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Glenn Safety Manual – Chapter 15

Personal Protective Equipment and Job Hazard Analysis

Approved by: QS/Chief, Safety and Health Division

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Chapter 15—Personal Protective Equipment and Job Hazard Analysis

Note: The current version of this chapter is maintained and approved by the Safety and Health Division (SHeD). The last revision date of this chapter was August 2026. The current version is located in the Glenn Research Center (GRC) Business Management System (BMS) Library. Approved by Chief of SHeD.

1.0 PURPOSE

This chapter establishes procedures and practices for the selection and use of personal protective equipment (PPE) not covered by specific programs (e.g., hearing protection or respiratory protection) at GRC, Lewis Field and Neil A. Armstrong Test Facility. The purpose of this chapter is to provide guidance to employees and supervisors on the selection of appropriate PPE to prevent injury or illness that may result from hazards that cannot be controlled using administrative or engineering controls. This chapter also establishes procedures and practices for conducting job hazard analysis (JHA) at GRC.

Note: Other Center programs within the Glenn Procedure (GLP)-QS-8715.1, GRC Safety Manual (GSM) and the GLP-QS-1800.1, GRC Occupational Health Programs Manual (OHPM) reference specific PPE associated with the hazards the program addresses. A list of these programs can be found in APPENDIX C.

2.0 APPLICABILITY

This chapter is applicable to all civil servants, support service contractors, construction contractors, students, and visitors assigned to GRC sites. In this chapter, all mandatory actions (i.e., requirements) are denoted by statements containing the term “shall.” The term “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.

3.0 BACKGROUND

3.1 Hazards exist in every workplace in many different forms: sharp edges, falling objects, flying sparks, chemicals, noise, and a myriad of other dangers. The Occupational Safety and Health Administration (OSHA) requires employers to protect their employees from workplace hazards that may cause injury or illness. Controlling a hazard at its source is the best way to protect employees. Depending on the hazard or workplace conditions, the use of engineering or work practice controls to manage or eliminate hazards to the greatest extent possible is recommended. For example, building a barrier between the hazard and the employees is an engineering control; changing the way in which employees perform their work is a work practice control. When engineering, work practice, and administrative controls are not feasible or do not provide sufficient protection, employers must provide PPE to their employees and ensure its use.

Note: All PPE purchases go through the GRC Micropurchase Process. A Purchase Guide is available to help select PPE within the required

standards/certifications/requirements that the PPE must meet. This guide can be accessed by entering "PPE" at Inside Glenn.

3.2 Workplace hazard assessments are performed to help identify hazards and hazard controls. GRC has multiple established processes to identify workplace hazards and the subsequent controls required to mitigate the hazards. Please see APPENDIX D for a list of current hazard assessment processes. The JHAs are one type of hazard assessment used to help identify hazards associated with Center activities and tasks, assess the risk associated with these hazards, and control that risk to an acceptable level. Overall goals of GRC's JHA program are to prevent injuries and illnesses, reduce property damage, supplement existing safety requirements, and enhance employee training on new, existing, and modified tasks.

4.0 POLICY

It is GRC policy to comply with all applicable regulations regarding PPE and JHA and to ensure that hazards are identified, appropriate PPE is utilized properly, and employees receive training on the use of PPE and JHAs.

4.1 PPE

The SHeD is charged with establishing and maintaining adequate policies and procedures for the use of PPE. GRC shall follow the requirements of NASA Procedural Requirements (NPR) 8715.3, NASA General Safety Program Requirements. The OSHA standards that apply to each type of PPE are noted in Sections 6.4 to 6.10. The determination of PPE will utilize one of the hazard assessment methods listed in Appendix D. Some types of PPE have their own chapter in the GSM or OHPM (e.g., hearing conservation and respirators) and are referenced as such.

4.2 JHA

Completion of the JHA helps ensure compliance with 29 United States Code (USC) 654, Occupational Safety and Health Act of 1970, Section 5(a)1, General Duty Clause; and 29 Code of Federal Regulations (CFR) 1910.132(d), Hazard Assessment and Equipment Selection. The JHA shall be required as follows:

a. Job or task has resulted in multiple close calls, accidents, injuries, or illnesses.

b. Job or task has the potential to cause severe or disabling injuries or illness, even if there has previously been no accident, injury, or illness.

c. Job or task could lead to severe accident or injury from one simple human error.

d. Job or task involves hazardous materials.

e. Job or task involves hazardous energy sources.

f. Job or task involves the use of PPE.

g. Job or task is new or has undergone changes in the process or procedures.

h. Job or task is complex enough to require written instructions.

5.0 PPE RESPONSIBILITIES

5.1 SHeD Chief or Designee

The SHeD Chief or Designee shall:

a. Develop, implement, and maintain all elements of the PPE program.

b. Provide training and guidance in the selection and use of PPE.

c. Inform supervisors and employees of the required hazard assessment processes, as listed in Appendix D, through the PPE training program.

d. Develop, maintain, and manage the GRC PPE training program.

e. Perform spot checks and periodic audits.

f. Approve PPE purchases to ensure that all items are equivalent to American National Standards Institute (ANSI) and meet necessary requirements.

g. Provide support for chemical-protective clothing (CPC) and other applicable aspects of the PPE program.

5.2 Supervisors

Supervisors of civil servants and support service contractors using PPE shall:

a. Ensure that hazard assessments are performed, where applicable, to identify and control physical and health hazards.

b. Ensure that all employees exposed to hazards in the workplace understand the hazards and the hazard assessments.

c. Maintain written documentation of a workplace hazard assessment using the appropriate hazard assessment processes and the corresponding hazard assessment documentation (see APPENDIX D).

d. Contact a SHeD safety engineer or industrial hygienist for assistance with hazard assessments of tasks that may pose exposure to hazardous chemicals.

e. For each workplace with hazards that necessitate PPE that cannot be corrected with engineering or administrative controls:

   (1) Provide guidance on the types of PPE that will protect affected employees from the hazards identified in the hazard assessment.

   (2) Communicate selection decisions to each affected employee.

   (3) Ensure that each selected PPE properly fits each affected employee and is used appropriately.

f. Attend the PPE training when such equipment is required in their area.

g. Ensure that each affected employee is assigned to, attends, and understands the PPE training course provided by SHeD or the training at an alternative venue approved by SHeD.

h. Ensure that each affected employee is prepared and able to use PPE properly before performing work that requires the use of PPE.

i. Enforce the requirements of the PPE program in their area.

j. Ensure that employees are retrained whenever:

(1) Changes in the workplace render previous training obsolete.

(2) Changes in the types of PPE to be used render previous training obsolete.

(3) Inadequacies in an affected employee's knowledge or use of assigned PPE indicate that the employee has not retained the requisite understanding or skill.

k. Ensure that employees are provided with all required PPE at no cost to them.

l. Maintain records of the task-specific PPE training required and provided within the organization.

m. Ensure that the Human Capital Development Division receives a copy of all PPE training records for entry and tracking in the System for Administration, Training, and Educational Resources for NASA (SATERN).

NOTE: Contractors must maintain their own training records.

n. Provide appropriate basic PPE, such as eye protection and hard hats, for visitors to hazardous locations, such as construction sites, machine shops, and chemical laboratories.

NOTE: PPE that requires specific training (respiratory protection, laser safety eye wear, etc.) cannot be issued without approval from SHeD. Personnel requiring this type of PPE will be referred to SHeD representatives whenever a question regarding the proper selection or use of PPE arises that cannot easily be determined with the resources provided to the supervisor or manager.

