



**Subject: Langley Research Center Noise Control and Hearing  
Conservation Program**

Responsible Office: Safety and Mission Assurance Office

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## PREFACE

### P.1 PURPOSE

- a. This NASA Langley Research Center Procedural Requirements (LPR) sets forth the procedural requirements and responsibilities for the Langley Research Center (LaRC) Noise Control and Hearing Conservation Program (HCP) under the direction of the Safety and Facility Assurance Branch (SFAB), Safety and Mission Assurance Office (SMAO). It provides specific requirements for protective measures to be taken for employees who may be exposed to hazardous noise levels.
- b. The requirements presented in this LPR implement Federal Occupational Safety and Health Administration (OSHA) regulations and NASA management policy for industrial hygiene programs. NASA, contractor management, and operations organizations will supplement the provisions of this procedural requirement by implementation of internal policies and instructions, as needed.

### P.2 APPLICABILITY

- a. These procedural requirements are applicable to all LaRC facilities and personnel.
- b. These procedural requirements are to be incorporated in any contract under which contractor employees will be assigned to on-site LaRC hazardous noise or potential hazardous noise areas.
- c. Contractors shall provide and implement their own written noise control and HCP.
  - (1) At a minimum, these programs shall be in accordance with the LaRC program as described herein.
  - (2) If a contracting company performs work in hazardous noise areas, the HCP shall include regular noise dosimetry to determine worker exposure.
  - (3) If exposures exceed the action level of 82 dB(A), workers shall be given annual audiograms, training, and be included in an effective HCP.
  - (4) As with other mandated safety programs, the HCP and associated records of LaRC contractors shall be subject to audit by the Hearing Conservation Program Officer (HCPO) or his/her designated representative.

### **P.3 AUTHORITY**

It is LaRC policy to comply with NASA regulations and Federal Laws as prescribed in the following documents:

- a. Noise Control Act of 1972, as amended
- b. "Occupational Noise Exposure," 29 Code of Federal Regulations (CFR) 1910.95
- c. "Basic Program Elements for Federal Employee Occupational Safety and Health Program," 29 CFR Part 1960
- d. Executive Order 12196 of February 26, 1980, "Occupational Safety and Health for Federal Employees"
- e. NASA Procedural Requirements (NPR) 1800.2C. "NASA Occupational Health Program" 2010, Chapter 4.8, "Hearing Conservation"

### **P.4 APPLICABLE DOCUMENTS**

- a. NPR 8715.3, NASA General Safety Program Requirements
- b. NPR 8715.1, NASA Occupational Safety and Health Programs
- c. Langley Policy Directive (LAPD) 1700.2, Safety Assignments and Responsibilities
- d. Langley Management System (LMS) Center Procedure (CP) 4760, Reporting Injuries, Illnesses, and Compensation Claims
- e. "American National Standards Institute (ANSI)/ Acoustical Society of America (ASA) S3.6-2010" (ANSI/ASA S3.6-2010) 2010, Specification for Audiometers
- f. ANSI/ASA S1.4-2014/Part 1 / IEC 61672:1-2013, Specifications for Sound Level Meters
- g. American Conference for Governmental Industrial Hygienists, Threshold Limit Values

### **P.5 MEASUREMENT/VERIFICATION**

None

**P.6 CANCELLATION**

LPR 2710.1, dated December 7, 2015

/s/ Clayton P. Turner      September 9, 2016  
Center Deputy Director      Date

**DISTRIBUTION:**

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

## CHAPTER 1: INTRODUCTION

### 1.1 Background

1.1.1 Every effort shall be made to ensure that the work environment affords the necessary protection and conservation of LaRC employees' and contracted employees hearing.

**NOTE:** *Hearing loss due to noise exposure is preventable. Noise-induced hearing loss (NIHL) is a serious threat to people exposed to hazardous noise levels. Loss of hearing can occur from exposure to impulse or impact noise as well as from exposure to steady-state (continuous/intermittent) noise. NIHL may be temporary or may become permanent through repeated unprotected exposure to intense noise. Initial deterioration of hearing may not be apparent to the individual. By the time there is employee awareness of the loss, the impairment may be substantial and irreversible.*

1.1.2 The aim of this procedural requirement is to:

- a. Minimize noise generated by LaRC operations.
- b. Prevent occupational noise-related hearing loss among employees.
- c. Provide a work environment free from hazardous noise.
- d. Give priority to engineering procedures to the greatest extent practicable to eliminate, control, or isolate sources of hazardous noise.

1.1.3 Preventive efforts shall be taken to conserve the hearing of personnel employed at LaRC by implementing a HCP as addressed in Chapter 3.

### 1.2 Definitions and Terminology

Appendices A, "Definitions and Terminology," and B, "Acronyms," are included to assist with using these procedural requirements.

### 1.3 Waivers

1.3.1 Requests for waivers to any of the requirements in this LPR shall be processed in accordance with LMS-CP-7151, "Obtaining Waivers for Langley Management System (LMS) Requirements."

