

# Kennedy NASA Procedural Requirements

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**Responsible Office:** Spaceport Integration and Services

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## KSC RESPIRATORY PROTECTION PROGRAM

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**National Aeronautics and  
Space Administration**

**John F. Kennedy Space Center**

KDP-KSC-T-2120 Rev Basic

**Change Log**

<b>Date</b>	<b>Revision</b>	<b>Description</b>
12/7/11	C-1	Administratively changed to clarify Action Level definition in Appendix A. The application of the action level to exposures to chemicals substances identified in CFR 1910, where use of the action level is an OSHA requirement.
9/19/12	C-2	Administratively changed to replace reference to cancelled NPD 1820.1, NASA Environmental Health Program, with NPD 1800.2C, NASA Occupational Health Program on page 4, P.3c
5/20/14	C-3	Administratively changed to comply with NPR 1400.1, NASA Directives and Charters Procedural Requirements; replaced KBM-ST-2.1A and KBM-ST-2.1B with KSC-UG-1800.
5/18/15	C-4	Administrative changes to reflect change in directorate name from Center Operations to Spaceport Integration and Services.
5/11/16	D	The requirements and responsibilities were revalidated as written. Administratively changed to replace references to the Medical and Environmental Support Contract (MESC) to the Kennedy Environmental and Medical Contract (KEMCON), references to the Institutional Services Contract (ISC) to the Kennedy Propellants and Life Support Services Contract (KPLSS), add KSC Forms to P.4 Applicable Documents and Forms, change the signature authority from Michael J. Benik to Nancy P. Bray, and other administrative changes to content and structure to comply with NPR 1400.1, NASA Directives and Charters Procedural Requirements.

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## PREFACE

### P.1 PURPOSE

a. This Kennedy National Aeronautics and Space Administration (NASA) Procedural Requirements (KNPR) document contains the requirements for the implementation of the Kennedy Space Center (KSC) Respiratory Protection Program. It provides both general and specific requirements for protective measures to be taken for employees who may be exposed to toxic air contaminants and oxygen deficient atmospheres. This KNPR does not in any way relieve various NASA organizations and their associated contractors of responsibility for the protection of personnel under their cognizance.

b. It is KSC's policy to provide employees with an environment in which occupational health hazards are identified, evaluated, eliminated, or controlled in such a manner that personnel do not suffer adverse health effects as a result of their employment. Activities shall be conducted in a manner that conforms to all applicable Federal, state, and local regulatory requirements. Personnel exposure to chemical and physical agents should, at all times, be restricted to levels as low as reasonably achievable.

c. The requirements presented in this KNPR implement Federal Occupational Safety and Health Administration (OSHA) regulations and NASA management policy for industrial hygiene (IH) programs. NASA, contractor management, and operations organizations will supplement the provisions of this Directive by implementation of internal policies and instructions, as needed.

### P.2 APPLICABILITY

a. This KNPR applies to all NASA organizational elements located at KSC, Cape Canaveral Air Force Station, NASA KSC facilities, and operations at other locations. This includes associated contractors (to the extent specified in their respective contracts), KSC tenant organizations, and other government agencies, their contractors and tenants.

b. In this directive, all mandatory actions (i.e., requirements) are denoted by statements containing the term "shall." The terms "may" or "can" denote discretionary privilege or permission, "should" denotes a good practice and is recommended, but not required, "will" denotes expected outcome, and "are/is" denotes descriptive material.

c. In this directive, all document citations are assumed to be the latest version unless otherwise noted.

