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Occupational Health Programs Manual – Chapter 4

Respiratory Protection Program

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NASA - Glenn Research Center
Cleveland, OH 44135

Change Record

Rev.	Effective Date	Expiration Date	GRC25, Change Request #	Description
F	5/9/2012	5/9/2017	285	Biannual update
Change 1	4/11/2014	5/9/2017	N/A	Administrative change to add front cover and change history log to comply with NPR 1400.1, deleted "The agency policy providing guidance for the selection and use of respiratory protection," in Section 4.0 and added "The GRC shall implement requirements of"
Change 2	9/30/2015	5/9/2017	N/A	Administrative change to remove hyperlinks.
Change 3	5/9/2017	5/9/2018	N/A	Administrative change to extend the expiration date to May 9, 2018, to allow more time to address the chapter revisions; changed document number from GLM-1800.1.4 to GLP-QS-1800.1.4.
G	4/26/2018	4/26/2023	18-001	Revision included administrative updates only.
Change 1	5/5/2021	4/26/2023	N/A	Administrative change to update Plum Brook Station to Neil A. Armstrong Test Facility
Change 2	8/16/2021	4/26/2023	N/A	Administrative changes to eliminate Appendix C and Appendix D as information is noted elsewhere in the chapter
H	X/X/2023	X/X/2028	23-002	Five-year Revision with general formatting corrections and administrative changes. Reformatted "shall" statements as per Glenn Research Center Directive Writing Guide.

***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.*

Contents

Chapter 4—Respiratory Protection Program

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 May 2023. The current version is located on the Glenn Research Center intranet within the BMS Library. Approved by Chief of Safety and Health Division.*

1.0 PURPOSE

The purpose of this chapter is to provide guidance for employees and supervisors on how to address potential respiratory hazard concerns in the workplace and to provide for the safe use of respiratory protection equipment. This Chapter details the current procedures and practices for the selection and use of respiratory protection at the NASA Glenn Research Centers (GRC), Lewis Field (LF), and Neil A. Armstrong Test Facility (GRC-ATF) sites.

2.0 APPLICABILITY

2.1 This chapter is applicable to all civil servant (CS) and support service contractor (SSC) employees assigned to GRC sites, construction contractors, students, and visitors. The SSCs, construction contractors, and visitors' employers are responsible for the health and safety of their employees. Employers with employees using respiratory protection equipment shall have a written Respiratory Protection Program, as required by the Occupational Safety and Health Administration (OSHA) and will ensure employees comply with all program requirements including medical clearance training, respirator fit tests, proper use and maintenance of respiratory protection equipment, and any other requirements as set forth in this Chapter.

2.2 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

The GRC, as part of its effort to provide a safe and healthful work environment, is committed to protect all employees from exposure to harmful concentrations of hazardous or toxic fibers, dust, fumes, mists, vapors, gases, or oxygen-deficient atmospheres. Where effective engineering controls are not feasible or while they are being instituted, respiratory protection measures described herein shall be used to protect workers. The Respiratory Protection Program encompasses all aspects of respiratory protection, from the initial hazard assessment, where the need for a respirator is determined, to the program evaluation, where the effectiveness of the program is assessed. The flow chart in Appendix B provides an outline of the Respiratory Protection Program managed by the Safety and Health Division (SHeD) Respiratory Protection Program Lead.

4.0 POLICY

4.1 The GRC's safety and occupational health programs are intended to maintain and protect the health and safety of our workers, as well as to promote employee wellness. This Chapter is based upon applicable laws and regulations, industry standards or other guidelines, as well as agency policy. The GRC shall follow the requirements of NASA Procedural Requirement (NPR) 1800.1, wherein it states that NASA Centers shall comply with the OSHA standards promulgated under Section 6 of the OSHA Act of 1970. In addition to complying with the OSHA Respiratory Protection Standard for General Industry (29 Code of Federal Regulations (CFR) 1910.134) and the OSHA Respiratory Protection Standard for Construction (29 1926.103), the following entities provide current guidance such as consensus and industry standards.

a. American Conference of Governmental Industrial Hygienists (ACGIH)

b. American National Standard Institute (ANSI)

c. National Institute for Occupational Safety and Health (NIOSH)

4.2 It is NASA's policy to adhere to OSHA or ACGIH occupational exposure limits (OELs), whichever is more protective, to ensure worker protection. Given the inherent unknowns common to research operations, in the absence of an established OEL, the most protective approach shall be employed. The SHeD industrial hygienists (IHs) provide technical support in determining OELs to ensure worker protection.

4.3 Compliance with the responsibilities and requirements of this chapter are measured and verified through the use of programmatic self-assessments, regulatory, and Agency audits and internal field inspections.

5.0 RESPONSIBILITIES

5.1 SHeD Respiratory Protection Program Lead shall:

a. Develop and implement a written Respiratory Protection Program to govern the selection and use of respiratory protective devices.

b. Conduct or facilitate baseline hazard assessments of operations, tasks, or procedures that possess the potential to create harmful airborne contaminants or oxygen-deficient atmospheres to determine specific respiratory protection needs.

c. Provide GRC Medical Services with an employee-specific respirator selection and use information to support medical clearance decision making.

d. Provide initial respiratory protection training and facilitate annual refresher training.

e. Provide the Strategic Advisory Services Division (SASD) with the course content for the respiratory protection training classes offered and the delivery dates for each fiscal year; forward attendance forms to the SASD for System for Administration, Training and Educational Resources for NASA (SATERN) recordkeeping of employee training history; provide a list of employees assigned the SATERN curriculum for Respiratory Protection.

f. Provide employees and supervisors with a respirator selection and cartridge change schedule (RSCCS) to document the respiratory protective equipment selected for the respiratory hazard(s), and to provide a cartridge change schedule to protect against gases and vapors.

g. Facilitate the performance of personal exposure assessments representative of the exposures of employees in similar exposure groups.

h. Facilitate self-contained breathing apparatus (SCBA) inspection and maintenance tasks to ensure program compliance.

i. Respond to requests for voluntary use of disposable filtering facepiece respirators (dust masks) to assess the hazard and ensure compliance with Appendix D of 29 CFR 1910.134.