## CHAPTER 2: RESPONSIBILITIES

### 2.1 General

This chapter describes the responsibilities of the Hearing Conservation Program Officer (HCPO), Occupational Health Clinic (OHC), Supervisors, and Employees.

### 2.2 Hearing Conservation Program Officer

The SFAB Certified Industrial Hygienist (CIH), appointed by the Safety Manager, or his/her designee shall be the HCPO and is responsible for:

- a. Implementing and administering the HCP.
- b. Ensuring that personnel who work in hazardous noise areas, including supervisors/managers, are instructed, individually or in groups, by qualified personnel concerning health hazards associated with noise exposure, noise control measures, and the HCP requirements.
- c. Maintaining a current inventory of all hazardous noise areas and noise levels recorded in these areas and providing the information to Facility Safety Heads and Supervisors.
- d. Working with Supervisors on the placement or reassignment of personnel with significant hearing loss. Based on the recommendation of the Chief Medical Officer (CMO).
- e. Measuring and analyzing noise levels to evaluate employee exposures and recommending appropriate means of controlling exposures that are found to be hazardous.
- f. Evaluating potential hazardous noise exposure areas/equipment which are identified through; industrial hygiene audits, investigation of complaints, participation in construction design reviews, review of purchase requisitions, contracts, and engineering (noise abatement) drawings.
- g. Conducting a pre-operational survey of each new operation, job, or procedure, which has an associated noise hazard potential before normal operations begin.
- h. Identifying tools and equipment which generate hazardous noise levels.
- i. Conducting resurveys as needed to evaluate each hazardous noise or job area in order to maintain master lists of areas that require hearing protection.
- j. Reviewing facility plans (i.e., modification and operations) to ensure that adequate attention is being given to noise exposure controls.

- k. Maintaining survey data relative to noise levels and employee exposures.
- l. Selecting hearing protective devices to be used and assessing the adequacy of all noise control measures.
- m. Approval of procurement of hearing protection devices.
- n. Conducting an annual review to ensure that employee hearing protection training is adequate.
- o. Ensuring Safety and Industrial Health audits of LaRC facilities include:
  - (1) Identifying hazardous noise level areas/equipment and provide this information to the HCPO.
  - (2) Updating the facilities list of personnel assigned to the HCP and supplying the updated list to the OHC.

### **2.3 Occupational Health Clinic**

The OHC shall be responsible for:

- a. Obtaining noise exposure histories, supervising audiometric testing, and evaluating test results of employees assigned to the HCP.
- b. Maintaining a registry of personnel working in hazardous noise areas, scheduling and conducting appropriate medical examinations, and/or referring personnel to an audiologist or an appropriate medical consultant.
- c. Notifying employees upon the detection of a significant hearing loss, and explaining the need for further testing. The employee's supervisor and the HCPO shall be notified if further testing substantiates a significant hearing loss.
- d. Working with the Office of Human Capital Management (OHCM), the employee's supervisor, and SMAO if a change in job assignment is recommended as a result of hearing loss.
- e. Ensuring that physicians have hearing conservation training and that personnel performing audiometry are certified by the Council for Accreditation for Occupational Hearing Conservation (CAOHC). (*Persons who operate microprocessor audiometers do not need to be certified*)
- f. Ensuring that audiometric equipment is calibrated and that ambient noise levels in the test environment permit measurements to 0 dB hearing level.

- g. Maintaining audiometric test results and other medical records pertinent to the HCP.
- h. Providing training at time of audiometric testing to ensure that personnel know the health hazards associated with noise exposure, and how to properly don hearing protectors including; molded earplugs, disposable foam inserts, and earmuffs.

## 2.4 Supervisors

Supervisors shall be responsible for:

- a. Reporting to the HCPO suspected noise hazards in their functional areas.
- b. Supplying the HCPO and the OHC with the names of personnel that may be exposed to noise at or above the action level of 82 dB(A), employees who complain of excessive noise, or who work in an area where it is difficult to understand a normal conversation when the speaker and listener face each other at a distance of 3 feet.

**NOTE:** *This is required so that the necessary exposure monitoring, training, hearing protective devices, baseline audiometric examinations, and other needed care or examinations can be provided.*

- c. Referring, all personnel who complain of hearing loss, other hearing complications, or ear problems, to the LaRC OHC for examination.
- d. Ensuring employees keep their appointments at the LaRC OHC for examination, fitting of hearing protective devices, and hearing conservation training.
- e. Enforcing the wearing of required hearing protective devices to conserve hearing and ensuring that administrative controls are followed.
- f. Advising the HCPO of any changes in operations requiring determinations or evaluations of noise levels.
- g. Contacting the OHCM to ensure any change in job assignment, of an employee due to hearing loss, is implemented in accordance with applicable OHCM policy.
- h. Assuring procurement and stocking of appropriate personal protective devices and obtaining the approval of the HCPO prior to purchase.
- i. Assuring procurement of noise generating equipment that complies with Buy Quiet and Quiet by Design (BQ/QBD) requirements, by obtaining the approval of the HCPO. (See Section 3.10)

## **2.5 Employees**

Employees shall be responsible for:

- a. Wearing required hearing protective devices as instructed to conserve hearing.
- b. Reporting hearing loss or hearing/ear problems to their supervisor.
- c. Reporting changes in noise levels in their Facility, to their Supervisors.
- d. Employees that are assigned to the HCP shall attend annual appointments at the LaRC OHC, for audiometric testing and hearing protection training.