5.3 Employees

5.3.1 Before performing work that necessitates PPE, employees shall:

a. Perform a hazard assessment in conjunction with their supervisors.

b. Attend PPE training.

c. Receive any applicable medical clearance.

d. Demonstrate understanding of PPE requirements and the ability to use, store, and properly decontaminate PPE.

e. Obtain the proper PPE in the proper size and fit for the work.

5.3.2 Employees shall also:

a. Know the hazards in the workplace.

b. Always wear designated, appropriate PPE for hazardous work.

c. Inspect PPE for damage prior to use.

d. Procure PPE through the GRC Micropurchase Process. All PPE purchases must be reviewed and accepted by SHeD.

e. Not use personally owned PPE at GRC without the supervisor's approval.

> *NOTE: Personally owned safety shoes, prescription safety glasses, and other PPE must meet applicable OSHA requirements and ANSI standards. The employer is required by law to provide required PPE to employees at no cost to the employee.*

f. Properly dispose of defective or damaged PPE; bag and label PPE contaminated with hazardous materials destined for disposal as hazardous waste.

g. Stop working in the hazardous area and notify the area manager or supervisor if there is any problem with issued PPE or concerns with the quality, appropriateness, effectiveness, or use of provided PPE.

5.4 Occupational Medical Services

Occupational Medical Services shall maintain complete, accurate records of all PPE-affiliated examinations for civil service personnel needing medical clearance prior to the use of PPE. Results of examinations are to be discussed with employees as needed.

> *NOTE: Support service contractors may utilize the Center's Occupational Medical Services but are not required to do so. For such services rendered outside the Center, the employer of the individual will maintain any relevant documentation regarding PPE medical clearance. Occupational Medical Services is responsible for any records created by the service.*

5.5 Contractors

Contractors are responsible for providing, implementing, and managing a site-specific PPE program for employees. Contractor PPE programs shall comply with Federal, NASA, and GRC requirements.

5.6 Contracting Officers and Contracting Officer's Technical Representatives

Contracting Officers and Contracting Officer's Technical Representatives shall be knowledgeable about PPE program requirements and ensure that contractors comply with these requirements.

6.0 PPE REQUIREMENTS

6.1 Hazard Assessment (*CFR 1910.132(d)*)

6.1.1 All affected employees, in conjunction with their supervisors, will conduct a hazard assessment. CFR 1910.132 states that the employer shall assess the workplace to determine if hazards are present, or are likely to be present, which necessitate the use of PPE.

6.1.2 In accordance with CFR 1910.132, the Supervisor shall verify that the required workplace hazard assessment has been performed through a written certification that identifies the workplace evaluated; the person certifying that the evaluation has been performed; the date(s) of the hazard assessment; and, which identifies the document as a certification of hazard assessment.

6.1.3 SHeD provides guidance for job and task hazard assessments through a variety of processes (see Appendix D).

6.2 Training (*29 CFR 1910.132(f)*)

6.2.1 SHeD is available to provide training for all employees required to wear PPE. Training shall be provided to employees before they are required to wear PPE.

6.2.2 Employees using PPE shall be trained to know and understand the following:

a. What PPE is necessary.

b. When PPE is necessary.

c. How to properly inspect PPE for wear or damage.

d. How to properly put on and adjust the fit of PPE.

e. How to properly remove PPE.

f. The limitations of PPE.

g. How to properly care for and store PPE.

> *NOTE: PPE-specific training requirements are specified for each of the PPE subcategories (e.g., eye and face protection and hand protection) (29 CFR 1910.132(f)).*

6.2.3 Refresher training shall be required when:

a. There is a change in the type of PPE being used, rendering previous training obsolete.

b. The employee does not show the ability to properly use the PPE.

c. A worker's job scope has changed or been altered, rendering previous training obsolete.

6.2.4 For chemical-specific training, the SHeD Industrial Hygienist should be contacted, as appropriate.

6.3 Acquisition of PPE

PPE used by employees at GRC must meet certain standards/certifications/requirements. This Purchase Guide provides a list of PPE and the required standards/certifications/requirements that PPE must meet. The Safety Division must approve all PPE purchases. If the PPE is not in the Purchase Guide, attach a hazard analysis of the work/task requiring the PPE. Safety reserves the right to request a hazard analysis on any PPE purchase requests. PPE is purchased through the

GRC Micropurchase Process (https://nasa.sharepoint.com/sites/GRC-PCard). Select PPE from the Special Approval dropdown menu to expedite the process. Contract employees can order through their employer.

> *NOTE: The PPE Micropurchase Guide can be accessed by entering "Personal Protective Equipment at Inside Glenn. (https://nasa.sharepoint.com/sites/grc-smad/SitePages/Personal-Protective-Equipment.aspx?csf=1&web=1&e=ado8zV)*

6.4 Eye and Face Protection (*29 CFR 1910.133, 29 CFR 1926.102, and ANSI Z87.1*)

6.4.1 The requirements of 29 CFR 1910.133, 29 CFR 1926.102, and ANSI Z87.1 shall apply to any PPE used to protect the eye and face.

6.4.2 Eye and face protection shall be worn when employees are exposed to eye or face hazards from:

a. Flying particles.

b. Molten metal.

c. Liquid chemicals (acids, caustics, hot liquids, etc.).

d. Hazardous gases or vapors.

e. Potentially injurious light radiation.

6.4.3 When the possibility of multiple and simultaneous exposures exist, protection against the highest level of each hazard shall be provided.

6.4.4 All protective eyewear used at GRC shall meet the requirements of ANSI Z87.1 or ANSI Z136 (for laser eyewear) and be marked with the manufacturer's name, applicable standard,

and side shields.

6.5 Head Protection (*29 CFR 1910.135, 29 CFR 1926.100, and ANSI Z89.1*)

6.5.1 The requirements of 29 CFR 1910.135,29 CFR 1926.100, and ANSI Z89.1 shall apply to any PPE used to protect the head from impact and electrical shock.

6.5.2 Protective helmets and hard hats

a. Be required when there is a potential for injury to the head from falling objects, side impact, or bumps.

b. Be able to reduce electrical shock and be worn when an employee is near exposed electrical conductors that could contact the head.

c. Meet the requirements established by ANSI/ISEA Z89.1, Industrial Head Protection.

6.6 Foot Protection (*29 CFR 1910.136, 29 CFR 1926.96, American Society for Testing and Materials (ASTM) F2412, and ASTM F2413)*

6.6.1 Per 29 CFR 1910.136, protective footwear with approved metatarsal or toe guards, or both, shall be worn by all personnel who are working in areas where there is a danger of foot injuries due to:

a. Falling objects.

b. Rolling objects.

c. Piercing the sole of the foot.

d. Electrical hazards at ground level.

6.6.2 All safety-toe footwear shall meet the requirements and specifications of ASTM F2413 and must be maintained in reliable condition to ensure its protective capabilities.

6.7 Hand Protection (*29 CFR 1910.138 and ANSI 105*)

6.7.1 The requirements of 29 CFR 1910.138 shall apply to applications where protective gloves are required.

6.7.2 Work gloves shall be used in accordance with the manufacturer's recommendations.

6.7.3 Hand protection shall be required when employee hands or arms are exposed to possible:

a. Severe cuts and lacerations.

b. Abrasions.

c. Punctures.

d. Skin absorption of harmful substances.

e. Chemical burns.

f. Temperature extremes.

