPR.
- c. Use appropriate controls and follow PPE program procedures.
- d. Ensure that materials are disposed of properly.

6.10.1.9 All materials resulting from the cleanup of a manufactured nanomaterial spill shall be handled as though it were hazardous and include procedures for access control and cleanup of both dry and wet materials. SPEEB shall be contacted for guidance in determining appropriate waste disposal.

6.10.1.10 Waste disposal shall be addressed, focusing on characterization of the manufactured nanomaterial waste as either hazardous or non-hazardous, packaging, labeling, or transportation requirements, as appropriate

6.10.1.11 The safe work practices listed below shall be followed when working with nanomaterials:

- a. Use appropriate gloves when handling liquids that contain nanomaterials
- b. Use local exhaust ventilation when performing liquid operations that generate aerosols.
- c. Use enclosed systems if gas-phase aerosols may be generated.

- d. Use enclosed or local exhaust ventilation systems if handling powders.
- e. Use enclosures or local exhaust ventilation if machining, grinding, or sanding products with nanomaterials.

6.10.1.12 The good housekeeping practices listed below shall be followed when handling nanomaterials:

- a. Cleaning shall be performed using a wet method or a hepa vacuum. Dry sweeping is prohibited.
- b. Wet wipes shall be bagged so as not to re-aerosolize products.
- c. Compressed air hose for cleaning is prohibited.

6.11 Reproductive and Developmental Hazards

6.11.1 LaRC shall protect the reproductive health of the workforce and others from exposures to hazardous materials and articles (i.e., chemical, biological, radiological, and physical) that are known or suspected of being capable of posing a hazard to human reproduction.

6.11.2 LaRC shall identify potential reproductive and developmental hazards and implement appropriate exposure control measures.

6.11.3 Exposures shall be kept As Low as Reasonably Practicable (ALARP) as short-term exposures to reproductive hazards can result in long-term health effects, and a developing fetus may also be adversely affected by exposures lower than those generally considered safe for adults.

6.11.4 Responsibilities

6.11.4.1 SFAB is responsible for providing the IH support to perform workplace hazard assessments along with supervisors to determine where potential chemical, biological, or physical reproductive and developmental hazards exist, including:

- a. Identifying if these potential hazards present an exposure risk.
- b. Conducting and documenting qualitative exposure assessments of concerned personnel.
- c. Performing area or personal exposure monitoring, if indicated.
- d. Reviewing work practices and PPE and recommending additional controls, if needed.
- e. Reviewing past occupational health reports and historical sampling results, if available.
- f. Reviewing MSDSs/SDSs for hazards.
- g. Assisting with the developing and reviewing of the work procedures if a suspected reproductive hazard is identified.
- h. Assisting with the development of training on specific reproductive and developmental hazards in the work area, including the proper use of PPE and

safety devices, the use of engineering controls, and other methods of decreasing exposure, if a suspected reproductive hazard is identified.

- i. Providing technical information to the LaRC Occupational Health Clinic for decisions on the need for medical surveillance and for provision of counseling for personnel.

6.11.4.2 Supervisors are responsible for:

- a. Assessing the potential reproductive hazards of personnel's jobs.
- b. Providing specific operations training.
- c. Protecting the privacy of personnel.
- d. Sending personnel to required initial and refresher health and safety training.
- e. Providing personnel with appropriate PPE.
- f. Ensuring personnel use recommended PPE and other control measures provided.
- g. Identifying alternative job duties or temporary reassignments when required or, if alternative job duties are not available, counsel personnel about leave options.
- h. Notifying SFAB about any significant changes in the work environment of pregnant personnel.

6.11.4.3 Personnel are responsible for:

- a. Notifying their supervisors if they are pregnant, planning a pregnancy, or concerned that their jobs are affecting their reproduction.
- b. Notifying their supervisors for a review of the applicable job hazard analyses and any other hazard analyses relevant to their facilities or procedures for reproductive or developmental hazards.
- c. Contacting their employer's medical provider or the LaRC Occupational Health Clinic for counseling as needed.
- d. Requesting a workplace hazard assessment by the SFAB IH staff as needed.
- e. Following all recommended work practices and wearing appropriate PPE.
- f. Reporting all exposure incidents to their supervisors.
- g. Attending all required initial and periodic training.

6.11.5 Medical Surveillance for Reproductive and Developmental Hazards

6.11.5.1 The type of medical surveillance required is based on the specific chemical or physical hazard present and the degree of potential exposure. The content of medical exams shall be determined by a physician with input from the SFAB IH staff, as appropriate, according to LaRC occupational health guidelines developed for chemical and physical exposure hazards.