5.2 SHeD shall:

a. Provide annual respirator fit testing, including a hands-on training component.

b. Maintain an annual documentation file for each employee including the fit test results, training quiz, the hazard assessment, and the RSCCS.

c. Issue the completed RSCCS to each employee and their supervisor.

d. Maintain the Respiratory Protection Program database to track program enrollment status, training, fit testing and medical clearance dates, hazard assessment data, and respiratory protection equipment selection.

e. Provide employees, and supervisors as needed, with reminders to ensure compliance with annual training, fit testing, and medical clearance requirements.

f. Assist the Respiratory Protection Program Lead with SCBA inspection and maintenance tasks to ensure program compliance, including SCBA inventory, SCBA annual bench testing, SCBA breathing air cylinder requalification, SCBA hands-on training, and the annual purge and refilling of all SCBA breathing air cylinders.

g. Facilitate and maintain a permanent record of SCBA breathing air cylinder recharging by the Brook Park Fire Chief, as requested by research users.

h. Assist SHeD IHs with personal exposure assessment sampling.

i. Perform annual program evaluations of CSs in the program to ensure continued program compliance and effectiveness.

j. Perform periodic audits of the onsite SSC respiratory protection programs for compliance and effectiveness.

5.3 Supervisor of Respirator User shall:

a. Ensure a hazard analysis and/or assessment, job hazard analysis (JHA), or a Chemical Hygiene Plan standard operating procedure (SOP) has been developed for each task in their area requiring respiratory protection, whichever is most appropriate.

b. Ensure the SHeD IH, has reviewed the operation or task to ensure the hazard assessment, JHA, or Chemical Hygiene Plan SOP has captured all of the elements of the tasks and the associated hazards, prior to the use of the material.

c. Ensure that employees are knowledgeable about the hazards posed, the safe work practices required, and the prescribed Personal protective equipment (PPE), including respiratory protective devices, required for areas in which they work and for the tasks they perform.

d. Ensure areas, where the use of hazardous chemicals requires respiratory protection, are properly ventilated, properly marked, and access is restricted.

e. Be aware of the proper use and limitations of respiratory protection devices by completing a respirator training class or similar awareness training.

f. Enforce the requirements of the Respiratory Protection Program in their area, including employee compliance with training, medical clearance, fit testing, and where required, adherence to the respirator cartridge change schedule.

5.4 Respirator Users

Those using respiratory protection shall:

a. Support their supervisor in ensuring a hazard assessment, JHA, or SOP has been conducted of their operation or task, potentially requiring a respirator, prior to the use of the potentially hazardous material(s).

b. Notify their supervisors of any operational changes or new uses of the materials requiring respiratory protection.

c. Coordinate with the SHeD IH for an exposure assessment, prior to the performance of the task requiring the use of a respirator; where possible, the respirator user will provide the SHeD IH with advance notification of respirator use (ideally 1 week), so that the appropriate sampling media and scheduling can be arranged.

d. Comply with the RSCCS provided by the Respiratory Protection Program Lead for each task requiring a respirator.

e. Comply with all aspects of the respirator program, including but not limited to, annual respirator fit testing, annual respirator training, annual medical evaluation, proper use, cleaning, maintenance, and storage.

f. Ensure proper respirator fit by performing a user seal check before entering into a hazardous environment.

g. Notify Medical Services and their supervisor if they experience any signs or symptoms of overexposure.

5.5 Medical Director, Occupational Medicine Services shall:

a. Provide medical evaluations of personnel identified by their organizations as respirator users, in conformance with protocols established by OSHA, NASA, and where required, other nationally recognized standards, as applicable.

b. Provide a written opinion, to the Respiratory Protection Program Lead, stating the employee is medically able to use the respirator, or any limitations on respirator use related to a medical condition, or related workplace conditions in which the respirator will be used, and the need for any follow-up evaluations (In addition, they will maintain records of all

occupational medicine activities associated with the support of the GRC Respiratory Protection Program.)

c. Provide employee access to medical records in accordance with 29 CFR 1910.1020.

5.6 Strategic Advisory Services Division Chief shall:

a. Maintain SATERN records for employees who have completed respiratory protection training.

b. Coordinate with the Respiratory Protection Program Lead to ensure the SATERN Respiratory Protection Training curriculum is current and activated to issue annual training reminders for CS employees active in the Respirator Program.

5.7 Safety and Health Division Chief shall:

Ensure a qualified individual is identified as the OSHA Respiratory Protection Program Administrator, to carry out the responsibilities as set forth in the GRC Respiratory Protection Program. The qualified individual will be identified by the organization tasked with the implementation of the Respiratory Protection Program. The Chief of SHeD will provide support to the Respiratory Protection Program Lead in the performance of their duties and will maintain respiratory protection program records and documentation provided by the Respiratory Protection Program Lead.

