

**Langley
Procedural
Requirements****LPR 1710.13 D****Effective Date: February 22, 2023****Expiration Date: February 28, 2028****Subject: Chemical Hygiene Plan****Responsible Office: Safety & Mission Assurance Office****TABLE OF CONTENTS**

PREFACE	3
P.1 PURPOSE	3
P.2 APPLICABILITY	3
P.3 AUTHORITY	3
P.4 APPLICABLE DOCUMENTS AND FORMS	4
P.5 MEASUREMENT/VERIFICATION	4
P.6 CANCELLATION	4
CHAPTER 1: INTRODUCTION	5
1.1 GENERAL	5
1.2 RESPONSIBILITY	5
CHAPTER 2: SAFE LABORATORY PRACTICES	7
2.1 DRESS CODE	7
2.2 EATING/DRINKING	7
2.3 HYGIENE/HOUSEKEEPING	7
2.4 USE OF ELECTRONIC DEVICES	7
2.5 EMERGENCIES	8
2.6 EMPLOYEE EXPOSURE/PROTECTION	8
2.7 PERSONAL PROTECTIVE EQUIPMENT	9
2.8 TRAINING	10
2.9 MEDICAL CONSULTATION/EXAMINATION	10
2.10 SAFETY DATA SHEET (SDS) PROGRAM	10
2.11 CONTAINER WARNING LABELS AND HAZARD INFORMATION	11

2.12 HAZARDOUS WASTE HANDLING AND DISPOSAL.....	12
CHAPTER 3: PROCEDURES FOR WORKING WITH SPECIFIC CHEMICAL CLASSES.....	13
3.1 HANDLING OF HAZARDOUS MATERIALS.....	13
3.2 ACIDS.....	14
3.3 BASES/CAUSTICS.....	14
3.4 OXIDIZERS	14
CHAPTER 4: PROCEDURES FOR WORKING WITH TOXIC SUBSTANCES.....	16
4.1 HANDLING OF TOXIC SUBSTANCES	16
4.2 REPRODUCTIVE HAZARDS	16
4.3 SELECT CARCINOGENS	17
4.4 SENSITIZERS	18
4.5 HIGHLY TOXIC CHEMICALS.....	18
CHAPTER 5: PROCEDURES FOR WORKING WITH FLAMMABLES/EXPLOSIVES AND OTHER HAZARDS.....	19
5.1 FLAMMABLES.....	19
5.2 PEROXIDES.....	19
5.3 PYROPHORICS	21
5.4 COMPRESSED GASES	21
5.5 CRYOGENIC LIQUIDS AND ASPHYXIAN GASES	22
5.6 WATER REACTIVE CHEMICALS	23
CHAPTER 6: PROCEDURES, ACTIVITIES, AND OPERATIONS REQUIRING PRIOR APPROVAL BEFORE IMPLEMENTATION.....	25
6.1 GENERAL.....	25
6.2 DESIGNATED WORK AREAS	25
CHAPTER 7: LABORATORY HOOD PROGRAM	26
7.1 INTRODUCTION	26
7.2 VENTILATION SPECIFICATIONS.....	26
7.3 LABORATORY HOOD GUIDELINES	26
APPENDIX A. DEFINITIONS.....	28
APPENDIX B. ACRONYMS	29

PREFACE

P.1 PURPOSE

- a. This Langley Procedural Requirement (LPR) has been developed in accordance with OSHA 29 CFR 1910.1450, "Occupational Exposure to Hazardous Chemicals in Laboratories." It outlines specific workplace practices and procedures to ensure that personnel are protected from health hazards associated with the chemicals with which they work.

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. Occupational Safety and Health Standards, 29 Code of Federal Regulations (CFR) pt. 1910.
- b. General Information, Regulations, and Definitions, 49 CFR pt. 171.
- c. Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, Training Requirements, and Security Plans, 49 CFR 172.
- d. NASA Procedural Requirement (NPR) 1800.1, NASA Occupational Health Program Procedures.
- e. NPR 8715.3, NASA General Safety Program Requirements.

P.4 APPLICABLE DOCUMENTS AND FORMS

- a. Toxic and Hazardous Substances, 29 CFR 1910 Subpart Z.
- b. Hazard Communication, 29 CFR §1910.1200.
- c. Occupational Exposure to Hazardous Chemicals in Laboratories, 29 CFR §1910.1450.
- d. LPR 1710.7, Safety Program for the Handling and Use of Explosives at Langley Research Center.
- e. LPR 1710.12, Potentially Hazardous Materials-Hazard Communication Standard.
- f. LPR 1740.6, Personnel Safety Certification.
- g. LPR 1800.1, LaRC Occupational Health Program.
- h. LPR 8500.1, LaRC Environmental and Energy Program Manual.
- i. LF 118, Safety Permit Request - Hazardous Material.
- j. LF 381, Laboratory Specific Chemical Hygiene Plan (CHP) Information.
- k. LF 498, Safety Permit.
- l. ANSI/ISEA Z87.1, Standard for Safety Glasses.
- m. International Agency for Research on Cancer (IARC), Monographs on the Identification of Carcinogenic Hazards to Humans (latest editions)¹.
- n. National Toxicology Program (NTP), Report on Carcinogens (latest edition)².

P.5 MEASUREMENT/VERIFICATION

- a. Annual Industrial Hygiene and Safety audits conducted by the Safety and Facility Assurance Branch.
- b. Annual review of laboratory specific chemical hygiene plans by laboratory personnel.

P.6 CANCELLATION

LPR 1710.13 C-1, dated March 30, 2018

/s/ David F. Young February 22, 2023

Center Deputy Director

Date

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

¹ <https://publications.iarc.fr/Book-And-Report-Series/Iarc-Monographs-On-The-Identification-Of-Carcinogenic-Hazards-To-Humans>

² <https://ntp.niehs.nih.gov/go/roc14>

CHAPTER 1: INTRODUCTION

1.1 GENERAL

1.1.1 Information in this Langley Procedural Requirement (LPR) shall be supplemented with a Laboratory Specific Chemical Hygiene Plan (CHP) developed using Langley Form (LF) 381.