### P.3 AUTHORITY

a. [Executive Order 12196, Occupational Safety and Health Programs for Federal Employees.](#)

b. [Title 29, Code of Federal Regulations \(CFR\), Part 1960.](#)

c. [NASA Policy Directives \(NPD\) 1800.2C, NASA Occupational Health Program.](#)

d. [NASA Procedural Requirements \(NPR\) 8715.1A, NASA Occupational Safety and Health Programs.](#)

**P.4 APPLICABLE DOCUMENTS AND FORMS**

- a. [Title 29 CFR 1910.134](#), and [1910.1000 – End](#).
- b. [Title 42 CFR Part 84](#).
- c. [Privacy Act of 1974 \(5 USC 522.\(i\)\(1\)\)](#).
- d. [KNPR 8715.3, NASA Safety Practices and Procedural Requirements](#).
- e. [KSC-UG-1800 ,KSC Medical Standards Users Guide](#).
- f. [KSC-PLN-1910, Site Specific Respiratory Protection Plan Template for NASA Civil Service Organization Operations at KSC](#).
- g. [KSC Form 16-539](#), KSC Respirator Usage Questionnaire
- h. [KSC Form 16-540](#), KSC Respirator Medical Evaluation Questionnaire
- i. [KSC Form 13-116](#), Physical Examination Request/Certificate
- j. [KSC Form 31-81](#), Respirator Training/Qualification

**P.5 MEASUREMENT/VERIFICATION**

None

**P.6 CANCELLATION OR SUPERSESION**

This document supersedes KNPR 1820.4, Rev. C-4, KSC Respiratory Protection Program.

*/original signed by/*

Nancy P. Bray  
Director, Spaceport Integration and Services

Distribution: TechDoc Library

## Chapter 1 Responsibilities

### 1.1 Heads of Primary Organizations

Heads of primary organizations and heads of contractor organizations to the extent provided by their contracts shall:

1.1.1 Provide operational implementation of the requirements of this KNPR.

1.1.2 Ensure personnel:

- a. Are notified of hazards and protective measures governing work with hazardous chemical agents.
- b. Are provided appropriate training and orientation to identify hazards associated with chemical agents in their work places and use respiratory protective equipment provided for their safety.
- c. Are notified of any changes or modifications to systems used to control exposure to these agents.

1.1.3 Implement and maintain control measures required for preventing or otherwise reducing employee potential exposure to hazardous chemical agents.

1.1.4 Ensure assessment plans, processes, and operations are reviewed for elimination or control of air contaminant hazards.

1.1.5 Designate organization representatives to the KSC Respiratory Protection Panel (RPP).

### 1.2 The Kennedy Space Center Occupational Medical Officer

The KSC Occupational Medical Officer, or designated representative, shall:

1.2.1 Provide medical evaluations to personnel identified by their organizations as respirator users.

1.2.2 Provide medical screening and surveillance examinations for those employees who may be occupationally exposed to certain hazardous chemical agents, as required by [29 CFR Part 1910](#), [29 CFR Part 1926](#), or other applicable NASA and United States Air Force requirements.

1.2.3 Provide, on a case by case basis, special physical evaluations to personnel identified as being exposed or potentially exposed to hazardous chemical agents as the result of an accident, mishap, or other unusual circumstance.

1.2.4 Ensure that physical examination criteria, as defined in [KSC-UG-1800](#), is implemented to conform to the protocols defined by OSHA, where required, and other nationally recognized standards as applicable.

1.2.5 Maintain records of all occupational medicine activities associated with support to the KSC Respiratory Protection Program as defined by Federal regulation (e.g., OSHA, NASA Health Standards).

1.2.6 Provide employee access to medical records in accordance with [29 CFR 1910.1020](#) and the [Privacy Act of 1974](#), as amended (5 USC 522.a).

### **1.3 The Kennedy Space Center Industrial Hygiene Officer**

The KSC IH Officer or designated representative shall implement and administer the KSC Respiratory Protection Program for NASA civil service personnel.

### **1.4 The Kennedy Environmental and Medical Contract Industrial Hygiene Office**

The Kennedy Environmental and Medical Contract (KEMCON) IH Office shall:

1.4.1 Provide baseline surveys of operations, tasks, or procedures which possess the potential to create harmful air contamination.

1.4.2 Provide health hazard evaluations of operations, tasks, or procedures where baseline surveys have shown the presence of harmful air contaminants at concentrations which may pose a health hazard to personnel.