6.11.5.2 Personnel working with reproductive health hazards shall undergo an occupational health consultation, if pregnant, as well as an examination, if deemed appropriate by the physician.

6.11.5.3 The LaRC Occupational Health Clinic is responsible for:

- a. Counseling personnel and performing medical surveillance, as appropriate, or assisting with referrals for medical counseling.
- b. Obtaining a written statement from the physician managing the pregnancy indicating whether or not the individual may continue working and listing any specific limitations, if any.
- c. Referring personnel to the appropriate specialist (e.g., health physicist, industrial hygienist, or ergonomic evaluator) for evaluation, depending on the nature of a potential hazard.
- d. Managing the written declaration of pregnancies for personnel exposed to radiological hazards or consulting with personnel's outside medical service providers.
- e. Maintaining complete, accurate records of all medical examinations conducted in house for personnel in the medical surveillance program.
 - (1) Records shall be retained for 30 years plus employment.
 - (2) Results of examinations shall be discussed with personnel as needed.
- f. Reviewing the following information with the assistance of the SFAB IH staff, as appropriate, during counseling: exposure potential; recommended work practices and PPE to minimize the risk of exposure; risks to reproductive health, the fetus, and breast milk; material safety data sheets for materials handled by the individual; occupational exposure limits; and available toxicity data for the chemicals being used or handled.
- g. Identifying examination elements following an exposure incident and sharing that information with other medical providers providing services to exposed personnel.
- h. Protecting the privacy of personnel.

APPENDIX A. DEFINITIONS

Acute Exposure. Short duration contact, typically minutes or hours.

Asphyxiatory. Capable of causing injury by depriving the body of oxygen. Substances producing this effect by dilution of atmospheric oxygen are referred to as simple asphyxiants.

Carcinogenic. Capable of causing cancer.

Note: MSDSs/SDSs are required to list any carcinogens present.

Chronic Exposure. Long duration contact, typically days, months, or years.

Permissible Exposure Level (PEL). Airborne concentration exposure standards are specified by federal regulation (OSHA, 29 CFR). Concentrations may be for 8-hour workdays or shorter periods (usually 15 minutes). See also Threshold Limit Values.

Reproductive Toxins. Chemicals that affect the reproductive capabilities including adverse effects on sexual function and fertility in adult males and females, as well as adverse effects on the development of the offspring.

Select carcinogen. Any substance which meets one of the following criteria:

- a. It is regulated by OSHA as a carcinogen; or
- b. It is listed under the category, "known to be carcinogens," in the Annual Report on Carcinogens published by the NTP (latest edition); or
- c. It is listed under Group 1 ("carcinogenic to humans") in "Monographs on the Identification of Carcinogenic Hazards to Humans," published by the IARC (latest editions); or
- d. It is listed in either Group 2A or 2B by the IARC or under the category, "reasonably anticipated to be carcinogens" by the NTP, and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:
 - (1) After inhalation exposure of 6–7 hours per day, 5 days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m³;
 - (2) After repeated skin application of less than 300 (mg/kg of body weight) per week; or
 - (3) After oral dosages of less than 50 mg/kg of body weight per day

Threshold Limit Value (TLV). Airborne concentration at or below which it is believed nearly all personnel may be repeatedly exposed day after day with no adverse effect. Usually expressed in parts per million (ppm) for gases or vapors and milligrams per cubic meter (mg/m³) for dusts, fumes, and mists. Threshold Limit Values are specified by the American Conference of Governmental Industrial Hygienists and several have been adopted for use by OSHA.

Working Alone. Personnel shall be considered to be working alone when they are performing work while out of audio or visual contact with coworkers.

APPENDIX B. ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
ALARP	As Low As Reasonably Practicable
ANSI	American National Standards Institute
BSC	Biological Safety Cabinet
BSL	Biosafety Level
CAS	Chemical Abstract Service
CDC	Centers for Disease Control
CFR	Code of Federal Regulations
COD	Center Operations Directorate
CP	Center Procedures
CPA	Compressed Gas Association
CHO	Chemical Hygiene Officer
CHP	Chemical Hygiene Plan
CMP	Configuration Management Program
CMTS	Chemical Material Tracking System
CWA	Clean Water Act
DOT	Department of Transportation
EPA	Environmental Protection Agency
ESC	Executive Safety Council
FC	Facility Coordinator
FEC	Facility Environmental Coordinator
FSH	Facility Safety Head
HF	Hydrofluoric Acid
HRO	Human Resources Office
IARC	International Agency for Research on Cancer
IH	Industrial Hygiene
LAPD	Langley Policy Directive
LaRC	Langley Research Center
LEL	Lower Explosive Limit
LF	Langley Form
LMS	Langley Management System
LPR	Langley Procedural Requirement
LMO	Logistics Management Office
MSDS	Material Safety Data Sheet