1.1.2 Each organization shall maintain a CHP for each laboratory.

1.1.3 The CHP shall be posted in a conspicuous location at each individual laboratory.

1.1.4 The CHP shall be reviewed annually by all personnel that work in the laboratory. Personnel shall sign the LF 381 after reviewing the CHP.

1.1.5 The CHP is not a substitute for existing safety handbooks, regulations, or operating procedures, but rather a summary or supplement, relevant to LaRC laboratories.

1.1.6 Laboratory personnel are responsible for reading and being familiar with the requirements in this LPR, LPR 1710.12, Laboratory Specific CHPs for their work areas, and other required safety-related documents, including the contents of OSHA regulatory Standard 29 CFR 1910.1450.

1.1.7 Personnel are expected to know:

- a. Who to contact concerning safety-related matters.
- b. Where to find safety-related documentation and reference materials.

1.2 RESPONSIBILITY

1.2.1 The LaRC Safety Manager shall:

- a. Be responsible for the development of safety programs as outlined in LaRC directives and procedural requirements, including overall responsibility for CHPs.
- b. Shall ensure chemical procedures at LaRC are in accordance with state, local and federal regulations.
- c. Monitor the procurement, storage, use, and disposal of chemicals used.
- d. Approve all safety permits and chemical worker certifications.
- e. Assist project directors in the development of precautions and identification of applicable facilities for the work.
- f. Conduct periodic ventilation measurements to assure proper functioning of fume hoods and other local exhaust ventilation equipment.

1.2.2 Chemical Hygiene Officer (CHO)/Facility Safety Head (FSH)

1.2.2.1 For laboratories operating under a CHP, the FSH shall be the designated CHO.

1.2.2.2 The CHO/FSH shall:

- a. Monitor the procurement, storage, use, and disposal of chemicals within their facilities.

- b. Provide technical guidance in the development and implementation of the provisions of the CHP and applicable LF 498s.
- c. Know the current legal requirements concerning regulated substances.
- d. Coordinate necessary training in accordance with this LPR.
- e. Establish and review normal and emergency operating procedures.
- f. Consult with the Safety and Facility Assurance Branch (SFAB) Industrial Hygiene (IH) staff concerning chemical control measures, including ventilation and personal protective equipment (PPE).
- g. Annually review and sign the CHP.

1.2.3 Laboratory supervisors shall:

- a. Ensure that personnel know and follow the chemical hygiene rules, that PPE is available and in working order, and that appropriate training has been provided.
- b. Plan each operation in accordance with the facility's chemical hygiene procedures.
- c. Know the current legal requirements concerning regulated substances.

1.2.4 All laboratory personnel shall:

- a. Read and understand this LPR, the CHP, and Safety Permits for all laboratories in which they work.
- b. Conduct each operation in accordance with the facility's chemical hygiene procedures.
- c. Be informed of the hazards associated with each chemical being used, by reviewing Safety Data Sheet (SDS) information prior to use.
- d. Understand hazard control procedures, including decontamination procedures of work surfaces and removal of contaminated waste containing carcinogens, reproductive toxins, and acutely toxic chemicals.
- e. Know and use required PPE for each operation.
- f. Practice good personal hygiene habits.

CHAPTER 2: SAFE LABORATORY PRACTICES

2.1 DRESS CODE

2.1.1 Clothing worn by laboratory personnel shall protect the body from chemical exposure or burns.

2.1.2 Shorts, cut-off sleeves, fishnet shirts, and tank tops shall not be permitted at any time.

2.1.3 Personnel shall not be permitted to work shirtless or barefoot.

2.1.4 Perforated shoes, high-heel, open-toe and open-heel shoes, sandals, or clogs shall not be permitted in laboratories. Shoes shall have stable soles that provide traction in slippery or wet environments to reduce the chance of falling.

2.1.5 Laboratory coats shall be worn over street clothing to prevent the transfer of hazardous materials from the work to home environment.

2.2 EATING/DRINKING

2.2.1 Consumption of food or beverages shall not be permitted in the laboratory and process areas.

2.2.2 Glassware or utensils that have been used for laboratory operations shall never be used for food or beverages.

2.2.3 Laboratory refrigerators and ice machines shall not be used for food storage.

2.2.4 The ice from laboratory ice machines shall not be used in beverages.

2.2.5 Labels shall be posted on all laboratory refrigerators, microwave ovens, and ice machines indicating that they are unsafe for food use.

2.3 HYGIENE/HOUSEKEEPING

2.3.1 Mouth suction shall not be used to pipette chemicals or to start a siphon.

2.3.1.1 A pipette bulb or aspirator shall be used to provide vacuum.

2.3.2 Hands and exposed skin shall always be washed with soap and water before personnel leave the laboratory area and before and after glove use.

2.3.2.1 Solvents shall not be used for washing skin.

2.3.2.2 The application of cosmetics shall not be allowed in a laboratory or process areas of a facility.

2.3.2.3 Protective gloves and clothing shall be used to keep chemicals off skin.

2.3.3 The laboratory area shall be kept clean and free from obstructions.

2.3.4 For storage, use, and disposal procedures for "sharps," see LPR 1710.12.

2.4 USE OF ELECTRONIC DEVICES

2.4.1 Personnel shall not use devices that will distract their attention while engaged in hazardous operations or activities unless those devices are required to properly perform the operation or activity.

2.4.2 These devices include telephones, cell phones, smart phones, tablets, audio devices, radios, televisions, etc.

2.4.3 Hazardous operations include operations or activities that require constant attention to prevent an undesired event which could result in death, personal injury, or damage to equipment.

2.5 EMERGENCIES

2.5.1 Reporting

2.5.1.1 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.

2.5.2 For emergency procedures, including reporting emergencies, first aid for both chemical and non-chemical exposures, and chemical spills, see LPR 1710.12.