1.4.3 Provide area and personal exposure monitoring which represent the exposure of employees where previous surveys have shown the presence of air contaminants at concentrations in excess of the action level.

1.4.4. Provide the KSC Occupational Medical Officer or the designated representative access to exposure monitoring records.

1.4.5 Provide to supervisors, site managers, and responsible safety organizations in the affected work area:

- a. Results of surveys and recommendations.
- b. Recommended methods for the control or elimination of air contaminant hazards.
- c. Requirements for employees to participate in the Respiratory Protection Program.
- d. Recommendations on the selection of respiratory protective equipment.
- e. Assistance in completing [KSC-PLN-1910](#).

1.4.6 Notify employers of exposure monitoring results for affected employees.

1.4.7 Review facility plans and operational procedures to assess the adequacy of precautions taken to control workplace air contaminants.

1.4.8 Provide technical assistance in the selection and design of engineering controls and work practices used to control or eliminate air contaminants.

1.4.9 Perform inspections of breathing air compressors and associated air filtration systems.

1.4.10 Advise and assist in development of Respiratory Protection Program training classes.

1.4.11 Chair the KSC RPP.

## **1.5 The Kennedy Space Center Respiratory Protection Panel**

The RPP serves as a Government and contractor forum for the implementation of respiratory protection programs. Membership consists of the KSC IH officer, designated representatives of NASA, and resident KSC contractor organizations representing: occupational medicine, environmental health, life support, fire services, safety, and training, as well as each contractor's respiratory protection program administrator. The panel shall:

1.5.1 Provide consultative services to KSC management and contractors on items related to respiratory protection.

1.5.2 Coordinate actions to resolve problems or rectify deficiencies in the selection, use, and maintenance of respirators.

1.5.3 Provide a forum for discussion and resolution of issues related to IH, life support, occupational medicine, fire, and training services provided by NASA to its contractors in support of their respiratory protection programs.

1.5.4 Assist the KSC IH Officer in the development and maintenance of respiratory protection policies, requirements, and general practices of the KSC Respiratory Protection Program.

1.5.5 Coordinate permanent deployment and removal of Escape-Only Respirators (EORs) (formerly known as Breathing Escape Units) as outlined in Chapter 2, paragraph 2.4.

## **1.6 Technical Training**

The Kennedy Institutional Support Services technical training office or other contractor training organizations shall, to the extent provided by the contract, provide respirator fit testing, training, and certification, and maintain associated employee training and certification records.

## **1.7 The Kennedy Propellants and Life Support Services Contract Life Support Organization**

The Kennedy Propellants and Life Support Services Contract (KPLSS) Life Support Organization shall:

1.7.1 Service all respirators assigned to life support to include inspection, testing, cleaning, sanitizing, repair, and refilling of cylinders, and maintain records of all elements performed.

1.7.2 Act as the main point of procurement initiation and issuance for supplied air respiratory protective devices in coordination with the KSC IH Officer and the KSC Propellants and Life Support Branch within NASA Spaceport Integration and Services and KPLSS Engineering.

1.7.3 As detailed in Operational Maintenance Requirements and Specifications Documents (OMRSD), perform periodic preventive maintenance procedures on all assigned respirators and



maintain records of these inspections on a recurring basis at frequencies determined by the KSC Propellants and Life Support Branch within NASA Spaceport Integration and Services and KPLSS Life Support.

1.7.4 Ensure appropriate manufacturer's certification for life support technicians who perform respirator maintenance. Ensure periodic recertification to maintain and upgrade technicians' capabilities. Maintain records of all such training, certification, and recertification.

1.7.5 Prepare and update, as required, Operation and Maintenance Instructions (OMI) for the use, servicing, and repair of all used respirators in accordance with OMRSD and manufacturers' recommendations.