6.7.3 ANSI 105 provides glove manufacturers a mechanism to classify their gloves for specified areas of glove performance to include the following: mechanical protection, chemical protection, detection of holes, heat and flame protection, vibration reduction, and dexterity. Chemical-resistant gloves are performance tested, following ASTM F739, by each manufacturer against chemicals to determine their ability to resist chemical breakdown from a specific chemical; therefore, the selection of chemical-resistant gloves must be based on the manufacturer's performance data, which is usually available online for most major manufacturers.

6.8 Chemical-Protective Gloves and Clothing (*29 CFR 1910.132 and 29 CFR 1910.138*)

6.8.1 A hazard assessment of the work area and workplace shall be performed to determine the need for chemical-protective clothing.

6.8.2 Employees shall review and adhere to Chemical Safety Data Sheets (SDSs).

6.8.3 Chemical-protective gloves and clothing shall be used in accordance with the manufacturer's recommendations.

6.9 Electrical PPE

For guidance on electrical PPE, refer to GLP-QS-8715.1-8, (GSM Chapter 8, Electrical Systems Safety) and National Fire Protection Association (NFPA) 70E.

6.10 Flame-Resistant (FR) Garments (Clothing) (*29 CFR 1910.132, NFPA 2112, and NFPA 2113*)

6.10.1 A hazard assessment of the work area and workplace shall be performed to determine the need for flame-resistant clothing.

6.10.2 For maximum protection, employees who are required to wear FR clothing shall adhere to the manufacturers' instructions.

6.10.3 Supervisors and employees shall:

a. Wear additional PPE as determined as necessary from a review of the potential hazards.

b. Not wear nonflame-resistant clothing (street clothes, rain jackets, etc.) over flame-resistant garments.

c. Ensure FR or non-melting undergarments (closest to the skin) are used. An incidental amount of elastic used on non-melting fabric underwear or socks shall be permitted.

d. Wear FR collars closed.

e. Wear sleeves and cuffs down and secured.

f. Ensure that protective neck, head, hand, and foot coverings be worn if the occupational hazard warrants their use.

NOTE: GLP-QS-8715.1-8, (GSM Chapter 8, Electrical Systems Safety), covers flame-resistant clothing as it pertains to electrical work (29 CFR 1910.269 and NFPA 70E).

7.0 JHA RESPONSIBILITIES

7.1 Supervisors

NOTE: "Supervisors" can also refer to Work Leads, Area Leads, Foreman, or whoever is assigning a job/task.

GRC Supervisors (including contractors) shall:

a. Ensure the JHA is completed and certified with the Supervisor's signature.

b. Identify and prioritize activities and tasks within their area of responsibility for which JHAs should be developed (e.g., develop JHAs first for those tasks with the highest probability of death and severe injury).

c. Ensure JHAs are developed for each applicable activity or task with the participation of affected employees.

d. Review JHAs with affected personnel prior to assigned task being performed.

e. Continually ensure that hazard controls documented in the JHAs are functional and being used properly.

f. Annually review and/or update applicable JHAs with affected employees.

g. Revise existing and/or approved JHAs when any changes occur in the basic steps, hazards, or hazard controls.

h. Review pertinent JHAs after an incident or close call is reported and update them, as needed, to prevent a recurrence.

i. Evaluate the need for a JHA (where none exists) if an incident or close call is reported.

j. Seek assistance from SHeD, as needed, in completing JHAs.

k. Support employees in their organization in attending GRC general JHA training (GRC–4R1954, PPE/JHA Training).

l. Complete the recommended GRC general JHA training (GRC–4R1954) through SATERN.

m. When applicable, use the collective JHAs of a workplace to establish general controls (PPE, signage, and barricades) for all personnel entering the workplace, including visitors.

7.2 Personnel

All personnel who work on the GRC premises and/or on GRC-funded tasks and will be required to use PPE during the completion of their duties shall:

a. Participate in the development, population, and maintenance of a JHA for their task(s).

b. Complete GRC general JHA training through SATERN (recommended) (GRC–4R1954, PPE/JHA Training).

c. Adhere to the documented controls listed in the JHA written for their task(s).

d. Be vigilant in identifying potential hazards not identified in the JHA and then notifying a supervisor.

7.3 SHeD Chief or Designee

The SHeD Chief or Designee shall:

a. Assist GRC organizations with JHA development.

b. Provide GRC general JHA training (GRC–4R1954, PPE/JHA Training).

c. Maintain and update the GRC JHA process, as necessary.

d. Assist GRC organizations with industrial hygiene or safety issues that arise during the JHA process.

e. Periodically verify employee, contractor, and visitor adherence to the policy and requirements of this chapter.

8.0 JHA REQUIREMENTS

Note: This was moved to Section 4.2 of Policy.

8.1 JHA Format and Content (*29 CFR 1910.132(d)*)

The suggested JHA format is form GRC 239, JHA Worksheet. An equivalent form may be used, but it shall contain the following information at a minimum to meet OSHA's workplace hazard assessment requirement (29 CFR 1910.132(d)):

a. Job/task description.

b. Workplace hazard assessment location (building, room, and/or area).

c. Who filled out or populated the JHA (Analyst(s)).

d. Other employees involved with the job/task.

e. Description of job/task steps (with focus on those where hazards are present).

f. Description of the hazards present in each step.

g. Hazard controls and the specific PPE to be utilized.

h. Signature of supervisor or other qualified individual certifying the JHA as a hazard assessment document.

8.2 Change Control

8.2.1 Should any changes occur that involve the basic steps in JHA, the employee and supervisor shall update that JHA in accordance with the provisions of this chapter.

8.2.2 In addition, the supervisor responsible shall conduct an annual review of work tasks and existing JHAs to determine if a new JHA is needed or if an existing JHA needs to be revised.

8.2.3 The supervisor will review a JHA if a task-related close call, accident, injury, or illness occurs and revise the JHA appropriately based on the results of the review.

8.3 Training

8.3.1 It is recommended that anyone who participates in JHA development, review, approval, or maintenance complete course GRC–4R1954, PPE/JHA Training. This training will cover the contents of this chapter and how to adequately develop a JHA.

8.3.2. SHeD provides JHA training along with GRC–4R1954. Attendance and completion of

of the course will be documented in SATERN.

9.0 RECORDS

Records are maintained as follows:

Title of Record	Record Custodian
Training records for civil servants	SATERN
Training records for support service contractors, construction contractors, maintenance contractors, and others	Support organizations (Copies of classroom attendance sheets will be made available to support organizations upon request
Workplace hazard assessments shall be maintained per the various document requirements	See document requirements for control of records.
JHA forms	Organization that populated the JHA
PPE affiliated examinations for personnel needing medical clearance prior to the use of PPE	Occupational Medical Services for civil servants and support service contractors that utilize Center medical services

NOTE: For such services rendered outside the Center, the employer of the individual will maintain any relevant documentation regarding PPE medical clearance.