2.6 EMPLOYEE EXPOSURE/PROTECTION

2.6.1 To protect personnel health, LaRC uses the most conservative exposure limits to hazardous chemicals from the following sources:

- a. The American Conference of Governmental Industrial Hygienists produces annual lists of Threshold Limit Values and Short Term Exposure Limits for common chemicals used in laboratories.
- b. The National Institute of Occupational Safety and Health has developed recommended exposure standards.
- c. OSHA has also developed regulatory standards called Permissible Exposure Limits (PELs), which define allowable maximum personnel exposure levels.

2.6.2 Exposure to hazardous chemicals can be minimized by understanding the common routes of exposure.

a. Inhalation

- (1) Inhalation of toxic vapors, mists, gases, or dusts can produce poisoning by absorption through the mucous membrane of the mouth, throat, and lungs and can seriously damage these tissues by local action.
- (2) Adequate ventilation shall be provided to prevent inhalation exposure.

b. Ingestion

- (1) Many chemicals used in the laboratory are extremely dangerous if they enter the mouth and are swallowed.
- (2) To prevent entry of toxic chemicals into the mouth, laboratory personnel shall wash their hands with soap and water before eating, smoking, or applying cosmetics, immediately after use of any toxic substance, and before leaving the laboratory.

c. Skin and Eye Absorption

- (1) Contact with the skin is a common mode of chemical injury. Chemicals enter the skin through hair follicles, sweat glands, and cuts or abrasions on outer layers of the skin. Some chemicals can be absorbed directly through the skin into the bloodstream. Skin can also be damaged by corrosives, which then allows chemicals to enter the body. Skin contact can be prevented by use of appropriate protective equipment.

d. Injection

- (1) Exposure to chemicals through injection is the least common exposure route. It is possible to be exposed to chemicals through mechanical injury from glass or sharp metal (such as needles or razor blades) contaminated with chemicals. Safe work practices are the best preventive measure for avoiding exposure through injection.

2.7 PERSONAL PROTECTIVE EQUIPMENT

2.7.1 Personal protective equipment that shall be worn in laboratories includes, but is not limited to:

a. Gloves

- (1) When handling any chemical, gloves shall be worn.
- (2) Contact the SFAB IH staff at 757-864-7233 for glove selection guidelines.

b. Hearing Protection

- (1) Whenever personnel noise exposure exceeds 85 decibels, personnel shall wear hearing protection.
- (2) Hearing protection shall be worn if operating any equipment posted with hazardous noise warning or if working in a designated hazardous noise area.

c. Respirators

- (1) When exposures to dust, fumes, mist, radio-nuclides, gases, and vapors exceed established limits of exposure, respiratory protection shall be required.

d. Safety Glasses

- (1) Personnel shall wear safety glasses that comply with ANSI/ISEA Z87.1 at all times in laboratories.
- (2) Operations that require improved protection against impact, liquid splash, and other eye hazards shall require safety goggles and/or face shields.
- (3) All visitors entering laboratories shall be required to wear safety glasses that comply with ANSI/ISEA Z87.1.
- (4) Contact lenses shall not be worn in work areas.
 - (a) If contact lenses are needed for medical reasons, they shall be used in conjunction with goggles.
 - (b) During an emergency, contact lenses shall be removed before eye irrigation.

- (c) Personnel shall contact their FSH or SFAB IH staff if they have a doctor's recommendation to wear contact lenses.

- e. Lab Coats

- (1) Lab coats shall be worn when working with chemicals to protect exposed skin and to prevent contamination of clothing.
 - (2) All visitors entering laboratories shall be required to wear a lab coat.

2.7.2 Personnel shall be trained in the proper use and maintenance of provided protective clothing and equipment, in accordance with Federal and Agency regulations.

2.7.3 Specific requirements concerning PPE are detailed in LPR 1800.1.

2.8 TRAINING

2.8.1 All personnel under a Potentially Hazardous Materials (PHM) permit or CHP shall be certified as Chemical Workers per LPR 1740.6.

2.8.2 The CHO/FSH or designee shall provide additional training to cover elements of the CHP to all personnel upon entry and on an annual basis.

2.8.3 Supervisors and FSHs shall be trained regarding hazards and appropriate protective measures so they can be available to answer questions from personnel and provide daily monitoring of safe work practices.

2.8.4 As new hazards are introduced, the CHP shall be updated, and additional training shall be provided to all affected personnel. The supervisor is responsible for maintaining training records

2.9 MEDICAL CONSULTATION/EXAMINATION

2.9.1 In accordance with LPR 1740.6, Chemical Workers shall undergo medical examination in accordance with LaRC Occupational Medical Examination Protocols (OMEPS).

2.9.2 Civil servants shall receive medical examinations at the occupational medicine clinic in building 1216, in accordance with LaRC OMEPS.

2.9.2.1 Contracts issued by LaRC shall require the same level of examination for contract personnel in accordance with LaRC OMEPS.

2.9.2.2 Examination requirements of contract personnel shall be the responsibility of the contracting company.

2.10 SAFETY DATA SHEET (SDS) PROGRAM

2.10.1 SDSs provide an excellent source of specific information on the chemicals which personnel must handle. SDSs inform personnel about the hazards posed by the chemicals, how to protect themselves against those hazards, as well as how to respond to emergency situations.

2.10.2 OSHA requires all employers to maintain a complete and accurate SDS for each hazardous chemical used in facility research or maintenance operations. SDSs shall be readily accessible (e.g., Chemical Material Tracking System (CMTS)) to personnel in those facilities.

2.10.3 All chemicals entering LaRC shall be accompanied by a SDS. 29 CFR 1910.1200 and 29 CFR 1910.1450 require manufacturers/suppliers to supply SDSs when materials are purchased.

2.10.4 No laboratory work shall be started unless a SDS for each chemical being used is present in CMTS. CMTS is the primary location of all SDSs for LaRC.

2.10.4.1 SDSs shall be readily available in the CMTS database at <https://emis.ndc.nasa.gov/cmts/index.htm>.

2.10.5 SDSs for chemicals shall be obtained from the manufacturer and entered into CMTS when the chemicals are ordered.

2.10.6 SDSs shall be updated as per LPR 1710.12.

2.10.7 Experimental materials that are generated on-site, for on-site use, are not required to have a SDS generated. Information on the known hazards of the materials shall be communicated to all users.