1.7.6 Provide consultative support to the KSC RPP on all aspects of respiratory protective equipment.

1.7.7 Provide training with information and documentation relative to changes in procedures or configuration of respiratory protective equipment that could affect the respiratory training program.

## **1.8 Civil Service Line Management and Contract Employers**

Civil service line management and contract employers shall:

1.8.1 Coordinate with appropriate safety and environmental health personnel to request workplace health hazard assessment of operations with suspected air contaminant generation.

1.8.2 Complete the Site Specific Respiratory Protection Plan for the use of respiratory protection equipment, as identified in the health hazard evaluation. See [KSC-PLN-1910](#).

1.8.3 Ensure proper completion and submittal of KSC Forms: [16-539](#), [16-540](#), and [13-116](#), which are required for the medical evaluation.

1.8.4 Ensure employees who have a medical evaluation by a physician or licensed health care professional (PLHCP) outside of the KSC Occupational Medicine Services have the appropriate documentation on file with their employer that states conformity and compliance with OSHA's medical evaluation guidelines.

1.8.5 Ensure that employees seeking certification to use respiratory protective equipment are medically certified to use such equipment and attend training and respirator fit testing, as required.

1.8.6 Ensure that employees obtain the proper visual correction devices that are compatible with proper and effective respirator use, when visual correction has been determined necessary by the PLHCP.

1.8.7 Attend respirator training if they supervise employees requiring the use of respirators.

1.8.8 Verify that employees are issued the correct type and size respirator for which they have been fitted and certified.

1.8.9 Ensure the proper use of respiratory protection equipment, engineering controls, and work practices established to reduce workplace exposure to harmful air contaminants.

1.8.10 Ensure that employees are not assigned to tasks requiring the use of respirators when they have facial hair, scars, or missing dentures which have the potential for causing leakage in the sealing surface of the respirator.

1.8.11 Notify their affected employees of the results of health hazard evaluations and exposure monitoring surveys, as defined in Section 2.7 of this KNPR.

1.8.12 Ensure the proper care and maintenance of respirators issued to their employees.

1.8.13 Maintain a current list of employees having respirator use certifications.

1.8.14 Review work assignments and work area hazards to determine potential need for use of respiratory protection equipment.

1.8.15 When respiratory protection must be worn for protection from hazardous materials, review Safety Data Sheets (SDS) for those materials with the affected employees.

1.8.16 Assist in the development of strategies to control or eliminate exposure hazardous.

## **1.9 Individual Employees**

Individual Employees shall:

1.9.1 Use control procedures established to maintain air contaminant control, including wearing and maintaining respiratory protective devices, as instructed.

1.9.2 Cooperate with supervisory, medical, environmental health, and safety personnel in activities to evaluate and control air contaminant hazards.

1.9.3 Notify supervisors of areas, operations, or equipment that may be a source of air contaminants.

1.9.4 Report any suspected chemical exposures to their supervisors.

1.9.5 Complete a KSC Respirator Medical Evaluation Questionnaire Form ([KSC Form 16-540](#)), and submit to Occupational Health Facility for evaluation if they require a respirator certification physical.

1.9.6 Notify supervisors of changes in their health status that may affect their ability to safely use respiratory protection and resubmit the [KSC Form 16-540](#).

## Chapter 2 Respiratory Protection Program

### 2.1 General

This section establishes requirements for the use of respiratory protective equipment. These requirements establish practices and procedures where the use of such equipment is required to perform tasks that are inherently hazardous because of the presence of toxic air contaminants or oxygen deficient atmospheres. These requirements are applicable to all NASA civil service and contractor organizations as well as their subcontractors. Mandatory requirements for compliance with the OSHA Respiratory Protection Standard are not repeated in this KNPR, but may be found in [29 CFR 1910.134](#).

### 2.2 Written Operating Procedures

2.2.1 Respirators shall only be used when authorized by an operating procedure or a written site-specific respiratory protection plan as described in [29 CFR 1910.134\(c\)\(1\)](#).