10.0 REFERENCES

Document Number	Document Name
29 USC 654	Occupational Safety and Health Act of 1970, Section 5(a)1, General Duty Clause
29 CFR 1910	Occupational Safety and Health Standards Subpart I, Personal Protective Equipment
29 CFR 1910.132(d)	Occupational Safety and Health Standards, Hazard Assessment and Equipment Selection
29 CFR 1910.133	Occupational Safety and Health Standards, Eye and Face Protection
29 CFR 1910.136	Occupational Safety and Health Standards, Foot Protection
29 CFR 1910.138	Occupational Safety and Health Standards, Hand Protection
29 CFR 1926	Safety and Health Regulations for Construction Subpart E, Personal Protective and Life Saving Equipment
NPR 1800.1	NASA Occupational Health Program Procedures, Accident Prevention.
GLP-QS-8715.1	Glenn Research Center Safety Manual
GLP-QS-1800.1	Glenn Research Center Occupational Health Programs Manual
OSHA Publication 3071	Job Hazard Analysis
ANSI Z136	Laser Safety (Eye Protection)
ANSI/International Safety Equipment Association (ISEA) 105	American National Standard for Hand Protection Selection Criteria
ANSI/ISEA Z87.1	American National Standard for Occupational and Educational Personal Eye and Face Protection Devices
ANSI/ISEA Z89.1	American National Standard for Industrial Head Protection
ASTM F739	Standard Test Method for Permeation of Liquids and Gases Through Protective Clothing Materials Under Conditions of Continuous Contact
ASTM F2412	Standard Test Methods for Foot Protection
ASTM F2413	Standard Specification for Performance Requirements for Protective (Safety) Toe Cap Footwear

NFPA 2112 — Standard on Flame-Resistant Clothing for Protection of Industrial Personnel Against Short-Duration Thermal Exposures from Fire

NFPA 2113 — Standard on Selection, Care, Use, and Maintenance of Flame-Resistant Garments for Protection of Industrial Personnel Against Short-Duration Thermal Exposures from Fire

Accident Prevention Manual for Industrial Operations. 1988. National Safety Council, Washington, D.C.

APPENDIX A. DEFINITIONS

Administrative controls. Administrative controls are procedures used to eliminate or reduce the exposure to the hazard, for example:

- Altering the manner in which employees implement a given procedure or perform a given process or task.
- Limiting the time that an individual performs a task.
- Rotating employees.

Arc flash. The passage of substantial electrical current through ionized air created by an electrical fault.

Breakthrough time. The time it takes for a chemical to permeate through a material.

Chemical protective clothing. Includes chemical-resistant gloves, aprons, coveralls, and boots.

Code of Federal Regulations. A codification of the general and permanent rules published in the Federal Register by the Executive Branch departments and agencies of the Federal Government. As it pertains to the personal protective equipment program, the applicable elements of both 29 CFR 1910 (Occupational Safety and Health Standards) and 29 CFR 1926 (Safety and Health Regulations for Construction) apply.

Control measures. Methods used to reduce or eliminate exposure to hazards or potential hazard.

Degradation. The change in a physical property of glove or chemical-protective clothing material as a result of contact with an incompatible chemical: for example, discoloration, brittleness, softness, swelling, and weakness.

Dermatitis. Inflammation of the skin.

Engineering controls. Methods of controlling employee exposure by modifying the source or reducing the quantity of contaminants released into the work environment, for example:

- Machine guards.
- Sound-absorbing panels.
- Local exhaust and ventilation.
- Substitution of a less hazardous chemical.

Exposure. Contact with a chemical, biological, or physical hazard.

Flame resistant. The property of a material whereby combustion is prevented, terminated, or inhibited following the application of a flaming or nonflaming source of ignition, with or without subsequent removal of the ignition source.

Flash fire. Rapidly spreading fire caused by igniting an atmosphere derived from hydrocarbon vapors of an ignitable liquid or finely divided combustible particles (e.g., coal dust or grain) in concentration exceeding the chemical's lower explosive limit.

Flame retardant. A chemical compound that can be incorporated into a textile fiber during manufacture or applied to a fiber, fabric, or the textile item during processing to reduce flammability.

Hazard assessment. A method used to determine hazards related to specific job tasks. The assessment may include employee exposure monitoring. The hazard assessment determines the chemical-protective clothing use and provides the OSHA-required certification that the assessment has been conducted.

Job hazard analysis (JHA). A method used to identify, quantify, and verify hazards related to job tasks.

Penetration. Bulk flow of a chemical through a glove material (e.g., through seams and pinholes).

Performance data. Testing data provided by chemical-resistant personal protective equipment manufacturers to inform users of each material's ability to protect against specific chemicals. Performance data typically measures penetration, degradation, and permeation of a chemical through a specific material.

Permeation. Movement of a chemical through a material at a molecular level without going through pinholes, pores, or other visible openings.

Personal protective equipment. Clothing, devices, and other work accessories designed to create a barrier against workplace hazards. PPE includes items such as goggles, face shields, safety glasses, hard hats, safety shoes, gloves, respirators, hearing protection (ear plugs and muffs), and chemical-protective clothing.

APPENDIX B. ACRONYMS

ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials (now ASTM International)
BMS	Business Management System
CFR	Code of Federal Regulations
CPC	Chemical-Protective Clothing
FR	Flame Resistant
GLP	Glenn Procedure
GRC	Glenn Research Center
GSM	Glenn Safety Manual
ISEA	International Safety Equipment Association
JHA	Job Hazard Analysis
LSOP	Laboratory Standard Operating Procedure
NFPA	National Fire Protection Association
NPR	NASA Procedural Requirement
OHPM	Occupational Health Programs Manual
OSHA	Occupational Safety and Health Administration
PPE	Personal Protective Equipment
SATERN	System for Administration, Training, and Educational Resources for NASA
SDS	Safety Data Sheet
SHeD	Safety and Health Division
USC	United States Code

APPENDIX C. DOCUMENTATION WITH SPECIFIC PPE REQUIREMENTS

C.1 GLP-QS-8715.1-8, Electrical Systems Safety

C.2 GLP-QS-8715.1-14, Shop Safety

C.3 GLP-QS-8715.1-18, Explosives, Propellants, and Pyrotechnics

C.4 GLP-QS-8715-16, Regulatory Permit Requirements, (Digging, Trenching, & Excavation Procedure)

C.5 GLP-QS-8715.1-34, Fall Protection

C.6 GLP-QS-1800.1-2, Asbestos

C.7 GLP-QS-1800.1-3, Hearing Conservation Program (e.g., earplugs and muffs)

C.8 GLP-QS-1800.1-4, Respiratory Protection Program (e.g., respirators)

C.9 GLP-QS-1800.1-5, Lead

C.10 GLP-QS-1800.1-11, Bloodborne Pathogens and Biological Materials

C.11 GLP-QS-1800.1-13, Laser Safety Program

C.12 GLP-QS-1800.1-25, Chemical Hygiene Policy

C.13 GLP-QS-1800.1-26, Occupational Exposure to Hazardous Chemicals and Toxic Substances

Printed copies are uncontrolled and may not reflect current information

APPENDIX D. HAZARD ASSESSMENT PROCESSES

D.1 Hazard Assessment Processes Chart

Table D.1 lists hazard assessment processes applicable to NASA GRC. This list may not cover all hazard assessment processes used at NASA GRC and approved by SHeD.