2.11 CONTAINER WARNING LABELS AND HAZARD INFORMATION

2.11.1 All chemical containers shall be properly identified and labeled, as per LPR 1710.12.

2.11.2 Containers of experimental materials generated on-site shall be labeled:

- a. With the name of the material, or
- b. With the citation in the researchers' lab book that references the precursor materials.

2.11.3 The National Fire Protection Act (NFPA) diamond label with the material name or trade name shall be placed on secondary containers (e.g., beakers, flasks).

2.11.4 Unlabeled containers shall not be permitted in the laboratory.

2.11.5 Chemicals that will be hand-carried between laboratories shall be labeled as to their contents and hazards.

2.11.5.1 Chemicals that will be hand-carried between facilities shall be labeled as completely as possible, including the name, address, and telephone number of the sender and recipient for samples in transit.

2.11.5.2 Chemicals being hand-carried shall be placed inside a carrier or secondary container to protect them from damage if dropped during transit.

2.11.6 Chemical containers shall be maintained in good condition.

2.11.6.1 Materials within containers with only minor damage shall be properly and safely re-packaged by the user.

2.11.6.2 Chemical containers with significant damage or containers of unknown structural condition, and which are not creating an immediate hazard to nearby personnel, should not be handled. SFAB should be contacted immediately at 757-864-7233 (4-SAFE) so that the condition of the container can be assessed and recommendations for disposal can be made.

2.11.6.3 If materials are discovered in significantly damaged containers and the materials are being released into the environment and creating a hazard to nearby personnel, the area shall be evacuated and secured, and 911 shall be called from any Center telephone or 757-864-2222 from a cellular telephone.

2.12 HAZARDOUS WASTE HANDLING AND DISPOSAL

2.12.1 Laboratories are required to manage all hazardous waste in accordance with Federal, State, and Local regulations, as well as LPR 8500.1

2.12.2 All hazardous waste containers shall be accumulated in a Satellite Accumulation Area (SAA). Specific SAA requirements can be found in LPR 8500.1.

2.12.3 Specific hazardous waste disposal procedures can be found in LPR 8500.1.

2.12.4 The Facility Environmental Coordinator (FEC) or Standard Practice and Environmental Engineering Branch (SPEEB) shall be contacted whenever questions occur about proper disposal methods for an item.

2.12.5 Petroleum Hydrocarbons

- a. All used oils and oily debris shall be kept separate from other chemical wastes.
- b. Wastes shall be labeled properly and deposited in appropriate containers.
- c. Waste labels are available from SPEEB (757-864-3500).

CHAPTER 3: PROCEDURES FOR WORKING WITH SPECIFIC CHEMICAL CLASSES

3.1 HANDLING OF HAZARDOUS MATERIALS

3.1.1 Only trained personnel shall be allowed to handle acids, bases, corrosives, toxic chemicals, and any other hazardous materials as defined in this chapter.

3.1.2 Students under the age of 18 are not permitted to work with, handle, or have exposure to hazardous materials.

3.1.3 All contact of vapor or liquid with skin, eyes, or mucous membranes shall be prevented.

3.1.4 PPE shall include safety glasses, goggles, or a face shield, and lab coat, as specified in Chapter 2.7.

3.1.5 Full-length sleeves and the appropriate gloves shall be worn.

3.1.6 Those working with hazardous agents shall ensure there is adequate ventilation.

3.1.7 Hazardous chemicals shall be handled in a lab hood. If the work cannot be conducted in a lab hood, respiratory protection may be required.

3.1.7.1 Laboratory hoods shall be inspected for proper operation before work begins.

3.1.7.2 SFAB shall be contacted for work conducted outside of a lab hood, to determine if respiratory protection is required, and to determine the appropriate respiratory protection for the task.

3.1.8 Chemical-specific OSHA regulations are found in 29 CFR 1910 Subpart Z.

3.1.9 The location of the nearest safety shower and eye wash station shall be noted before beginning work.

3.1.10 Accident Response

- a. In case of a medical emergency exposure, 911 shall be dialed from any Center telephone or 757-864-2222 from a cellular telephone.
- b. The CHO/FSH or designee shall be notified immediately.
- c. An appropriate spill plan shall be established.
- d. Appropriate containment materials shall be on hand in case of spills.

3.1.11 Transfer and Transport

- a. The appropriate PPE shall be used.
- b. The chemical compatibility of transfer pumps and receiving vessels shall be verified.
- c. Bottle carriers shall be used when transporting small quantities to prevent breakage and to act as a containment vessel should breakage occur.
- d. Transfers shall use chemical carriers or secondary containment.
- e. All transfers shall be conducted in a controlled area.

- f. All materials shall be marked and properly labeled as per LPR 1710.12

3.2 ACIDS

3.2.1 An acid is a substance that yields hydronium ions when dissolved in water. As a group, acids are highly reactive. This reactivity adds to their usefulness, but also demands that laboratory spills be given special attention.

3.2.2 Additional safety precautions when working with acids:

- a. Acids shall be used under well-ventilated conditions.
- b. Aprons made of acid-resistant material shall be worn as necessary.
- c. When diluting acids with water, always add the acid to the water, not the water to the acid.

3.2.3 Storage

3.2.3.1 Acids shall be segregated, preferably in separate cabinets, from active metals, oxidizing acids, incompatible acids (e.g., inorganic/organic), flammables and combustibles, bases, and chemicals that react with acids to form toxic gases.

3.3 BASES/CAUSTICS

3.3.1 Bases are substances that yield hydroxyl ions when dissolved in water. The major hazard in the use of bases is their corrosive action on tissue. Severe, painful tissue damage can rapidly result from acute exposures in which significant amounts of bases are inhaled, splashed on the skin, or swallowed.

3.3.2 Additional safety precautions when working with bases/caustics:

- a. Personnel shall be cautioned to check themselves over thoroughly after working around bases to ensure that no clothing or skin has been exposed.
- b. There is no warning sting with bases, as with acids, and an unattended burn can make considerable headway before it is noticed.