6.0 REQUIREMENTS

6.1 Hazard Assessment (*OSHA* 29 CFR 1910.132*(d) and 29 CFR 1910.134(d)*)

6.1.1 The selection of any PPE including respirators is based on an assessment of the hazards. Guidance for this process is covered in the GLP-QS-8715.1. Glenn Safety Manual (GSM), Chapter 15, PPE and JHA. Respiratory hazards may exist in the workplace in the form of dust, fibers, nanoparticles, fumes, mists, gases, vapors, and biological materials.

6.1.2 During the hazard assessment, several factors must be investigated including:

a. The nature of the task being performed and the potential for generation of airborne contaminants

b. The physical, chemical, and toxic properties of the material

c. The contaminant concentration and duration of exposure

d. The environmental factors (heat and humidity)

e. Worker exertion level while performing the task

f. The potential for engineering and administrative controls

g. Additional PPE needed

6.1.3 If an inhalation hazard is identified based on information from the hazard assessment, the SHeD IH will recommend the use of controls. Engineering and administrative controls, such as ventilation, chemical substitution, and limiting or restricting personnel access to areas, will be used whenever feasible and practical. When engineering controls are not feasible and practical, or do not completely eliminate the hazard, respiratory protection will be used. For tasks that are of short duration, infrequent or non-routine, respiratory protection can be used.

6.1.4 To meet the hazard assessment requirement, respirator users shall complete the following documentation:

a. The JHA for the task requiring a respirator, as detailed in the GSM Chapter 15

b. Respiratory Protection Hazard Assessment form completed and reviewed during each respirator training session and during each respirator fit test.

6.2 Exposure Assessment (*OSHA 29 CFR 1910.134(d)*)

6.2.1 For the selection of respiratory protection, the employer is required to assess the employee's actual inhalation exposure to the worksite hazard(s). The exposure assessment is done in the workplace, by way of air sampling, modeling, or some other means, to determine what airborne hazards are present, what the concentration is, and what level of respiratory protection is needed. Exposure assessment data provides the basis for the respirator users written RSCCS, incorporating OSHA assigned protection factors (APFs) and maximum use concentration (MUC) requirements, and respirator manufacturer's canister and cartridge service life specifications.

6.2.2 If there is more than one employee in an area performing the same task requiring respiratory protection, one exposure assessment can be performed for all employees performing that task. These are referred to as exposure assessments for similar exposure groups.

6.2.3 It is the responsibility of the respirator user to notify the SHeD IH, as appropriate, when they are going to perform the task requiring the use of a respirator. This notification shall give the SHeD IH as much notice as possible (ideally 1 week) so the appropriate sampling media and scheduling can be arranged.

6.3 Selection of Respirators (*OSHA 29 CFR 1910.134(d)*)

6.3.1 General Requirements

6.3.1.1 For each employee, the Respiratory Protection Program Lead shall choose either an air-purifying respirator or an atmosphere-supplying respirator for the airborne hazard based upon the JHA and, where possible, exposure assessment data. Proper selection of respirators will be made according to the OSHA Respiratory Protection Standard, 29 CFR 1910.134. Only NIOSH certified respirators will be used in accordance with the conditions of certification.

6.3.1.2 When a negative pressure respirator has been selected for an employee, and the physician or other licensed health care professional (PLHCP) finds a medical condition that may place the employee's health at risk, a powered-air purifying respirator (PAPR), which provides a positive

pressure in the facepiece, shall be provided by the employer, subject to the approval of the PLHCP. Employees may choose to use a PAPR in lieu of a negative pressure respirator; however, the use of a PAPR is subject to the approval of the Respiratory Protection Program Lead and the employee's supervisor.

6.3.2 Air-Purifying Respirators for Non-Immediately Dangerous to Life or Health Atmospheres (*OSHA 29 CFR 1910.134(d)(3)*)

6.3.2.1 Air-purifying respirators (APR) function by removing contaminants from the ambient air by passing the air, which is moved by the user's breathing action or by a blower, through an air-purifying filter, cartridge, or canister. The respirator filters, cartridges, or canisters contain a particulate filter or an adsorbent, or a combination of both, used to remove the airborne contaminates. The respirator selected shall maintain the employee's exposure to the hazardous substance, when measured outside the respirator, at or below MUC.

6.3.2.2 Respirator filters, cartridges or canisters have a limited service life, thus the respirator user shall be knowledgeable about "end-of-service-life" indicators and will be provided with a written RSCCS for each respiratory hazard identified. The RSCCS enables the respirator user to easily identify the respirator and filtering devices required for the identified tasks, and specifies the change schedule for the selected filters, cartridges, or canister.

6.3.2.3 Full-facepiece respirators shall be used when there is potential for flying particles, liquid or chemical splashes, or a corrosive atmosphere.

6.3.2.4 Air-purifying respirators shall not be used in immediately dangerous to life and health (IDLH) atmospheres including oxygen-deficient atmospheres and unknown atmospheres.

6.3.3 Voluntary Use of Disposable Filtering Facepiece Respirators (*OSHA 29 CFR 1910.134, Appendix D*)

6.3.3.1 A disposable filtering facepiece respirator (also referred to as a dust mask or disposable respirator) may only be used on a voluntary basis for exposures to low concentrations of nuisance particulate matter and for protection against some types of biohazard agents such as mold. Use of filtering facepiece respirators requires the completion and submission of the GRC 785 form, "Employee Request-Voluntary Use N95 Disposable Filtering Facepiece Respirator."