Table D-1. Hazard Assessment Processes

Process	Description/ Purpose	Reference Document	Form/ Documentation
Bloodborne Pathogens Exposure Control Plan	Identifies potentially exposed employees and determines proper control measures	OHPM Chapter 11	
Chemical Preapproval Process	Acquisition of Hazardous Chemicals and Materials to identify area use and proper control measures	OHPM Chapter 14	
Confined Space Entry Permit	Identify various hazards and controls for work in confined spaces, including excavations >4 feet in depth	GSM Chapter 16	GRC 199
Energized Electrical Work Permit	Identify electrical hazards and required control measures prior to performing energized work	GSM Chapter 8	GRC780
Facilities Inspections	Identify facility-based safety and fire hazards to provide a safe environment for employees to work	GSM Chapter 24	System For Tracking Audits/Assessments And Reviews
GRC Nanomaterials Standard Operating Procedure	Identifies types of nanomaterials in use by the GRC staff, current practices including PPE use and controls and assists in determining need for exposure assessment or additional controls	OHPM Chapter 25	GRC765
Fall Prevention Plan	Pre plan process for employees and SHeD to determine the need for applicable types of fall protection based on the identified hazards	GSM Chapter 34	GRC979
Hazardous Noise Exposure Assessment	Determines employee enrolment in the hearing conservation program and hearing protection requirements	OHPM Chapter 3	SHeD Report
Hot Work Permit	Prevent loss of life, property, and research capability caused by ignition from hot work operations. Mitigate hazards to ensure that all occupational health requirements are met to protect the workers and adjacent personnel.	GSM Chapter 16	GRC7A and GRC7B or GRC7C
JHA (Work order system)	Identify hazards associated with job/task and the control measure necessary to mitigate the hazards	GSM Chapter 15	GRC239

Laboratory Standard Operating Procedures (LSOP)	Identify hazards associated with chemical laboratory operations	OHM Chapter 25	Chemical Hygiene and LSOP eRoom
Respiratory Protection Hazard Assessment	Required to identify employee respiratory hazards to determine respiratory protection needs	OHPM Chapter 4	SHeD Report
Safety Permit & Process Hazards Safety	The process establishes a system for documenting operational hazards and controls for research and test operations. It is also designed to identify hazards that may result from changes.	GSM Chapters 1 and 3	GRC923 and GRC923A

D.2 JHA Process

D.2.1 Preliminary Job Review

Supervisors and employees will review the work tasks performed by the organization to determine if any meet the criteria listed in Section 8.1. If any of the criteria are met, a JHA will be developed for that task.

D.2.2 Task Observation or Review

The supervisor and employees will observe the work task to understand how it is performed and will consider task-specific job hazard training at this time. Sometimes it is helpful to photograph or videotape the task. If the task does not yet exist, the supervisor and employees should at least discuss the work task to determine how it might be performed.

D.2.3 Documentation of Basic Steps

After observing or reviewing the task, the supervisor and employees will identify and document the basic steps of the task. Include enough information to evaluate the hazards associated with each step without getting overly detailed. The more people who review the task and the basic steps, the more complete the evaluation will be. GRC 239, JHA Worksheet, is the recommended form to record information.

D.2.4 Hazard Identification and Evaluation

D.2.4.1 The supervisor and employees will review each step and identify potential hazards, both unsafe acts and unsafe conditions. During this exercise, ask questions such as the following:

a. What can go wrong?

b. What are the consequences?

c. How could it happen?

d. What are other contributing factors?

e. How likely is it that the hazard will occur?

f. What control measures, if any, are currently in place?

D.2.4.2 A list of common hazards is available below and in OSHA Publication 3071, JHA.

NOTE: This is not an all-inclusive list.

a. Caught in, on, or between.
b. Chemical. Toxic, flammable, combustible, corrosive, reactive.
c. Collision. Struck by or against.
d. Electrical. Shock, short circuit, fire, static, electrostatic discharge, loss of power.
e. Ergonomics. Strain, human error, repetitive motion, perception.
f. Excavation. Collapse, contact with underground structures and/or utilities.
g. Explosion. Over pressurization.
h. Falls. To same level, to different level, slips and/or trips.
i. Fire. Fuel, oxidizer, ignition source.
j. Kinetic energy. Linear, rotary.
k. Mechanical. Vibration, failure, stored potential energy.
l. Noise. Continuous, impact.
m. Pathological. Disease, bacteria, microorganisms.
n. Radiation. Ionizing, non-ionizing, electromagnetic, ultraviolet, infrared, visible.
o. Temperature extreme. Heat, heat stress, hypothermia, cold, and cryogenics.
p. Weather. Snow, rain, wind, ice, lightning, tornado, flood.

NOTE: The focus of the JHA process is on identifying unsafe acts, hazards, and conditions and controlling them to prevent or minimize accidents, injuries, illness, or property damage. This evaluation should not overly criticize the individual performing the task.

D.2.5 Hazard Control Measures

Once the hazards for each step are identified, the supervisor and employees will identify existing or potential control measures that will eliminate or minimize the hazards. Control measures include engineering controls, administrative controls, and/or specific PPE, in this order of preference.

NOTE: This is not an inclusive list.

a. Engineering controls:
   (1) Eliminate or minimize the hazard through design.
   (2) Enclose the hazard or the personnel.
   (3) Isolate the hazard with guards, interlocks, and barriers.

b. Administrative controls:

(1) Written operating procedures, work permits, and safe work practices.

(2) Exposure time limitations.

(3) Alarms, signs, and warnings.

(4) Buddy system.

(5) Training.

c. Personal protective equipment:

(1) Respirators.

(2) Hearing protection.

(3) Gloves.

(4) Protective clothing/aprons/sleeves.

(5) Safety glasses.

(6) Face shields.

(7) Hard hats.

(8) Safety shoes/boots.

D.2.6 Review and Submit JHA

The supervisor or employee may choose to submit the JHA to SHeD for additional review and comment. Once all issues are resolved, the supervisor and/or assigned safety professional/ delegate will review the final JHA with the affected employees in the organization.

APPENDIX E. SUPPLEMENTARY PERSONAL PROTECTIVE EQUIPMENT INFORMATION

The following information is intended to assist the user in selecting PPE.

NOTE: This is not an inclusive list, and any mention of a specific product brand name is not intended as an endorsement of that product.

E.1 EYE AND FACE PROTECTION

E.1.1 Eye and Face Protection Classifications

All eye and face protection must be ANSI Z87.1-approved and have Z87 or Z87+ marked on it. Various types of eye and face protection are available depending upon the specific hazard and include (but are not limited to) the following items:

a. **Safety Glasses**. Safety glasses are used to protect the eyes from flying particles, machining chips, and minor impacts. Safety glasses must be selected based on whether the hazard is low (Z87) or high impact (Z87+) and must have integrated or attachable side shields.

b. **Safety Glasses with Face Shield**. Safety glasses with face shield are used to protect the eyes, face, and neck. Face shields alone do not provide adequate protection from many hazards and must always be worn in conjunction with safety glasses with side shields or goggles. When employees handle high-pressure compressed gases or exposed cryogens, face shields must be of sufficient length to protect the face and neck.

c. **Goggles**. Goggles are used to protect employees from airborne dusts, molten metal from gas welding and cutting, chemical liquids or vapors, and sources of high-intensity visible light, ultraviolet-A or ultraviolet-B radiation, or infrared radiation. Goggles must be selected for a specific type of hazard. They must have direct or indirect vent features if fogging can occur and be sized to accommodate prescription eyeglasses when required by the user.

d. **Welding Helmet**. Welding helmets are required to protect employees from mechanical, thermal, and optical hazards associated with arc welding. Safety glasses or goggles must be worn in addition to the welding helmet.

e. **Arc Flash Hoods, Helmets, and Face Shields**. These are used to protect employees exposed to electrical arc flash hazards as required by NFPA 70E, Standard for Electrical Safety in the Workplace.

NOTE: The maximum arc fault current must be determined by analysis to select the appropriate level of eye and face protection.