3.3.3 Storage

3.3.3.1 Bases shall not be stored with acids. The reaction between the two will generate large quantities of heat.

3.3.3.2 As most bases are non-volatile, special storage cabinets are not necessary.

3.4 OXIDIZERS

3.4.1 Oxidizers will react violently with flammables and combustibles and shall be separated from flammables and combustibles as well as reducing agents.

3.4.2 Additional safety precautions when working with oxidizers:

- a. Unintentional contact with organic and other oxidizable substances shall be avoided.
- b. Reaction vessels containing these reagents shall be heated using fiberglass mantles or sand baths rather than oil baths.

3.4.3 Accident Response

3.4.3.1 Chemically resistant trays and spill pads shall be used to make clean up easier.

3.4.3.2 Organic materials, such as paper towels or cotton rags, shall not be used for clean-up of oxidizer spills.

3.4.4 Storage

3.4.4.1 Oxidizers shall not be stored with organics or other oxidizable compounds as they initiate or promote combustion.

3.4.4.2 Oxidizers shall be stored in glass or unbreakable inert containers.

3.4.4.3 Corks and rubber stoppers shall not be used.

CHAPTER 4: PROCEDURES FOR WORKING WITH TOXIC SUBSTANCES

4.1 HANDLING OF TOXIC SUBSTANCES

4.1.1 These chemicals are particularly hazardous substances that include, but are not limited to, select carcinogens, reproductive toxins, and substances that have a high degree of acute toxicity.

Note: Information about toxic substances and how they affect your health can be found at the Agency for Toxic Substances and Disease Registry website <https://www.atsdr.cdc.gov/substances/index.asp>

4.1.2 Handling and accident response procedures for toxic substances are the same as for hazardous materials (see Chapter 3).

4.1.3 Additional safety precautions when working with toxic substances:

- a. These chemicals shall be used only in a controlled area (e.g., a laboratory, or portion of a laboratory or a facility such as an exhaust hood that is designated for use of highly toxic substances).
- b. All personnel who have access to the controlled area shall be aware of the substances being used and the necessary precautions.
- c. Personnel shall follow all recommended work practices and wear appropriate PPE.
- d. The controlled area shall be conspicuously marked with warning and restricted access signs.
- e. Toxic compounds shall be handled with adequate ventilation.
- f. Toxic compounds shall be stored in properly labeled, non-breakable containers.
- g. Chemical decontamination shall be used whenever possible.
- h. Vacuum pumps shall be protected against contamination by scrubbers or cold traps and vented into an approved exhaust system.
- i. All used PPE shall be properly disposed of in accordance with LPR 8500.1.
- j. Hands shall be thoroughly washed with soap and water after handling chemicals.
- k. The work area shall be decontaminated before normal work is resumed.

4.1.4 The user shall contact the CHO/FSH or designee or SFAB for guidance in determining the need for a PHM permit.

4.2 REPRODUCTIVE HAZARDS

4.2.1 Reproductive and developmental hazards can result from exposures of shorter duration and at a lower level than those considered safe for most personnel. LaRC strives to keep exposures as low as reasonably practicable, below published regulatory and recommended limits.

4.2.2 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.

4.2.3 Additional safety precautions when working with reproductive hazards:

- a. Personnel shall always take adequate precautions to guard against inhalation, direct skin contact, or accidental ingestion of chemicals known to be reproductive hazards.

4.2.4 Some of the reproductive hazards that may be found in LaRC laboratories include:

- a. Hexanes, Hydroquinone, Methanol, Methylene Chloride;
- b. Methylenedianiline (MDA), N-Methyl-2-Pyrrolidone (NMP);
- c. Oxalic acid, 98%;
- d. Tetrahydrofuran (PHT as inhibitor 99.9%), Toluene; and
- e. Trichlorobenzene (1,2,4-), Trichloroethylene.

4.2.5 The FSH and supervisor shall be notified of pregnancy as soon as possible.

4.2.6 Pregnant personnel shall be allowed to work in the laboratory only after a thorough evaluation of the hazards has been conducted by the supervisor and the personnel's doctor.

4.2.7 Storage

4.2.7.1 Reproductive hazards shall be stored in properly labeled, non-breakable containers in a well-ventilated area.

4.3 SELECT CARCINOGENS

4.3.1 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.

4.3.2 Storage

4.3.2.1 Carcinogens shall be stored in properly labeled, non-breakable containers in a well-ventilated area.

4.4 SENSITIZERS

4.4.1 Sensitizers include:

- a. Respiratory Sensitizer: induces hypersensitivity of the airways following inhalation of the chemical.
- b. Skin Sensitizer: contact can develop into allergic reaction in normal tissue after repeated exposure to the chemical.

4.4.2 Additional Safety Precautions When Working with Sensitizers

4.4.2.1 Suitable gloves and clothing shall be worn to prevent skin contact with sensitizers or substances of unknown sensitizing potential.

4.4.3 Storage

4.4.3.1 Breakable containers shall be stored in chemically resistant trays.

4.4.3.2 Contaminated waste shall be stored in labeled impervious containers.

4.4.3.3 Liquid waste shall be stored in glass or plastic bottles.

4.5 HIGHLY TOXIC CHEMICALS

4.5.1 Highly toxic chemicals include:

- a. Acutely toxic chemicals, which cause damage in a relatively short time after a single concentrated dose. Irritation, burns, illness, or death may result.
- b. Extremely chronic toxic chemicals, which are substances that cause irreversible neurological damage or death with extremely small doses.

4.5.2 Additional safety precautions when working with extremely chronic or acutely toxic chemicals include:

- a. Users must familiarize themselves with the specific hazards of the compounds with which they are working.
- b. If dry powder is used, wet mops or a High Efficiency Particulate Air (HEPA) exhausted vacuum cleaner shall be used instead of dry sweeping. Hand-held vacuum cleaners are not HEPA exhausted units.
- c. The user shall ensure that containers of contaminated waste, including washings from contaminated flasks, are transferred from the controlled area in a secondary container.