2.2.2 Hazardous operating procedures that require the use of respiratory protective equipment shall meet the requirements for hazardous technical operating procedures found in [KNPR 8715.3](#).

### 2.3 Respiratory Protective Equipment

2.3.1 Adequate respiratory protection shall be provided whenever:

- a. Personnel are required to work in hazardous atmospheres where the action level of the hazardous air contaminant is exceeded or oxygen deficient atmospheres are present.
- b. Personnel are involved in the handling, transfer, or use of hazardous chemicals where the toxicity of the chemical is of such a nature as to place those personnel at significant risk of serious illness or injury in the event of a leak, spill, or other release of the chemical.
- c. Personnel are required to enter atmospheres which have unknown concentrations of oxygen or air contaminants.
- d. An industrial hygienist or safety professional determines that personnel exposure(s) could exceed the action level.

2.3.2 The selection of respiratory protection equipment shall take into consideration:

- a. The nature of the hazard(s) associated with the operation or process.
- b. The nature of the work operation or process.
- c. The physical and chemical properties and additive effects of the air contaminant(s) (additional general considerations are sorbent efficiencies, odor warning properties, irritation potential, and lower flammability limit).
- d. The adverse health effects of the air contaminant(s).
- e. Warning properties of the hazardous air contaminant(s).

- f. The relevant occupational exposure limits.
- g. The measured concentration(s) of hazardous air contaminant(s).
- h. Worker activities in the area of the operation and the potential stress of work conditions on employees wearing the respirators.
- i. The period of time respiratory protection will be worn by employees during the work shift.
- j. The physical characteristics, functional capabilities, and limitations of the respirator.
- k. The substance specific OSHA standard.

2.3.3 Selection of appropriate respiratory protection equipment must take into account the assigned protection factor (APF) for each type of respirator as listed in Appendix C and OSHA specific substance standards. When using a combination respirator (e.g., airline respirators with an air-purifying filter), employers shall ensure that the APF is appropriate to the mode of operation in which the respirator is being used.

#### 2.3.4 Maximum Use Concentration (MUC):

- a. The employer shall select a respirator for employee use that maintains the employee's exposure to the hazardous substance, when measured outside the respirator, at or below the MUC.
- b. Employers shall not apply MUCs to conditions that are immediately dangerous to life or health (IDLH); instead, they must use respirators listed for IDLH conditions in [29 CFR 1910.134\(d\)\(2\)\(ii\)](#).
- c. When the calculated MUC exceeds the IDLH level for a hazardous substance, or the performance limits of the cartridge or canister, then employers shall set the maximum MUC at that lower limit.

2.3.5 For selection and use limitations of particulate respirators, consult [42 CFR Part 84](#).

## 2.4 Escape Only Respirator (Formerly Known as Breathing Escape Unit)

### 2.4.1. EOR are required in work areas where:

- a. A potential exists for the rapid development of an IDLH atmosphere, and
- b. There is no immediate means for the affected employees to egress the IDLH area to a safe atmosphere.

2.4.2 Requests for permanent deployments or removal of EOR will be made to the KSC RPP. The RPP shall appoint a team that will make an evaluation as to whether the above criteria are met.

The evaluation team will include representatives of:

- a. The responsible contractor safety and health organization (i.e., the team lead responsible for coordinating the assessment representatives).
- b. Life Support.
- c. Environmental Health.
- d. The requesting organization.

2.4.3 On completion of the evaluation, the Chair of the KSC RPP shall prepare a written report for concurrence by the members of the evaluation team.

The report shall:

- a. Evaluate the toxic properties of the hazardous commodities in question.
- b. Evaluate accident scenarios in which an IDLH atmosphere could rapidly develop.
- c. Identify operations in the affected area and the number of employees potentially exposed to the hazardous condition.
- d. Identify the availability of rapid egress routes for affected employees to take in the event of an emergency and time required for the egress.
- e. Identify the appropriate type(s) of National Institute for Occupational Safety and Health certified EOR for the accident scenario(s) evaluated by the team where potential exists for the rapid development of an IDLH atmosphere and there is no immediate means to a safe atmosphere.
- f. List other mitigating factors, as applicable.