6.3.3.2 Requirements include a review of OSHA 29 CFR 1910.134, Appendix D, a review of an online manufacturer training video for the disposable filtering facepiece, and compliance with all other aspects of the Respiratory Protection Program, except for respirator medical evaluation and the respirator fit test.

6.3.3.3 For involuntary or required use of a filtering facepiece, compliance with all aspects of the Respiratory Protection Program, including medical evaluation and respirator fit testing, is required.

6.3.4 Atmosphere-Supplying Respirators for IDLH Atmospheres (*29 CFR 1910.134 (d)(2)*)

6.3.4.1 The IDLH atmospheres, including oxygen-deficient atmospheres and unknown atmospheres, require the highest level of respiratory protection and reliability. Atmosphere-supplying respirators provide a continuous supply of compressed breathing air to the user. Employees entering IDLH atmospheres shall be provided with either 1) a full-facepiece pressure-demand SCBA, certified by NIOSH for a minimum service life of 30 min, or 2) a combination full-facepiece pressure-demand supplied-air respirator (SAR) with an escape auxiliary self-contained air supply.

6.3.4.2 For atmosphere-supplying respirators, a stationary source of compressed breathing air is delivered to the respirator user through a pressure-demand device. A pressure-demand device ensures a positive pressure inside the facepiece relative to ambient air, so that any leakage of air is outward rather than into the facepiece. More breathing air is introduced into the facepiece as a result of a pressure drop when the wearer takes a breath. Atmosphere-supplying respirators shall be of the pressure-demand, open-circuit type.

6.3.4.3 The advantages and disadvantages of using atmosphere-supplying respirators should be considered prior to selection for use. SCBAs have a limited-service life of 30 to 60 minutes, depending on the size of the breathing air tank and the conditions of use. A SAR can be used for a longer duration than a SCBA, but the trailing airline may restrict the movement of the user and has the potential to come into contact with machinery or vehicles that could sever the line or restrict the flow of air.

6.3.4.4 Atmosphere-supplied respirators provided only for escape from IDLH atmospheres shall be NIOSH-certified for escape from the atmosphere in which they will be used. Currently, escape-only respirators are located in the GRC Hangar and the GRC-ATF Space Environments Complex (SEC) (currently inactive).

6.4 Medical Evaluation (*29 CFR 1910.134 (c)(1)(ii) and Appendix C and NASA NPR 1800.1, Chapter 2.9*)

6.4.1 The use of respiratory protection places a physiological burden on the respirator user. A medical evaluation shall be performed for each employee required to use a respirator in the workplace to determine the employee's ability to wear the selected respiratory protection. The employee's medical evaluation will be performed by a PLHCP prior to the initial fit test or use of a respirator and annually thereafter. Prior to the medical evaluation, the Respiratory Protection Program Lead will provide the PLHCP information on the type and weight of the respirator selected, the duration and frequency of use, the expected physical workload, additional protective clothing to be worn, and any temperature and humidity extremes encountered. The PLHCP will perform a medical evaluation that includes using a medical questionnaire that meets the requirements of 29 CFR 1910.134, Appendix C, and a review any other health or physical conditions that are pertinent. The PLHCP will provide a written opinion to the employee and the Respiratory Protection Program Lead regarding the employee's physical ability to use a respirator and any limitation of use including the need for any follow-up evaluations.

6.4.2 When a negative pressure respirator has been selected for an employee and the PLHCP finds a medical condition that may place the employee's health at risk, a PAPR, which provides a positive pressure in the facepiece, shall be provided if the PLHCP determines that such a respirator can safely be used.

6.4.3 If respirator user experiences physical symptoms related to respirator use, they shall contact Medical Services immediately for a review of their medical status.

6.5 Training (*29 CFR 1910.134 (k)*)

6.5.1 Respiratory protection training is required for all employees who are required to use respirators, prior to the use of a respirator and annually thereafter. The training shall be comprehensive and understandable and recur annually or more often, if necessary. Respiratory protection training can consist of classroom instruction including a hands-on component or a combination of viewing training videos followed by an annual fit test that includes a hands-on review of critical information. Employees must be able to demonstrate they understand

a. Why the respirator is necessary and how improper fit, usage, or maintenance can compromise the protective effect of the respirator

b. What the limitations and capabilities of the respirator are

c. How to use the respirator effectively in emergency situations, including situations in which the respirator malfunctions

d. How to inspect, put on and remove, use, and check the seals of the respirator

e. What the procedures are for cleaning, maintenance, and storage of the respirator

f. How to recognize medical signs and symptoms that may limit or prevent the effective use of respirators

g. How to recognize filter and cartridge “end-of-service-life” indicators

6.5.2 Employees who use a filtering facepiece on a voluntary basis shall be provided with the basic advisory information required by 29 CFR1910.134, Appendix D, as well as completing the GRC 785 form “Employee Request-Voluntary Use N95 Disposable Filtering Facepiece Respirator” .

6.5.3 In addition to respirator training, hazard communication training is a component of the program, where employees are trained in the respiratory hazards to which they are potentially exposed during routine and emergency situations. Training about the respiratory hazards is specific to the task and hazard. SHeD offers training for the following:

a. Hazard Communication Program

b. Chemical Hygiene Plan

c. OSHA-regulated materials training

d. Silica awareness

e. Nanomaterials

f. Lunar dust and/or simulants awareness

g. Asbestos, lead, and mercury awareness

h. Hexavalent chromium awareness

6.5.4 Also, supervisors provide on-the-job training where a Safety Data Sheet (SDS) is reviewed, and the hazards discussed.