4.5.3 Storage

4.5.3.1 All containers shall be labeled with the appropriate identification and warning labels.

4.5.3.2 Containers of highly toxic chemicals shall be stored only in ventilated limited access areas in labeled, unbreakable, chemically resistant, secondary containers.

CHAPTER 5: PROCEDURES FOR WORKING WITH FLAMMABLES/EXPLOSIVES AND OTHER HAZARDS

5.1 FLAMMABLES

5.1.1 Flammables include:

- a. Flammable liquid means any liquid having a flashpoint below 100 °F (37.8 °C) or higher, the total of which make up 99 percent or more of the total volume of the mixture.
- b. A flammable gas is any material that is a gas at 68 °F or less at 14.7 psi of pressure and when in mixture of 13 percent or less by volume with air or has a flammable range in 14.7 psi with air of at least 12 percent regardless of the lower limit.

5.1.2 Additional safety precautions when working with flammables/explosives:

- a. Flammable substances shall be handled only in areas free of ignition sources.
- b. Flammable substances shall never be heated using an open flame.
- c. A steam, water, oil, or air bath or a heating mantle shall be used.
- d. Adequate ventilation shall be used to prevent the formation of flammable atmospheres.

5.1.3 Accident Response

5.1.3.1 Clean up of accidental spills of flammable materials may require the use of non-sparking tools. The SDS shall be reviewed to determine the appropriate tools for clean-up.

5.1.4 Transfer and Transport

5.1.4.1 When transferring these substances in metal and plastic containers, static generated sparks shall be avoided by bonding and the use of ground straps.

5.1.5 Storage

5.1.5.1 Flammable materials shall be stored in flammable solvent cans per NFPA 45.

5.1.5.2 Flammable substances shall be kept in special cabinets designed for this purpose.

5.2 PEROXIDES

5.2.1 Peroxides are unstable and pose a risk of explosion.

5.2.1.1 Peroxide-forming chemicals react with oxygen present in the atmosphere to form peroxides.

5.2.1.2 The concentration of the peroxide contaminant plays an important role and can change through evaporation and distillation processes.

5.2.1.3 Heat, shock, and friction can create dangerous situations, which can lead to explosions.

5.2.2 A list of peroxide forming compounds can be found in LPR 1710.12.

Note: Aging of the chemical is a significant factor in the production of peroxides. Peroxide-forming compounds often contain additives to prevent the formation of peroxides. However, the addition of additives delays but does not eliminate the hazard. More information can be found in LPR 1710.12. The procurement, storage, handling, use, and disposal of explosive materials are referenced in LPR 1710.7.

5.2.3 Additional Safety Precautions When Working with Peroxide-Forming Compounds

5.2.3.1 These substances shall be purchased in small quantities and not stockpiled.

5.2.3.2 Unused peroxide-forming compounds shall not be returned to the container.

5.2.3.3 Containers of peroxide-forming compounds shall be tested for peroxides quarterly.

5.2.3.4 Containers of aged or expired peroxide-forming compounds shall not be opened unless they have been tested within the past 90 days.

5.2.3.5 Solutions of peroxides in volatile solvents shall be handled so as to prevent evaporation of the solvent as the peroxide concentration will increase.

5.2.3.6 The user shall not open any container having obvious crystal formation around the lid.

5.2.3.7 Metal spatulas shall not be used to handle peroxides, because metal contamination can lead to explosive decomposition.

5.2.3.8 Ignition sources shall not be permitted in the area.

5.2.3.9 Friction, grinding, and other forms of impact shall be avoided.

5.2.3.10 Any questions should be forwarded to the Explosives Safety Officer at 757-864-7233 (4-SAFE).

5.2.3.11 Liquid spills shall be absorbed with vermiculite.

5.2.4 Transfer and Transport

5.2.4.1 Small quantities of peroxides shall be handled so as to avoid ignition sources, shock, and extreme temperature changes.

5.2.5 Storage

5.2.5.1 Peroxide-forming compounds shall be stored in airtight containers in a cool, dry, dark place.

5.2.5.2 Peroxide-forming compounds shall not be refrigerated or frozen unless recommended by the manufacturer.

5.2.5.3 Glass containers that have glass stoppers shall not be used.

5.2.5.4 Chemicals shall be stored in the original container supplied by the manufacturer.

5.2.5.5 To minimize the rate of decomposition, peroxides shall be stored at the lowest temperature consistent with their solubility or freezing point, but not lower, as they may

become more sensitive to shock and heat.

5.2.5.6 These chemicals shall be properly labeled with the receiving date, the opening date, the peroxide test date, and the date recommended for disposal.

5.2.5.7 The recommended disposal date shall also be tracked within CMTS in the expiration section.

5.2.5.8 These chemicals shall be properly disposed of upon expiration and after they have been tested for peroxides.

5.2.5.9 Metal containers with screw lids shall be avoided.

5.2.5.10 The CHO/FSH or FEC shall be notified immediately if expired bottles of these materials are discovered, especially if they are in poor condition.

5.3 PYROPHORICS

5.3.1 Pyrophorics are liquids or solids that will spontaneously ignite in air at temperatures less than 130 °F.

5.3.2 These substances shall be stored in inert atmospheres or under kerosene.

5.4 COMPRESSED GASES

5.4.1 Any gas stored or used from a compressed gas cylinder has the hazard of rupture and/or explosive force on release that is normally associated with that of high-pressure vessels or systems.

5.4.2 Compressed gases present the potential for exposure to both chemical and mechanical hazards depending on the particular gas.