2.3.4 Upon distribution of the report, KPLSS Engineering will provide EORs based upon availability. The requesting organization is responsible for coordinating with KPLSS Life Support for the deployment and removal of EORs.

2.3.5 It is the responsibility of the requesting organization to revise all documentation (e.g., OMI, requirements documentation, and facility drawings) needed to assure the proper scheduling and deployment of the requested EOR. When additional EORs are required, but are not available for support from the existing life support inventory, it is the responsibility of the requesting organization to coordinate their procurement and maintenance with the Propellants and Life Support Branch within NASA Spaceport Integration and Services.

## **2.5 Respirator Care and Maintenance**

Cleaning and disinfection of respirators shall be in accordance with [29 CFR 1910.134](#), Appendix B-2.

## **2.6 Breathing Air**

2.6.1 Compressed breathing air shall meet the requirements in [29 CFR 1910.134](#) paragraph (i).

2.6.2 Testing of compressor-supplied breathing air shall be in accordance with Table B in Appendix C.

## **2.7 Health Hazard Evaluation**

2.7.1 An initial health hazard evaluation of potentially hazardous operations shall be conducted when any information, observation, or calculation shows that an employee may be exposed to oxygen-deficient atmospheres or air contaminants above their action levels. This includes, but is not limited to, data from monitoring of similar operations, procedure reviews, potential for skin and eye contact, and employee complaints of unusual odors, irritations, or other signs or symptoms of potential exposures.

a. The health hazard evaluation shall evaluate and describe:

- (i) The operation, process, or equipment generating the air contaminant(s).
- (ii) Their approximate concentrations.
- (iii) Other operations in the area.
- (iv) The number of potentially exposed employees.
- (v) The duration and frequency of the exposure.
- (vi) Respiratory protection requirements, including applicable respirator filter cartridge change out schedule.
- (vii) Associated personal protective equipment.
- (viii) Any regulatory requirements applicable to the operation.

b. Health hazard evaluations shall be repeated annually or whenever any changes to facilities, equipment, work practices, procedures, or engineering control measures are made.

2.7.2 Employees and their representatives shall be provided an opportunity to observe area and personal exposure monitoring.

2.7.3 Results of health hazard evaluations shall be posted in the affected employees' work areas or otherwise provided to affected employees for their review.

## **2.8 Medical Screening and Surveillance Examinations**

2.8.1 A medical evaluation is required for every employee who is to be assigned to tasks requiring the use of respiratory protective equipment.

2.8.2 Specific requirements for medical evaluation are defined in [29 CFR 1910.134](#), Appendix C, or as otherwise directed by the Occupational Medical Officer.

2.8.3 For employees who are not resident at KSC, the Occupational Medical Officer may accept an already existing medical examination or written opinion from a licensed physician stating whether the employee has any detected medical condition which would place the

employee's health at increased risk from respirator use and any recommended limitations on the use of respirators.

## **2.9 Employee Training and Respirator Fit Testing**

2.9.1 Respirator training and fit testing shall be in accordance with [29 CFR 1910.134](#).

2.9.2 Upon completion of respirator fit testing and verification of employees' medical certifications, each employee shall be issued an employee training certification card ([KSC Form 31-81NS](#)) which identifies the employee, and the manufacturer(s), model(s), size(s), expiration date, protection factor(s) of the respirator(s), and fit tester's initials for which the employee has been fit tested.

2.9.3 Qualitative and quantitative respirator fit tests shall be performed only by qualified individuals specifically trained and assigned responsibility for providing respirator fit tests.