6.6 Fit Testing (OSHA 29 CFR 1910.134 (f) and Appendix C)

6.6.1 All employees using a tight-fitting facepiece respirator shall pass an appropriate quantitative fit test (QNFT) or qualitative fit test (QLFT). The QNFT is the preferred method of testing a proper facepiece fit and is required for SCBA and full-facepiece pressure-demand SAR.

6.6.2 The Respiratory Protection Program Lead shall select the appropriate type of respirator for each employee, utilizing hazard assessment and exposure assessment data specific to the task. The employee will then be able to choose their respirator from a sufficient number of respirator models and sizes so that the respirator is acceptable to and correctly fits the employee.

6.6.3 The employee shall be fit tested by a SHeD IH, after the initial medical clearance but prior to the first use of the respirator and annually thereafter. Additional fit tests will be conducted when there are changes in an employee's physical condition that could affect respirator fit.

6.6.4 The effectiveness of a tight-fitting respirator is dependent on an airtight seal between the respirator and the user's face. Thus, an employee will not be fit tested if facial hair comes between the user's face and the respirator facepiece seal. Spectacles, goggles, face shields, or welding helmets shall also be worn so as to not interfere with the seal. Prior to being fit tested, employees must demonstrate the ability to perform a user seal check by conducting a negative and positive pressure test. Upon completion of the fit test, each employee will be issued a fit test report, which identifies the employee, the type of respirator fit tested, and the fit test expiration date.

6.6.5 Upon completing the fit test and compliance with annual training and medical clearance requirements, respirator users will be issued a RSCCS that provides ordering information for their respirator, the appropriate filters and cartridges, and the cartridge change schedule to protect against gases and vapors.

6.7 Use of Respirators (OSHA 29 CFR 1910.134 (g) and Appendix B–1)

6.7.1 General

6.7.1.1 Requirements are established for the use of respirators: to prohibit conditions that may result in facepiece seal leakage; to prevent employees from using respirators in hazardous environments; to ensure continued effective respirator operation throughout the work shift; and to establish procedures for the use of respirators in IDLH atmospheres.

6.7.1.2 The effectiveness of a tight-fitting respirator is dependent on an airtight seal between the respirator and the user's face, and properly functioning valves. Facial hair that comes between the sealing surface of the facepiece and the face or that interferes with valve function is not permitted. Spectacles, goggles, face shields, or welding helmets shall be worn so as not to interfere with the seal. Employees who wear spectacles (glasses) and are required to use a full-facepiece respirator will be issued a respirator spectacle kit with prescription lenses.

6.7.1.3 For all tight-fitting respirators, a user seal check, as mandated by OSHA 29 CFR 1910.134 Appendix B-1, shall be performed to ensure an adequate face-to-facepiece seal. Respirator users will perform a user seal check by conducting the negative and positive pressure test each time the respirator is worn.

6.7.1.4 Air-purifying respirators can only be worn in environments with sufficient oxygen and known contaminants. The Respiratory Protection Program Lead shall develop a respirator cartridge change schedule for each task, using information from the hazard assessment, exposure assessment, and cartridge manufacturer. The cartridge change schedule determines when the respirator user must replace the filters or cartridges. The respirator user is responsible maintaining compliance with the cartridge change schedule. Organic vapors can migrate through the respirator cartridge carbon bed without airflow; thus, the use of organic vapor cartridges is limited to one shift.

6.7.1.5 Respirator users shall be permitted to leave the work area when they need to wash their faces and respirator facepiece to prevent eye or skin irritation, if they detect vapor or gas breakthrough, if they experience changes in breathing resistance or leakage of the facepiece, and/or they need to change the filter, cartridge, or canister elements as specified in the RSCCS. Reentry into hazardous atmosphere will not be undertaken until the respirator is replaced or repaired. If employees experience physical symptoms, they must immediately leave the area and report to Medical Services and notify their supervisor.

6.7.1.6 Respirator users shall not wear respirators in the presence of hazardous atmospheres other than those identified in the respirator user's RSCCS.

6.7.2 Use of Respirators in IDLH Atmospheres (*OSHA 29 CFR 1910.134 (g)*)

6.7.2.1 Only full-facepiece pressure-demand SCBA certified by NIOSH for a minimum service life of 30 min or a combination full-facepiece pressure-demand SAR with an auxiliary self-contained air supply may be used in IDLH atmospheres including oxygen-deficient and unknown atmospheres.

6.7.2.2 One employee or when needed, more than one employee, shall be located outside the IDLH atmosphere. Visual, voice, or signal line communication will be maintained between the employee in the IDLH atmosphere, and the employees located outside the IDLH atmospheres.

6.7.2.3 The employee(s) located outside the IDLH atmosphere shall call 911, GRC Dispatch, in case of emergency.

6.8 Care and Maintenance of Respirators (*OSHA 29 CFR 1910.134 (h) and Appendix B–2*)

6.8.1 Respirator users are responsible for the cleaning, disinfection, inspection, and maintenance of their personal respirators. Respirator users needing support for respirator care and maintenance should contact the Respiratory Protection Program Lead or the SHeD IHs.

6.8.2 Respirators shall be cleaned and disinfected as often as necessary to be maintained in a sanitary condition, in a manner that prevents damage to the respirator and does not cause harm to the user. OSHA 29 CFR 1910.134, Appendix B–2, Respirator Cleaning Procedures, will be followed or procedures recommended by the manufacturer, where equivalently effective. If the respirator is used periodically throughout the day, at a minimum, it must be cleaned at the end of the day or shift. Individually wrapped cleaning towelettes issued by NASA stock may be used, but they must be supplemental to OSHA or manufacturer respirator cleaning procedures.