E.1.2 Eye and Face Protection Usage

a. **Safety Glasses with Side Shields**. Side protection is always required for safety glasses or safety goggles. Personnel may use prescription safety glasses, but these must be equipped with side shields, and glasses must meet the requirements of ANSI Z87.1. Prescription safety glasses may be ordered through GRCs Occupational Medical Services.

b. **Contact Lens and Prescription Glasses Wearers**. Employees may wear contact lenses while performing hazardous work, but they must wear approved safety glasses or goggles. Otherwise, approved safety glasses or goggles must fit easily over prescription eyeglasses.

c. **Welding Helmet Wearers**. Welding helmets are a controlled item within Stock. Modern professional welding helmets are equipped with auto-darkening filters up to shade 10 that react to electrical arcs within a few milliseconds. Although OSHA does not specifically approve the use of these types of helmets because of the lack of test data, they are commonly used throughout industry, and most comply with the radiant-energy filtering requirements of ANSI Z87.1. GRC does not recommend or prevent the use of these electronic welding helmets. It is up to the employees' supervisor to determine if these offer adequate protection from optical radiation and to verify that the helmet does meet ANSI Z87.1. Standard welding helmets, without auto-darkening filter lenses, must be equipped with appropriate shades for the type of welding to be performed.

d. **Safety Glasses with Phototropic Lenses**. Do not use phototropic lenses for operations where there are rapid changes in ambient light. Examples would be tow motor or vehicle operators moving materials from exterior bright sunlight to interior artificial light. Do not use phototropic or photochromatic lenses for indoor industrial applications. They may be used outdoors only, providing the operations do not involve hazardous ultraviolet or infrared radiation.

E.1.3 Eye and Face Protection Inspection and Maintenance

a. Eye protection is a personal item and should be used exclusively by the individual to whom it is issued.

b. All eye and face protection must be maintained in a clean and reliable condition. Continuous use of dirty or scratched lenses can contribute to eye fatigue and result in accidents. Eye protectors should be cleaned as needed in a solution of mild soap and water.

c. Pitted or scratched prescription lenses must be replaced before the safety eyewear may be used again. Supervisors will ensure compliance.

E.1.4 Eye and Face PPE

Table E-1 provides a selection chart for eye and face PPE.

Note: This space left intentionally blank. Table E-1 is on the next page.

TABLE E-1. EYE AND FACE PPE SELECTION CHART (ANSI/ISEA Z87.1)

Source (and some examples)	Assessment of hazard	Protection required
Impact (chipping, grinding, machining, masonry work, woodworking, sawing, drilling, chiseling, powdered fastening, riveting, and sanding)	Flying fragments, objects, large chips, particles, sand, dirt, etc.	Glasses with side protection Goggles Face shields worn over spectacles or goggles
Heat (furnace operations, pouring, casting, hot dipping, and welding)	Hot sparks Splashes from molten metals High-temperature exposure	Glasses with side protection Goggles Face shields worn over spectacles or goggles Screen face shields Reflective face shields
Chemicals (acid and chemical handling, degreasing, and plating)	Splash Irritating mists	Goggles (eyecup or cover type) Face shields worn over spectacles or goggles Special-purpose goggles
Dust (woodworking, buffing, and general dust conditions)	Nuisance dust	Goggles (eye cup or cover type)
Electric arc welding	Optical radiation	Welding helmet over spectacles or goggles Welding shield over spectacles or goggles Typical shades, 10 to 14
Gas welding	Optical radiation	Welding goggles Welding face shield over spectacles or goggles Typical shades: Gas welding, 4 to 8 Cutting, 3 to 6 Brazing, 3 to 4
Cutting Torch brazing Torch soldering	Optical radiation	Spectacles Welding face shield over spectacles or goggles Typical shades, 1.5 to 4
Glare (working outside)	Poor vision	Glasses with shaded or special-purpose lenses Face shield over spectacles or goggles

Note: This space left intentionally blank. Table E-2 starts on next page.

Table E-2 provides a selection chart for eye and face PPE for radiant energy applications.

TABLE E-2. EYE AND FACE PPE SELECTION CHART FOR RADIANT ENERGY (29 CFR 1910.133)

Operations	Number of 1/32-in. electrodes	Arc current, A	Minimum protective shade
Shielded metal arc welding	Less than 3 3 to 5 5 to 8 More than 8	Less than 60 60 to 160 160 to 250 250 to 550	7 8 10 11
Gas metal arc welding and flux-cored arc welding		Less than 60 60 to 160 160 to 250 250 to 500	7 10 10 10
Gas tungsten arc welding		Less than 50 50 to 150 150 to 500	8 8 10
Air carbon arc welding		Less than 500 500 to 1000	10 11
Plasma arc welding		Less than 20 20 to 100 100 to 400 400 to 800	6 8 10 11
Plasma arc cutting		Less than 300 300 to 400 400 to 800	8 9 10
Torch brazing			3
Torch soldering			2
Carbon arc welding			14

E.2 HEAD PROTECTION

E.2.1 Hard Hat Usage

a. All head protection used by employees must be ANSI Z89.1 approved and be marked with a Z89.1 stamp.

b. All head protection utilized by employees must offer protection from impact and penetration by falling and flying objects and from limited electrical shock and burn. Therefore, bump caps will not be used for protection from head hazards because they do not meet the ANSI requirements, which establish specific protective performance characteristics.

c. All safety hats must be fitted so that there is at least 1½ inch of airspace between the top of the wearer's head and the inside shell of the hat. This permits the suspension to provide adequate cushioning. Hard hats must be worn such that the suspension system fits securely on the head and the hat adjustment is at the back. Wearing the hard hat in any other manner will seriously compromise its protective capabilities.

d. Chin straps are recommended where there is a reasonable probability that safety hats could be knocked or blown off.

e. Winter liners can be worn in cold weather conditions.

f. Protecting the head may also require covering or confining long hair when there is a potential for it to become entangled in moving machinery.

E.2.2 Hard Hat Inspection and Maintenance

a. Employees are responsible for inspecting their hard hats before each use. Hard hats should be cleaned of debris prior to inspections to ensure that all fractures and defects can be seen. Hard hats should be cleaned in warm water with a mild detergent. Solvents and other harsh chemicals should not be used to clean a hard hat.

b. All components including the shell, suspension, headbands, and accessories should be visually inspected for dents, cracks, punctures, and any damage due to impact, rough treatment, or wear that may reduce the structural integrity of the hard hat below design criteria.

c. Damaged hard hats cannot be repaired. They must be discarded and replaced. Other defective parts (suspension, chin strap, and other attachments) must be replaced with original equipment manufacturer parts.

E.2.3 Hard Hat Classifications

a. Hard hats are classified by ANSI as follows:

(1) Class G. Provides impact and penetration resistance as well as electrical protection up to 2200 V

(2) Class E. Provides impact and penetration resistance as well as electrical protection up to 20,000 V

(3) Class C. Provides only impact and penetration resistance; made of aluminum and will conduct electricity; should not be worn around electrical hazards

b. Two styles of hard hats are approved for use:

(1) Type I, offers protection from overhead impacts and penetration and limited side impact.

(2) Type II, offers protection from overhead and side impacts and penetration (much like a batting helmet).

c. Only Class G and Class E hard hats are allowed to be used at GRC.

E.3 FOOT PROTECTION

E.3.1 Foot Protection Usage

a. All footwear must be properly laced and fit snugly.

b. The toe cap must cover the entire toe area of the foot. If the toe cap does not cover the entire toe area, or extends past the toe area, the footwear will not provide the proper fit or adequate protection, and it will be uncomfortable to wear.

E.3.2 Foot Protection Inspection and Maintenance

a. Footwear is a personal item and should be used exclusively by the individual to whom it is issued.

b. Footwear should be maintained in a clean and reliable condition.

c. Footwear should be inspected before each use for:

(1) Tears in the upper part of the safety shoe.