2.9.4 Fit-test results shall be related to APF as follows:

- a. Half-mask, air-purifying respirators may be worn in atmospheres no greater than 10 times the established exposure limit, when the respirator user passes the qualitative fit test, or when the respirator user passes a quantitative fit test with a minimum fit factor of greater than 100.
- b. Full-facepiece, air-purifying respirators may be worn in atmospheres no greater than 50 times the established exposure limit when the respirator user passes a quantitative fit test with a minimum fit factor greater than 500.
- c. Powered air-purifying respirators (PAPR) and supplied-air respirators with tight-fitting facepieces require fit testing. They may be used in atmospheres no greater than allowed by the APF for that respirator listed in the Appendix C, Table A.

## **2.10 Records and Documentation**

2.10.1 Access to employee exposure and medical records shall be in accordance with [29 CFR 1910.1020](#) and the [Privacy Act of 1974](#), as amended (5 USC 522.a).

Employee exposure and medical records shall be maintained in accordance with the requirements of [29 CFR 1910.1020](#).

2.10.2 Copies of this KNPR, [29 CFR 1910.134](#), [OSHA Respiratory Protection Standard](#), other applicable OSHA regulations, and any appropriate records required by this KNPR shall be provided, upon request, to employees, former employees, representatives of employees, representatives of the United States Department of Labor, and NASA Headquarters personnel. Copies of this KNPR and other current NASA issuances are available electronically at the [KSC Business World](#) web site under KSC Directives.

## Appendix A. Definitions

Action Level: The concentration designated in [29 CFR 1910](#) for a specific substance, calculated as an eight-hour time-weighted average, which initiates certain required activities such as exposure monitoring and medical surveillance.

Assigned Protection Factor (APF): The workplace level of respiratory protection a respirator or class of respirators is expected to provide to employees when the employer implements a continuing, effective respiratory protection program as specified in Chapter 2 of this KNPR.

Demand: A mode of operation for a Supplied Air Respirator (SAR) in which air flows into the respirator only when inspiration creates a lower pressure within the facepiece than the ambient atmospheric pressure.

Escape Only Respirator (EOR): Respiratory devices that are designed for use only during escape from hazardous atmospheres.

Filtering Facepiece: A negative pressure particulate respirator with a filter as an integral part of the facepiece or with the entire facepiece composed of the filtering medium.

Maximum Use Concentration (MUC): The maximum atmospheric concentration of a hazardous substance from which an employee can be expected to be protected when wearing a respirator. This 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.

Occupational Exposure Limit: The most stringent of:

- a. The permissible exposure level (PEL) for the hazardous chemical as listed in [29 CFR Part 1910](#), Subpart Z.
- b. The Threshold Limit Value (TLV) assigned by the American Conference of Governmental Industrial Hygienists in the latest edition of "Threshold Limit Values for Chemical Substances and Physical Agents in the Work Environment."
- c. A NASA PEL when published as a NASA Health Standard.
- d. Where there is no PEL, TLV, or NASA standard for the chemical, an exposure level based on available published scientific information such as MSDS.

Resident: An employee who is employed by a federal or contractor organization that is a tenant of KSC.

Respirator: Any device worn by an individual that is intended to provide the wearer with respiratory protection against inhalation of air contaminants or oxygen deficient atmospheres.



## Appendix B. Acronyms

APF	Assigned Protection Factor
CFR	Code of Federal Regulations
EOR	Escape-Only Respirators
IDLH	Immediately Dangerous to Life or Health
IH	Industrial Hygiene
KEMCON	Kennedy Environmental and Medical Contract
KNPR	Kennedy NASA Procedural Requirements
KPLSS	Kennedy Propellants and Life Support Services Contract
KSC	Kennedy Space Center
MUC	Maximum Use Concentration
NASA	National Aeronautics and Space Administration
OMI	Operation and Maintenance Instructions
OMRSD	Operational Maintenance Requirements and Specifications Documents
OSHA	Occupational Safety and Health Administration
PAPR	Powered Air Purifying Respirator
PEL	Permissible Exposure Level
PLHCP	Physician or Licensed Health Care Professional
RPP	Respiratory Protection Panel
SAR	Supplied Air Respirator
SCBA	Self-Contained Breathing Apparatus
SDS	Safety Data Sheet
TLV	Threshold Limit Value