5.4.3 Additional Safety Precautions When Working with Compressed Gas

- a. Positive ventilation, and in the case of flammable and explosive gases, spark and explosion-proof fan motors and electrical equipment, shall be provided.
- a. The contents of any compressed gas shall be clearly identified on the cylinder.
- b. Signs identifying flammable compressed gases shall be clearly posted.
- c. All gas lines shall be clearly labeled so as to identify the gas being transported.
- d. Cylinders shall be firmly secured at all times using a clamp and belt or chain.
- e. Cylinders shall be placed in such a way that the cylinder valve is readily accessible at all times.
- f. The main cylinder valve shall be closed whenever the gas is not in use.
- g. All pressurized systems shall have appropriate pressure relief devices in accordance with LPR 1710.40.
- h. Pressure release equipment for protecting devices attached to cylinders containing potentially hazardous gases shall be vented to the outside or into an appropriate exhaust system.
- i. All pressure regulators shall be equipped with spring-loaded pressure relief valves.

- j. Common brass pressure regulators shall not be used with corrosive gases.
- k. Regulators used with carbon dioxide shall have special internal designs and special materials to prevent freeze-up and corrosion problems.
- l. Internal bleed type regulators shall not be used.
- m. Valves shall be opened slowly.
- n. Personnel shall use proper ventilation equipment when opening a cylinder containing toxic gas.
- o. Pliers shall not be used on cylinder hardware.
- p. All piping, regulators, appliances, and hoses shall be kept tightly sealed and in good condition.
- q. Equipment used for flammables shall not be interchanged with similar equipment used for other gases.
- r. Sparks and flames shall be kept from the area of flammable gas cylinders.
- s. Cylinders shall not be emptied less than 172 kPa (25 lbf/in²) because the residuals may become contaminated if the valve is left open.
- t. Labels shall be used to designate whether cylinders are full, in use, or empty.
- u. The regulator shall be removed when not in use.
- v. The valve cap shall be replaced when not in use.
- w. Empty cylinders shall not be refilled.
- x. All pressure equipment shall be inspected periodically and more often when corrosive or hazardous gases are used.

5.4.4 Storage

5.4.4.1 Cylinders containing flammables or toxic gases shall be stored in gas storage lockers vented to the outside or stored outside the facility.

5.4.4.2 Cylinders of oxygen shall never be stored with cylinders containing flammables.

5.4.4.3 Empty and full cylinders shall not be stored in the same location.

5.4.4.4 Cylinders shall not be laid on the ground.

5.5 CRYOGENIC LIQUIDS AND ASPHYXIAN GASES

5.5.1 Some gases normally used in the form of cryogenic liquids or solids have hazards associated with their use.

5.5.1.1 The low temperatures present in cryogenic liquids or solids may cause local freezing hazards to personnel exposed for a sufficient length of time.

5.5.1.2 The powerful oxidizers, liquid oxygen (O₂) and fluorine (F₂), shall be protected from contact with organic materials or fuels as explosive reactions may result.

5.5.1.3 The vaporization of cryogenic liquids (i.e., phase change from cryogenic liquid to asphyxiant gas) can displace oxygen and create an oxygen-deficient atmosphere. This

is dependent on the volume of the liquid and the volume of the room in which the cryogenic liquid is handled.

5.5.2 Oxygen Monitoring Systems

5.5.2.1 Oxygen deficiency alarm monitors shall be located in areas where cryogenics are handled and spills may occur.

5.5.2.2 Areas where large quantities of cryogenics are used on a routine basis shall have permanent oxygen monitoring systems that are connected to the facility fire alarm system.

5.5.2.3 Permanent oxygen monitoring systems shall:

- a. Be reviewed and approved by the SFAB IH staff and NASA LaRC AHJ prior to installation.
- b. Sound an alarm at 19.5 percent oxygen and shall activate audio and visual (i.e., blue strobe light) alarms in the local area.
- c. Activate the fire alarm system and evacuate the facility at 16.5 percent oxygen.
- d. Have signage posted near the blue lights describing the emergency action to be taken.

5.5.2.4 Areas that use small quantities of cryogenics on an infrequent basis can use approved portable oxygen monitors.

5.5.2.5 The need, location and type of oxygen detection monitors shall be assessed on a case-by-case basis by SFAB IH staff.

5.5.2.6 All oxygen monitoring systems shall be routinely calibrated per the requirements of the LaRC Metrology Program.

5.5.3 Liquid nitrogen (LN₂) is the most commonly used cryogenic liquid at LaRC. Although LN₂ is a relatively inert gas, also has the following hazards:

- a. If spilled or allowed to evaporate quickly in large quantities in confined areas, can greatly dilute or replace the O₂ of the air so that asphyxiation will ensue.
- b. LN₂ gas can condense the O₂ from the air, making a mixture of LN₂ and O₂ that may assume some of the hazards of liquid O₂, that is, violent reaction with organic compounds.

5.5.4 Protective equipment shall be used (e.g., cryogenic gloves, aprons, eye protection) to guard against freezing and avoid spills or very rapid evaporation into an enclosed area.

5.6 WATER REACTIVE CHEMICALS

5.6.1 General Information and Storage Requirements

5.6.1.1 Water reactive chemicals can lead to the formation of flammable toxic gases or release of an extreme amount of energy following contact with water.

5.6.1.2 Areas where water reactive compounds are present shall be posted in such a way that firefighting personnel are aware of their presence.

5.6.1.3 Water reactive chemicals shall be stored in accordance with the manufacturer's recommendations.

CHAPTER 6: PROCEDURES, ACTIVITIES, AND OPERATIONS REQUIRING PRIOR APPROVAL BEFORE IMPLEMENTATION

6.1 GENERAL

6.1.1 In the interest of integrating safe laboratory practices, whenever a particular procedure, operation, or activity is to involve the use of carcinogens, reproductive toxins, or substances with a high degree of acute or chronic toxicity, the FSH and SFAB shall be informed during the planning stages.

6.1.1.1 The Principle Investigators shall investigate the toxicity of materials of interest and inform the FSH in writing of their plans.

6.1.1.1.1 This is accomplished through the filing of a hazardous material safety permit request, LF 118. In accordance with LPR 1710.12 and OSHA 29 CFR 1910.1450, prior approval shall be given before beginning work with hazardous materials.