NASA	National Aeronautics and Space Administration
NFPA	National Fire Protection Association
NIH	National Institutes of Health
NIOSH	National Institute of Occupational Safety and Health
NTP	National Toxicology Program
OCHMO	Office of the Chief Health and Medical Officer
OHO	Occupational Health Officer
OSHA	Occupational Safety and Health Administration
OMEP	Occupational Medical Examination Protocol
PEL	Permissible Exposure Limit
PHM	Potentially Hazardous Materials
PHMC	Potentially Hazardous Materials Committee
PPE	Personal Protective Equipment
PR	Purchase Requisition
SDS	Safety Data Sheet
SFAB	Safety and Facility Assurance Branch
SMAO	Safety and Mission Assurance Office
SOP	Standard Operating Procedure
SOW	Statement of Work
SPEEB	Standard Practice & Environmental Engineering Branch
TSCA	Toxic Substances Control Act
UEL	Upper Explosive Limit

APPENDIX C. REFERENCES

- a. Kirk-Othmer Encyclopedia of Chemical Technology.
- b. Matheson Gas Data Book, Handbook of Compressed Gas.
- c. Centers for Disease Control and Prevention National Institute for Occupational Safety and Health, National Institute for Occupational Safety and Health (NIOSH) Pocket Guide to Chemical Hazards.
- d. National Research Council (US) Committee on Prudent Practices in the Laboratory, Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards, Updated Version (2011).

APPENDIX D. ITEMS MANAGED AS HAZARDOUS MATERIALS AT LARC

Note: This is a non-exhaustive list. This information may also be found in CMTS on the FAQ page¹. The SFAB IH are available to answer additional questions.

D.1. Items Managed as Hazardous Materials at LaRC

D.1.1 A hazardous material is a substance that because of its quantity, concentration, or physical/chemical characteristics, poses a potential hazard to human health and safety or to the environment. Hazardous material management at NASA LaRC follows LMS-CP-4759. The following items are managed as hazardous materials at the Center:

- a. Chemicals
- b. Compressed and Liquefied Gases
- c. Paints
- d. Dopes and Varnishes
- e. Preservation and Sealing Compounds
- f. Solvents and Cleaners
- g. Adhesives and Epoxies
- h. Fuel Oils
- i. Solid Fuels
- j. Coolants, Oils, and Greases (e.g., hydraulic oils, lubricating oils, cutting fluids, antifreeze)
- k. Liquid Propellants and Fuels (e.g., petroleum or chemical based)
- l. Welding, Soldering, and Brazing Materials
- m. Dyes
- n. Pesticides
- o. Lead Acid Batteries

Note: Alkaline batteries (e.g., 9-Volt) are not managed as hazardous materials at LaRC.

D.2 Items not managed as Hazardous Materials at LaRC

D.2.1 Some items that pose only a slight health or safety risk are not managed as hazardous materials at LaRC. These items may have an accompanying MSDS/SDS and warning information on the label. These products must be stored, managed, and used responsibly, following the guidelines provided on the MSDS/SDS. However, these lower risk items are not managed as hazardous materials under LMS-CP-4759, and do not require the submittal of LF 44 or tracking in CMTS.

D.2.2 Items that are not managed as hazardous materials at LaRC include office and

¹ The list of items managed as hazardous material at LaRC may be found on CMTS at https://emis.ndc.nasa.gov/cmts/instruct/manuals/helpme/hazmat_new.htm.

household products used for the product's specified purpose and procured in a normal consumer quantity. Examples of these items are:

- a. Office supplies such as correction fluid, ink pens, canned air, magic markers, printer cartridges, toner cartridges, tape, and surface cleaners for personal spaces.
- b. Household consumer products such as bleach, glass cleaner, disinfectants, air fresheners, soaps, lotions, alkaline batteries, and personal insect repellants (the type applied to your person, e.g., OFF).

Note: Some of these products are acquired in larger containers than those normally procured for household use (e.g., a 5-gallon jug of Windex used for dispensing to smaller containers). In these cases, the items would be managed as hazardous materials.

D.2.3 Personnel may call (757) 864-7233 (4-SAFE) with questions about whether a particular product is required to be managed as a hazardous material under LMS-CP-4759.