**Appendix C. Tables**

<b>Table A – Assigned Protection Factors (APF)<sup>9</sup></b>					
Type of respirator <sup>1,2</sup>	Quarter Mask	Half Mask	Full Facepiece <sup>5</sup>	Helmet/Hood	Loose-Fitting Facepiece
Air-Purifying Respirator <sup>3</sup>	5	10 <sup>4</sup>	50	–	–
PAPR	–	50	1,000	25/1,000 <sup>4</sup>	25
Supplied Air Respirator (SAR) or Airline Respirator <sup>6,7</sup>					
Demand Mode	–	10	50	–	–
Continuous Flow Mode	–	50	1,000	25/1,000 <sup>8</sup>	25
Pressure-Demand or Other Positive-Pressure Mode	–	50	1,000	–	–
Self-Contained Breathing Apparatus (SCBA)					
Demand Mode	–	10	50	50	–
Pressure-Demand or Other Positive-Pressure Mode (e.g., open or closed circuit)	–	–	10,000	10,000	–

Notes:

- Employers may select respirators assigned for use in higher workplace concentrations of a hazardous substance for use at lower concentrations of that substance, or when required respirator use is independent of concentration.
- The APF in Table A are only effective when the employer implements a continuing, effective respirator program including training, fit testing, maintenance, and use requirements.
- Air-purifying respirators may not be used in oxygen deficient atmospheres.
- This APF category includes filtering facepieces, and half-masks with elastomeric facepieces.
- Only full-facepiece respirators are to be used in contaminant concentrations that produce eye irritation.
- Any SAR may be used in an oxygen deficient atmosphere where the oxygen content is above the oxygen deficient IDLH limits.
- Only a full facepiece pressure demand SCBA or combination full facepiece pressure demand SAR with auxiliary self-contained air supply may be used in unknown IDLH or oxygen deficient IDLH atmospheres.
- The employer must have evidence provided by the respirator manufacturer that testing of these respirators demonstrates performance at a level of protection of 1,000 or greater to receive an APF of 1,000. This level of performance can best be demonstrated by performing a workplace factor or simulated workplace factor study or equivalent testing. Absent such testing, all other PAPRs and SARs with helmets or hoods are to be treated as loose-fitting facepiece respirators, and receive an APF of 25.

9. These APFs do not apply to respirators used solely for escape. For escape respirators used in association with specific substances covered by [29 CFR 1910](#) Subpart Z, employers must refer to the appropriate substance-specific standards in that subpart. Escape respirators for other IDLH atmospheres are specified by [29 CFR 1910.134](#).

<b>Table B – Compressor Breathing Air Evaluations</b>			
<b>COMPRESSOR TYPE</b>	<b>CO ALARM</b>	<b>HIGH TEMP ALARM</b>	<b>EVALUATE</b>
<b>OIL LUBRICATED</b>	Yes	Yes	90 Days
	Yes	No	90 Days
	No	Yes	45 Days
	No	No	45 Days
<b>OIL-FREE</b>	Yes	Yes	90 Days
	Yes	No	90 Days
	No	Yes*	90 Days
	No	No	45 Days

\*Auto shutoff device installed. Historic evaluations are satisfactory.

## Appendix D. References

- D.1 ANSI/CGA G-7.1-2004, Commodity Specification for Air.
- D.2 ANSI/CGA C-7-2004, Guide to the Preparation of Precautionary Labeling and Marking of Compressed Gas Containers.
- D.3 ANSI Z88.2-1992, American National Standard for Respiratory Protection.
- D.4 Federal Specification BB-A-1034B, Compressed Air, Breathing.
- D.5 American Conference of Governmental Industrial Hygienists, Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices (current edition).
- D.6 National Institute for Occupational Safety and Health, Guide to Industrial Respiratory Protection.