(2) Worn or torn laces.

(3) Protrusions through the sole.

(4) Dents in the toe cap or metatarsal protection.

If any of the listed conditions occur, the footwear must be replaced immediately.

E.3.3 Foot Protection Classification

a. Foot protection is classified by ASTM F2413 utilizing the tests shown in Tables E.3 through E.6.

TABLE E-3. CLASSIFICATION TABLE TOE CAP COMPRESSION

Classification	Weight, lb	Clearance remaining in toe, in.	
		Male	Female
C/50	1750	0.5	0.468
C/75	2500	0.5	0.468

TABLE E-4.—CLASSIFICATION TABLE TOE CAP IMPACT

Classification	Force, ft-lb	Clearance remaining in toe, in.	
		Male	Female
I/50	50	0.5	0.468
I/75	75	0.5	0.468

TABLE E.5.—CLASSIFICATION TABLE METARSAL COMPRESSION

Classification	Weight, lb	Clearance remaining in toe, in.	
		Male	Female
MT/50	1750	0.5	0.468
MT/75	2500	0.5	0.468

TABLE E.6.—CLASSIFICATION TABLE METATARSAL IMPACT

Classification	Force, ft-lb	Clearance remaining in toe, in.	
		Male	Female
MT/50	50	0.5	0.468
MT/75	75	0.5	0.468

b. Foot protection labels classified by ASTM F2413 use a specific four-line format that identifies the type of footwear and the hazards for which it is designed to provide protection.

(1) Line 1. Identifies that the footwear is protective footwear that complies to an ASTM standard with a specific year of issuance. Example: ASTM F2413-05 (ASTM Standard No.) (Year of issuance)

(2) Line 2. Identifies the gender of user and the classifications for impact resistance, compression resistance, and metatarsal impact resistance. For example, M/I/75/C/75 indicates the following:

M	I	75	C	75
Male	Impact-Resistant Footwear	Impact Classification	Compression-Resistant Footwear	Compression Classification

(3) Lines 3 and 4*. Identify footwear made to offer protection from specific types of hazards.

(a) *CD*—Identifies protection against conductive hazards

(b) *EH*—Identifies footwear with outsole and heel made of electrical insulation properties

(c) *SD*—Identifies footwear designed to reduce the accumulation of excess static electricity

(d) *PR*—Identifies footwear designed to be puncture resistant

(e) *MT*—Identifies footwear designed to be impact resistant to the top of the foot

(f) *CS*—Identifies footwear which provides chain saw cut resistance

(g) *DI*—Identifies footwear which provides dielectric insulation

*Line 4 is used only when more than three sections of this specification apply to any one pair of protective footwear.

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c. An example of foot protection labels classified by ASTM F2413-05 follows here:

Line 1	ASTM F 2413-05	Protective footwear which complies to the performance requirement of F 2413 issued in 2005
Line 2	M/I/50/C/50	Footwear worn by male worker which has Class 50 impact resistance and Class 50 compression resistance
Line 3	PR	Puncture resistant footwear
Line 4	CS	Footwear which is chain saw cut resistant

E.3.4 Foot Protection Options

Several options are available for foot protection. Some options follow here.

a. Toe Protection:

(1) Toe armor. Nonmetallic composite toe cap developed by Wolverine that totally encapsulates the toes, weighs less than steel, and transmits less cold.

(2) Steel toe. Steel cap that can be heavy and can increase risk of frostbite in cold weather; extends from the sole of the shoe over the toes.

(3) Composite toe. Nonmetallic toe that weighs less than steel and transmits less cold; extends from the sole of the shoe over the toes.

b. Soles:

(1) Dura Shocks soles (Wolverine Outdoors, Inc.). Long-wearing, lightweight outsole with very high shock absorbance and durability (only offered in Wolverine brand of shoes).

(2) Vibram soles (Vibram S.p.A.). Tough, long-wearing soles available on more expensive shoes.

c. Shoe Material:

(1) Kevlar® stitching (DuPont). Organic fiber manufactured by DuPont with unique characteristics in comparison to other manmade or natural fibers—has high strength; high thermal, puncture, and cut resistance; and maintains resistance to many chemicals and solvents.

(2) GORE-TEX® fabric (W.L. Gore & Associates). Waterproof membrane that keeps liquids out while allowing air to penetrate; allows feet to breathe, keeping them cooler and dryer.

(3) SympaTex® waterproof material (SympaTex Technologies GmbH). Waterproof material that keeps feet dry while allowing them to breathe.

(4) Thinsulate™ (3M). Lightweight, nonbulky shoe insulation by 3M that keeps feet warm.

(5) Insulated shoes. Shoes that have an insulating material in the lining to keep feet warm and comfortable in cold environments.

d. Shoe and Shoe Features for Special Hazards:

(1) Electrical hazard shoe. Shoe designed to protect the wearer from open circuits of 600 volts or less under dry conditions.

(2) SD1 (electrostatic dissipating) shoe. Shoe constructed to reduce the accumulation of static electricity by conducting the body charge to the properly grounded flooring system; footwear falls within 106 to 108 ohms of resistance, which is generally considered to be acceptable for semiconductor applications.

(3) Puncture-resistant sole. Stainless steel midsole designed to reduce the hazards of puncture wounds caused by sharp objects that could penetrate the sole.

(4) Metatarsal protection. Composite or steel plate that entirely covers the top of foot beyond the toes for additional protection.

E.4 HAND PROTECTION

E.4.1 Hand Protection Classifications

Typically, gloves are designed to protect employees from physical hazards such as cuts, abrasions, and burns. Chemical-resistant gloves are designed to protect employees from chemical exposures. ANSI/ISEA 105 classifies gloves in multiple categories:

a. Mechanical Protection:

(1) Cut Resistance

(2) Puncture Resistance

(3) Abrasion Resistance

b. Chemical Protection:

(1) Chemical Permeation Resistance

(2) Chemical Degradation Resistance

c. Heat and Flame Protection:

(1) Ignition Resistance and Burning Behavior

(2) Heat Degradation Resistance

(3) Conductive Heat Resistance

d. Vibration Reduction

e. Dexterity

Note: This space left intentionally blank.

E.4.2 Hand Protection Usage

a. Work gloves will be used in accordance with the manufacturer's recommendations.

b. Loose-fitting work gloves must ***not*** be used when an employee is working on or near open moving parts such as drills and grinders. In this case, the gloves must be form fitting and cannot have torn fragments hanging from them.

c. Oils and greases are common causes of occupational dermatitis. Oil- and grease-protective work gloves should be worn when working around oily and greasy parts.

d. Thermal-protective gloves provide insulative protection from high temperatures, ***not*** protection from spilled cryogenic liquids. They are designed to fit loosely so that they can quickly be shaken off in case of a spill.

e. Cryogenic waterproof gloves provide protection from the extremely low temperatures associated with cryogenic liquids. They are designed to fit loosely so that they can quickly be shaken off in case of a spill.

E.4.3 Hand Protection Inspection and Maintenance

All hand PPE must be maintained in good, clean condition in accordance with the manufacturer's recommendations. Gloves should be checked for signs of deterioration before every use.

E.5 CHEMICAL-PROTECTIVE CLOTHING

E.5.1 Chemical-Protective Clothing Selection

a. When a hazard assessment has identified a need for CPC, proper selection is based on the following:

   (1) Task performed.

   (2) Identification of potential dermal hazards.

   (3) Severity of the hazard.