6.1.2 Examples of activities and operations requiring prior review and approval before implementation are given below:

- a. Use of OSHA regulated carcinogens.
- b. Any new or modified experiments, including scale-ups.
- c. Any new activity that will involve the use of high temperature (>500 °C) and/or pressure (125 PSIA).
- d. Any activity that will utilize a toxic substance for an extended period of time. This includes storage as well as handling times.
- e. Any activity utilizing a substance requiring special disposal or storage requirements for itself or its derivatives.
- f. Any activity involving the use or synthesis of organometallic materials.

6.2 DESIGNATED WORK AREAS

6.2.1 Designated work areas shall be established for work involving the use of carcinogens, reproductive toxins, and substances with a high degree of acute toxicity.

6.2.2 Laboratory hoods shall be identified throughout the area of such work. Signs can be obtained through the FSH or SFAB IH staff.

CHAPTER 7: LABORATORY HOOD PROGRAM

7.1 INTRODUCTION

7.1.1 Operations involving toxic or unknown gases, vapors, aerosols, and dusts shall be performed in a laboratory hood. Hoods offer significant personnel protection. They prevent toxic, unknown, offensive, or flammable vapors from entering the general laboratory atmosphere, they place a physical barrier between personnel and the chemical environment, and they provide an effective containment device for accidental spills of chemicals.

7.1.2 Laboratory hoods shall remain on at all times.

7.1.3 The sash shall be maintained at the lower extreme when not actively being used and within the proper positioning range when physical protection is needed.

7.2 VENTILATION SPECIFICATIONS

7.2.1 All new, existing, or upgraded laboratory hoods intended for use with any material shall attain an average linear face velocity of 100 feet per minute, with the sash fully opened or lowered to a minimum, allowable working sash height of 12 inches.

7.2.2 If the hood face opening has to be reduced to achieve 100 fpm or a high velocity for a particular hood use, then visible markings shall clearly indicate the working sash height.

Note: Directional arrows are used on all hoods to designate the proper working sash height.

7.2.3 All hoods shall be designed and operated to maintain relatively uniform air velocity over the entire face.

7.2.3.1 As a general rule, the velocity measured at any single point shall not vary more than 20 percent from the overall average.

7.3 LABORATORY HOOD GUIDELINES

7.3.1 The SFAB IH staff shall inspect existing laboratory hoods for proper use, air turbulence, and adequate face velocity at least annually and after any significant adjustment or modification that could affect performance.

7.3.2 Lab hood inspection results shall be visibly posted on the front of the hood.

7.3.3 New hoods shall be inspected at the time of installation and before use.

7.3.4 Hood Baffle Adjustment

7.3.4.1 The baffle adjustment controls shall be utilized to attain uniform face velocity.

7.3.4.2 High heat loads are best controlled by fully opening the top slot.

7.3.4.3 Heavier-than-air vapors are best controlled by increasing the bottom slot opening and decreasing the top slot opening.

7.3.4.4 Avoid shutting off an exhaust slot completely.

7.3.5 General Requirements

7.3.5.1 Large bulky objects and hood clutter are detrimental to hood performance. Too much equipment and bulky objects in the hood are common causes of poor air performance, i.e., air turbulence and dead space.

7.3.5.2 Work being performed in the hood shall match the type of hood systems.

7.3.5.3 Work shall be placed well inside the hood. The forward six inches of the hood are most subject to draft and turbulence.

7.3.5.4 Materials shall be poured, transferred, and weighed as far back as possible.

7.3.5.5 Personnel shall not place their heads inside laboratory hoods.

7.3.5.6 The hood sash shall be maintained at the smallest practical open area.

7.3.5.7 The hood shall be kept clean.

7.3.5.8 Spills shall be cleaned immediately to avoid build-up of contaminants within the hood.

7.3.5.9 Laboratory hoods shall be equipped with an airflow measurement device to warn if ventilation fails, is inadvertently turned off, or falls below a predetermined unacceptable value for the work being performed.

7.3.5.10 A hood suspected of not performing properly shall be promptly brought to the attention of the FSH, designee or SFAB.

7.3.5.11 Hoods that are not performing properly shall be posted "Do not Use."

7.3.5.12 The hood shall be removed from service until adequate airflow has been verified.

7.3.5.13 All operations involving perchloric acid shall be performed in lab hoods that are designed for perchloric acid use, or under a PHM Safety Permit as prescribed in 1710.12.

APPENDIX A. DEFINITIONS

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

Carcinogen(ic). Capable of causing cancer.

Note: SDSs are required to list any carcinogens present.

Center. NASA Langley Research Center

Cryogenic. Maintained at extremely low temperatures.

Immediately Dangerous to Life or Health (IDLH) Concentration. Concentration at which serious health impairments, or irreversible biological effects possibly leading to death in a period of seconds or several days later, could occur.

Laboratory. Laboratory means a facility where the laboratory use of hazardous chemicals occurs. It is a workplace where relatively small quantities of hazardous chemicals are used on a non-production basis (OSHA 29 CFR 1910.1450).

Narcotic. Capable of causing depression of the central nervous system; drowsiness, stupor, loss of coordination, unconsciousness.

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.)

Threshold Limit Value (TLV). Airborne concentration at or below which it is believed nearly all workers 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.

APPENDIX B. ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
CFR	Code of Federal Regulations
CHO	Chemical Hygiene Officer
CHP	Chemical Hygiene Plan
CMTS	Chemical Material Tracking System
FSH	Facility Safety Head
HEPA	High-Efficiency Particulate Air
IARC	International Agency for Research on Cancer
IH	Industrial Hygiene
LaRC	Langley Research Center
LN2	Liquid nitrogen
LF	Langley Form
LPR	Langley Procedural Requirement
MDA	Methylenedianiline
NFPA	National Fire Protection Act
NMP	N-Methyl-2-Pyrrolidone
OMEP	Occupational Medical Examination Protocol
O2	Oxygen
PHM	Potentially Hazardous Materials
PPE	Personal Protection Equipment
PEL	Permissible Exposure Limits
RCRA	Resource Conservation and Recovery Act
SAA	Satellite Accumulation Area
SDS	Safety Data Sheet
SFAB	Safety and Facility Assurance Branch
SPEEB	Standard Practice and Environmental Engineering Branch