6.8.3 Respirators shall be stored to protect them from damage, contamination, dust, sunlight, extreme temperatures, excessive moisture, and damaging chemicals, and they will be stored to prevent deformation of the facepiece and the inhalation and exhalation valves.

6.8.4 Respirator Inspections

Respirators used in routine situations shall be inspected by the user before each use and during cleaning. Respirator inspections will include a check of respirator function, tightness of connections, and the condition of the various parts, including but not limited to, the facepiece, head straps, valves, connecting tube, cartridges, canisters, or filters. The inspection will also include a check of the elastomeric parts for pliability and signs of deterioration. Defective respirators will be turned into SHeD for replacement.

6.8.5 Additional Care and Maintenance for Atmosphere-Supplying Respirators National Fire Protection Association (*NFPA) 1852, CGA 7.1, and Department of Transportation (DOT) 49 CFR Part 178*

6.8.5.1 SCBA used for research, and not maintained for emergency use, shall be inspected before and after each use. SCBA used for emergency use must be inspected before and after each use and monthly. The external surface of the SCBA and the facepiece components will be cleaned, disinfected, and stored after each use according to the manufacturer's instructions. The SCBA inspections will be performed by the respirator users to assure continuing familiarity with the respirator and will include a determination that the regulator and warning devices are functioning properly.

6.8.5.2 If defects are found during an inspection, they shall be brought to the attention of the Respiratory Protection Program Lead. The defective SCBA will be marked "Danger—Defective SCBA—Do Not Use" and returned to Respiratory Protection Program Lead for immediate repair. The Respiratory Protection Program Lead will ensure that all repairs will be performed by the manufacturer or personnel trained by the manufacturer of the equipment and will maintain a detailed record of all repairs conducted on these systems.

6.8.5.3 SCBA shall be tested at least annually on a breathing machine, or SCBA "bench tested." The testing must meet the requirements specified in NFPA 1852 (2019). The Respiratory Protection Program Lead will facilitate the SCBA annual breathing machine testing (bench testing).

6.8.5.4 SCBA breathing air cylinders shall be maintained in a fully charged state and will be recharged when the pressure falls to 90 percent of the manufacturer's specified pressure level. The SHeD IH will facilitate the recharging of the SCBA breathing air cylinders upon request; currently, the SHeD IH transports SCBA cylinders to the City of Brook Park Fire Station for recharging with Grade E breathing air. Compressed breathing air stored in SCBA breathing air cylinders will be replaced at least annually. The SHeD IH will maintain a permanent record of cylinder recharging.

6.8.5.5 Compressed breathing air used for respiration shall meet at least the requirements for Grade D breathing air as described in the ANSI/Compressed Gas Association Commodity Specification for Air, Compressed Gas Association (CGA) G7.1–2018. Breathing air cylinders must meet the following requirements: the cylinders will be hydrostatically tested by a licensed cylinder retester in accordance with the appropriate DOT regulation and cylinders of purchased air must have a certificate of analysis from the supplier for a minimum of Grade D breathing air.

6.8.5.6 The Respiratory Protection Program Lead shall facilitate the periodic SCBA cylinder requalification, including hydrostatic testing, according to DOT specifications. The retest facility must be a qualified DOT Research and Special Programs Administration retest facility with a valid retester identification number. Generally, composite cylinders are requalified every 5 years and all-metal cylinders are requalified every 5 years. Composite cylinders have a service life of 15 years, and the service life of all-metal cylinders is determined at the time of requalification. Requalified cylinders are marked with the retester identification number and the retest date.

6.8.5.7 Compressors used to supply compressed breathing air shall be constructed and situated so as to prevent entry of contaminated air in the air-supply stream and minimize moisture content. Compressors used to supply breathing air must be in compliance with 29 CFR 1910.134(i) specifications.

6.8.5.8 The NASA GRC at LF and GRC-ATF does not have any personnel approved for the emergency-use respirators. Emergency response is provided for GRC by the City of Brook Park and for GRC-ATF by Perkins Township.

6.8.6 Emergency Escape-Only Respirators (*OSHA 29 CFR 1910.134(c)(1)(iv)*)

Emergency escape-only respirators shall be inspected before being place in the workplace, and in accordance with the manufacturer's recommendations. Emergency escape-only respirators must be clearly marked and stored where they are always accessible. Currently, escape-only respirators are located in the GRC Hangar and GRC-ATF SEC facilities (currently inactive).

6.9 Program Evaluation (OSHA 29 CFR 1910.134(l))

6.9.1 Respirator program evaluations of the workplace shall be conducted annually by the SHeD IHs, and the results will be reviewed by the Respiratory Protection Program Lead. The purpose of the program evaluation is to ensure that the written program is being properly implemented; to consult with employees to ensure that they are using their respirators properly; and to ensure the program continues to be effective. The evaluation must be conducted in the

workplace, and can include but not be limited to, respirator fit, appropriate respirator selected for the hazard, proper use in the workplace, and proper maintenance. The Respiratory Protection Program Lead will correct any problems identified during the program evaluation.

6.9.2 The SSCs shall conduct program evaluations of their respiratory protection program at a frequency that ensures that all elements of the OSHA Respiratory Protection Standard are being effectively implemented. The SHeD will perform periodic audits of the onsite SSC respiratory protection programs for compliance and effectiveness.

6.10 Compliance

Respirator users who fail to comply with respirator program requirements will be referred to their supervisors and may be removed from the program or may receive a corrective and preventive action report if compliance with all requirements is not met.