   (4) Degree of exposure to the hazard (frequency and duration).

   (5) Employee sensitivity to CPC material (e.g., latex allergy).

   (6) Performance data of the gloves and garments (permeation, degradation, penetration, and breakthrough time).

b. It is important to note the following when selecting CPC:

   (1) Latex gloves offer no chemical protection and can only be worn to protect hands against general dirt and debris and only by individuals not allergic to latex.

   (2) Users must know the glove or garment material and the manufacturer. Do not depend on the color and appearance of the garment to indicate performance information.

   (3) Chemical-resistant gloves or garments may only provide limited protection against many chemicals.

(4) No single glove or garment material is suitable for all chemicals.

(5) Performance characteristics of gloves or garments are based on manufacturer's information.

(6) Chemical resistance varies by manufacturer. Always check with the manufacturer for material effectiveness against specific chemical conditions in the workplace.

(7) When working with a chemical mixture, CPC that protects against all the chemicals in the mixture must be selected. This may require more than one layer of CPC.

E.5.2 Chemical-Protective Clothing Usage and Maintenance

a. When protection against physical and chemical hazards is required, two layers may be worn. For example, a chemical-protective glove can be used as a liner or first layer followed by an outer, more durable glove to protect against abrasion or punctures.

b. Nondisposable, chemical-protective gloves and garments must be cleaned after each use to ensure that chemical contamination does not remain on the glove.

c. In some circumstances, it may be more cost effective to regularly dispose of cheaper gloves or garments than to reuse more expensive gloves or garments.

d. Employees must remove CPC in such a manner so as to prevent skin contamination. This is discussed in the PPE training.

E.6 FLAME-RESISTANT CLOTHING

E.6.1 Flame-Resistant Clothing Selection and Usage

a. A hazard assessment of the work and workplace should be carried out to determine the need for FR clothing. (APPENDIX D has more information on the hazard assessment process at GRC). The hazard assessment should be used to determine if flammable materials are present in quantities that will generate a flash fire and endanger employees. Factors to consider in determining if FR clothing is required include, but are not limited to, the following:

(1) Proximity of the work to be performed to a hazard presenting a flash fire potential.

(2) The presence of flammable materials in the environment during process operations.

(3) The potential for the task being performed to increase the possibility of a flammable release; this could result from a mechanical failure such as a line breaking.

(4) Operating conditions of the process (e.g., potential for flammable fumes or vapors).

(5) The presence of engineering controls designed to reduce exposure to flammable materials present during normal operations.

(6) Accident history.

(7) Means and duration of egress within potential exposure zone (e.g., location and distance to exits, potential congestion, elevated or restricted areas, connections to lifelines/fall protection, capability of workers to escape, etc.).

(8) For maximum protection, employees who are required to wear FR clothing must adhere to the manufacturer's instructions.

b. Supervisors and employees must:

(1) Wear additional PPE as determined necessary from a review of the potential hazards.

(2) Not wear nonflame-resistant clothing (street clothes, rain jackets, etc.) over flame-resistant garments.

(3) Ensure FR or nonmelting undergarments (closest to the skin) are used. An incidental amount of elastic used on nonmelting fabric underwear or socks is permitted.

(4) Wear FR collars closed.

(5) Wear sleeves and cuffs down and secured.

(6) Ensure that protective neck, head, hand, and foot coverings be worn if the occupational hazard warrants their use.

E.6.2 Flame-Resistant Clothing Care, Maintenance, and Inspection

a. Organizations can choose to maintain their own FR clothing; however, private companies can be contracted to inspect, launder, repair, and dispose of FR clothing in accordance with NFPA 2113.

b. Flame-resistant clothing needs to be cleaned in accordance with manufacturer's instructions. If cleaning instructions are not provided, protective garments to be cleaned in accordance with the recommendations provided in ASTM F1449, Standard Guide for Industrial Laundering of Flame, Thermal, and Arc Resistant Clothing.

c. FR clothing that is contaminated must:

(1) Be disposed of if decontamination is not recommended by the manufacturer or cannot be achieved.

(2) Be handled in such a manner as to prevent cross-contamination.

(3) Not be laundered or dry cleaned in public facilities.

(4) Not be stored with other clothing without being laundered.

(5) FR clothing should be inspected by the employee for damage, soiling, or contamination after each use. Damaged and contaminated FR clothing must be immediately removed from service. FR clothing must also be removed from service when it exceeds the manufacturer-stated service life, if one is indicated.

d. Repair and alterations to FR clothing should be done in accordance with the manufacturer's instructions and should be performed in the same manner and using the same materials as the manufacturer. Deteriorated FR clothing must be disposed of when it can no longer be repaired or serviced.

E.6.3 Flame-Resistant and Flame-Retardant Clothing Examples

Garments for protection against flash fire are available from a variety of manufacturers, in a range of items (coveralls, pants, shirts, vests, parkas, rainwear, disposable garments, aprons, etc.). Flame-resistant garments are made from a variety of either inherently flame-resistant fabrics or fabrics that have been treated with a flame retardant. Listed below are examples of flame-resistant and flame-retardant clothing.

a. Flame Resistant:

   (1) Nomex® (DuPont).

   (2) CXP® (Milliken and Company) Nomex® (Dupont).

b. Flame Retardant Treatments for Fabrics:

   (1) Dale Antiflame® (Dale Antiflame).

   (2) Indura® (Westex Inc.).

   (3) Proban® (Albright and Wilson).

   (4) Zirpro® (Wool Foundation, Nominee Company Ltd.).

   (5) Pyrovatex® (Ciba-Geigy Corporation).

E.7 OBTAINING PERSONAL PROTECTIVE EQUIPMENT

All PPE purchases go through the GRC Micropurchase Process. A Purchase Guide is available to help select PPE within the required standards/certifications/requirements that the PPE must meet.

Change History

Rev.	Effective Date	Expiration Date	GRC25, Change Request #	Description
B	2/21/2012	2/21/2017	81	Process and format updates
Change 1	4/14/2014	2/21/2017	N/A	Administrative change to add front cover and change history log to comply with NPR 1400.1. Deleted "The authority for this program is outlined in" and inserted "The GRC shall follow the requirements of" in Section 4.0 Policy
Change 2	9/30/2015	9/30/2015	N/A	Administrative change to remove hyperlinks.
C	6/24/2016	6/24/2021	16-002	IFO Audit finding – reflect requirements within NPR 8715.3; add PPE procurement to roles and requirements.
Change 1	8/22/2017	6/24/2021	N/A	Administrative change to change document number from GLM-QS-1700.1.15 to GLP-QS-8715.1.15.
Change 2	8/22/2019	6/24/2021	N/A	Administrative change to combine GSM Chapters 15 Personal Protective Equipment and 33 Job Hazard Analysis into one chapter as Chapter 15 Personal Protective Equipment and Job Hazard Analysis. No changes to policies, roles, or requirements were made.
Change 3	5/12/2021	6/24/2021	N/A	Administrative change to update NPR and Neil A. Armstrong Test Facility
D	6/29/2021	6/29/2026	21-004	Moved Section 8.1 (JHA Requirements - When a JHA is needed) to Section 4.2. Process and format updates Updated to meet requirements of GLPR 1410.1
E	08/27/2026	08/27/2031	2026-26	5-year review. Changes include: • Remove the STOCK program from the chapter • 5.3.2 Added the Micropurchase process

***Include all information for each revision. Do not remove old revision data. Add new rows to table when space runs out by pressing the tab key in the last row, far right column.*