7.0 RECORDS

a. Job hazard analyses.—Maintained as detailed in the GSM, Chapter 33, Job Hazard Analysis.

b. Respiratory Protection Program Hazard Assessments – Maintained on the SHeD server, IH Respirator Program.

c. Exposure assessments - Maintained on the SHeD server, IH Exposure Assessments file, and in the electronic health records system (EHRS).

d. RSCCS – Maintained on the SHeD server, IH Respirator Program.

e. Voluntary Use of Disposable Filtering Facepiece Respirators (dust masks) – Maintained on SHeD server, IH Respirator Program.

f. Medical evaluations.— Maintained by Medical Services and kept for the duration of an employee's employment plus 30 years.

g. Respiratory Protection Training Records – Maintained in SATERN by HCDD.

h. Respirator Fit Test records – Maintained on SHeD server, IH Respirator Program.

i. SCBA Equipment List – Maintained on SHeD server, IH Respirator Program.

j. SCBA cylinder requalification certifications – Maintained on SHeD server, IH Respirator Program, kept for the life of the cylinder.

k. SCBA breathing machine test (bench test) certifications.— Maintained on SHeD server, IH Respirator Program, kept until the next bench test is completed.

l. Annual Respirator Program Evaluation Records – Maintained on SHeD server, IH Respirator Program.

8.0 REFERENCES

Document Number	Document Name
ACGIH	American Conference of Governmental Industrial Hygienists, Threshold Limit Values (TLV®) -Occupational Exposure Guidelines for Chemical Substances and Physical Agents, and Biological Exposure Indices (BEIs®) for chemical substances.

NPR 1800.1	NASA Occupational Health Program Procedures
29 CFR 1910.134	Occupational Safety and Health Administration (OSHA) Respiratory Protection Standard
29 CFR 1910.1020	OSHA Access to Employee Exposure and Medical Records
29 CFR 1910.1001 to 1045	Chemical Specific Regulations, U.S. Department of Labor, Occupational Safety and Health
ANSI/CGA G 7.1	American National Standards Institute (ANSI)/Compressed Gas Association Commodity Specification for Air
NFPA 1852	National Fire Protection Association, Standard on Selection, Care, and Maintenance of Open-Circuit SCBA, (available from SHeD)
NASA GRC82	NASA GRC Job Hazard Analysis Form

APPENDIX A.—DEFINITIONS

Air-purifying respirator.—Respirator with an air-purifying filter, cartridge, or canister that removes specific air contaminants by passing ambient air through the air-purifying element.

Assigned Protection Factor.—The workplace level of respiratory protection that a respirator or class of respirators is expected to provide.

Atmosphere-supplying respirator.—Respirator that supplies the respirator user with breathing air from a source independent of the ambient atmosphere and includes supplied-air respirators and self-contained breathing apparatus units.

Canister or cartridge.—Container with a filter, sorbent, or catalyst, or combination of these items, which removes specific contaminants from the air passed through the container.

Electronic Health Records System.– A software program implemented by NASA headquarters for NASA Centers to track and manage employee medical records and industrial hygiene workplace exposure data.

Emergency situation.—Any occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment that may or does result in an uncontrolled significant release of an airborne contaminant.

Employee exposure.—Exposure to a concentration of an airborne contaminant that would occur if the employee were not using respiratory protection.

End-of-service-life indicator.—A system that warns the respirator user of the approach of the end of adequate respiratory protection, for example, that the sorbent is approaching saturation or is no longer effective.

Engineering controls.—Methods of controlling employee exposures to toxic materials by modifying the source or reducing the quantity of contaminants released into the workroom environment.

Escape-only respirator.—Respirator intended to be used only for emergency exit.

Filter or air purifying element.—Component used in respirators to remove solid or quid aerosols from the inspired air.

Filtering facepiece.—Negative pressure particulate respirator with a filter as an integral part of the facepiece or with the entire facepiece composed of the filtering medium (commonly known as a disposable dust mask or a N95 dust mask).

Fit test.—A protocol to qualitatively or quantitatively evaluate the fit of a respirator on an individual (see also QLFT and QNFT).

Hazard assessments.—Industrial hygiene evaluation of the health hazards posed by a specific operation or task.

High-efficiency particulate air filter.—A filter that is at least 99.97 percent efficient in removing monodisperse particles of 0.3 μm in diameter. The equivalent NIOSH 42 CFR 84 particulate filters are the N100, R100, and P100 filters.

Immediately dangerous to life or health.—atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere.

Industrial hygienist.—A professional tasked with the anticipation, recognition, evaluation, and control of health hazards in the workplace.

Maximum use concentration.—The maximum atmospheric concentration of a hazardous substance from which an employee can be expected to be protected when wearing a respirator and is determined by the APF of the respirator or class of respirators and the exposure limit of the hazardous substance. The MUC can be determined mathematically by multiplying the APF specified for a respirator by the required OSHA permissible exposure limit, short-term exposure limit, or ceiling limit. When no OSHA exposure limit is available for a hazardous substance, an employer must determine an MUC on the basis of relevant available information and informed professional judgment.

N95.—A NIOSH-approved particulate filtering facepiece respirator that filters at least 95 percent of airborne particles. The N95 is not resistant to oil.

Negative pressure respirator (tight fitting).—A respirator in which the air pressure inside the facepiece is negative during inhalation with respect to the ambient air pressure outside the respirator.

National Institute for Occupational Safety and Health.—An agency of the Health and Human Services Department under the Centers for Disease Control (CDC).

Occupational exposure limit.—The most stringent of

- the permissible exposure limit (PEL) for the hazardous chemical as listed in 29 CFR Part 1910, Subpart Z
- The TLV for the hazardous chemical assigned by the American Conference of Governmental Industrial Hygienists (ACGIH) in the latest edition of “Threshold Limit Values for Chemical Substances and Physical Agents in the Work Environment”
- a NASA PEL when published as a NASA Health standard
- where there is no PEL, TLV, or NASA standard for the chemical, an exposure level based on available published scientific information such as Material Safety Data Sheets

Oxygen-deficient atmosphere.—Atmosphere with oxygen content below 19.5 percent by volume.

Permissible exposure limit.—The occupational exposure limit established by OSHA; the permissible concentration in air of a substance to which nearly all workers may be repeatedly exposed 8 hours a day, 40 hours a week, for 30 years without adverse effects.

Physician or other licensed health care professional.—A physician or other licensed health care provider who must be legally permitted by his or her professional license to conduct the type of medical evaluation required by the respiratory standard.

Positive pressure respirator.—Respirator in which the pressure inside the respiratory inlet covering exceeds the ambient air pressure outside the respirator.

Powered air-purifying respirator.—Air-purifying respirator that uses a blower to force the ambient air through air-purifying elements to the inlet covering.

Pressure-demand respirator.—Positive pressure atmosphere-supplying respirator that admits breathing air to the facepiece when the positive pressure is reduced inside the facepiece by inhalation.

Qualitative fit test.—A pass/fail fit test to assess the adequacy of respirator fit that relies on the individual's response to the test agent. QLFT provides only a pass/fail result.

Quantitative fit test.—An assessment of the adequacy of respirator fit by numerically measuring the amount of leakage into the respirator.

Respirator selection and cartridge change schedule.—A document issued to each respirator user by the Respiratory Protection Program Lead to provide the user with information on the respiratory protection devices selected, the cartridge change schedule, and the exposure assessment data used to determine the selections.

Self-contained breathing apparatus.—Atmosphere-supplying respirator for which the breathing air source is designed to be carried by the user.

Service life.—The period of time that a respirator, filter, sorbent, or other respiratory equipment provides adequate protection to the wearer.

Supplied-air respirator or airline respirator.—An atmosphere-supplying respirator for which the source of breathing air is not designed to be carried by the user.

Threshold limit value.—Established by the American Conference of Governmental Industrial Hygienists (ACGIH) to designate degree of exposure to contaminants and expressed as parts of vapor or gas per million parts of air by volume at 25 °C and 760 mmHg pressure, as approximate milligrams of particles per cubic meter of air (mg/m^3) or as number of fibers per cubic centimeter of air (f/cc). An exposure level under which it is believed most people can work consistently for 8 hours a day, day after day, with no harmful effects.

Threshold limit value–time-weighted average.—The time-weighted average concentration for a normal 8-hr workday and a 40-hour workweek to which nearly all workers may be exposed repeatedly, day after day, without adverse effects.

Threshold limit value–ceiling.—The concentration of a contaminant that should not be exceeded at any time.

Threshold limit value–short-term exposure limit.—A 15-minute TWA exposure that is not to be exceeded at any time during a workday even if the 8-hour TWA is within the TLV–TWA. Exposures above the TLV–TWA up to the STEL should not be longer than 15 minutes must not occur more than four times per day, and there should be at least 60 minutes between successive exposures in this range.

Tight-fitting facepiece.—A respiratory inlet covering that forms a complete seal with the face.

Time-weighted average exposure.—Average concentration of an agent over a given working period of a person’s exposure, as determined by sampling.

User seal check.—An action conducted by the respirator user each time a respirator is worn to determine if the respirator is properly seated to the face.

APPENDIX B.—ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
AIHA	American Industrial Hygiene Association
ANSI	American National Standards Institute
APF	Assigned Protection Factor
APR	Air-purifying respirator
CFR	Code of Federal Regulations
CGA	Compressed Gas Association
CS	Civil servant
DOT	Department of Transportation
EHRS	Electronic Health Records System
GRC	Glenn Research Center
GRC-ATF	Neil A. Armstrong Test Facility
GSM	Glenn Safety Manual
IDLH	Immediately dangerous to life or health
IH	Industrial hygienist
JHA	Job hazard analysis
LF	Lewis Field
MUC	Maximum use concentration
NFPA	National Fire Protection Association
NIOSH	National Institute for Occupational Safety and Health
NPR	NASA Procedural Requirement
OEL	Occupational exposure limit
OSHA	Occupational Safety and Health Administration
PAPR	Powered air-purifying respirator
PEL	Permissible exposure limit
PLHCP	Physician or other licensed health care professional
PPE	Personal protective equipment
QLFT	Qualitative fit test
QNFT	Quantitative fit test
RSCCS	Respirator selection and cartridge change schedule

SATERN	System for Administration, Training and Educational Resources for NASA
SAR	Supplied-air respirator or airline respirator
SASD	Strategic Advisory Services Division
SCBA	Self-contained breathing apparatus
SDS	Safety Data Sheet
SEC	Space Environments Complex
SHeD	Safety and Health Division
SOP	Standard operating procedure
SSC	Support service contractor
TLV	Threshold limit value
TLV-C	Threshold limit value–ceiling
TLV-TWA	Threshold limit value–time-weighted average
TLV-STEL	Threshold limit value–short-term exposure limit

APPENDIX C.—RESPIRATORY PROTECTION PROGRAM FLOWCHART