## **2.6 Procurement Office**

The procurement office shall:

- a. Ensure that procurement of equipment that has the potential to produce hazardous noise levels of 80 dBA and higher shall be conducted in accordance with section 3.10, Procurement of New Equipment.
- b. Ensure approval from the Safety Office for the procurement of new equipment expected to generate noise emission levels approaching the hearing conservation action level of 82 dBA and higher.

## CHAPTER 3: PROCEDURES

The procedures for implementing the HCP are presented in this chapter. The procedures include noise hazard evaluation, application of engineering control measures, use of hearing protection devices, audiometric testing, worker training, and recordkeeping.

### 3.1 Employees Assigned to the Hearing Conservation Program

3.1.1 Whenever an employee is occupationally exposed to noise equal to or exceeding the LaRC action level of 82 dBA Time-Weighted Average (TWA) for 30 days or more per year, or can be expected to be exposed to 85 dBA TWA for any one day, they shall be required to participate in the HCP. Exposures will be computed without regard to any attenuation provided by the use of personal protective equipment.

3.1.2 A register of employees who are required to participate in the HCP shall be maintained by Supervisors within each LaRC facility.

### 3.2 Noise Hazard Evaluation

Noise hazard evaluation includes identifying hazardous noise areas, employees working in these areas, and posting signs and decals in those areas.

3.2.1. Noise measurements should be made by industrial hygienists or other personnel who have been trained in noise evaluation techniques whenever any information, observation, or calculation indicates:

- a. That an employee may be exposed to noise at or above the action level of 82 dBA.
- b. Where employees complain of excessive noise.
- c. Where it is difficult to understand a normal conversation when the speaker and listener face each other at a distance of 3 feet.

3.2.2 A noise survey should be conducted with a sound level meter to identify areas and equipment which have noise levels of:

- a. 85 dBA or greater for steady and/or intermittent noise.
- b. 140 dB peak sound pressure or greater for impact/impulse noise.

3.2.3 Sound Level Meters should conform, at a minimum, to the requirements for a Type 2 sound level meter as specified in ANSI/ASA S1.4-2014/Part 1 / IEC 61672:1-2013, Specifications for Sound Level Meters.

3.2.4 Measurements should be taken at the approximate position of the worker's more exposed ear, using the A-weighting and slow meter response for continuous noise and

C-weighting for impulse noise. A sufficient number of readings should be taken to account for variations in noise levels.

### 3.2.5 Acoustical Calibrator (Pistonphone)

- a. The sound level meter should be calibrated with the acoustic calibrator, before and after noise measurements, on the day that measurements are to be made.
- b. The Industrial Hygienist using the sound level meter should maintain a record of these daily calibrations.
- c. The acoustic calibrator should be comprehensively calibrated by the factory or factory equivalent, annually. The results of these procedures should be maintained on calibration worksheets.
- d. When the equipment is found to be out of calibration, the HCPO should be notified that corrective actions are being taken.

## 3.3 Hazardous Noise Areas

3.3.1 Areas shall be identified by noise measurement as specified below.

3.3.2 Areas shall be resurveyed within 30 days of any modification affecting the noise levels.

3.3.3 If no documentation of noise levels exists in facility noise files, a walkthrough inspection shall be conducted during the safety and industrial hygiene audit, or as a separately scheduled survey.

3.3.4 When significant differences from the previous surveys are noted, the area shall be resurveyed.

3.3.5 The results of these surveys shall be recorded by the HCPO.

3.3.6 These records shall be retained for at least 40 years.

3.3.7 Full work shift dosimetry shall be performed periodically in facilities with operations where personnel are exposed to noise levels in excess of 75 dB(A) for extended periods and there is reason to suspect that exposure may approach the LaRC Action Level of 82 dB(A).

3.3.8 Dosimetry for civil servants shall be conducted by the SFAB CIH or his/her designee.

3.3.9 Dosimetry procedures and results shall be reviewed by a CIH.

3.3.10 Contractors shall be responsible for conducting their own noise dosimetry in accordance with LaRC, NASA, ANSI and OSHA standards.

3.3.11 The HCPO and/or CIH or his/her designee may provide guidance to contractor organizations when requested, but noise dosimetry and worker exposure assessment shall be the responsibility of the contracting company/organization.

### **3.4 Posting of Hazardous Noise Areas or Equipment**

3.4.1 All work areas or equipment that produce sound pressure levels (SPL) of 85 dB(A) or greater, or 140 dB(C) SPL for impulse/impact noise, shall be prominently posted with signs and decals.

3.4.2 Signage visible to personnel entering or working in the area, should be posted at entrances to or on the periphery of hazardous noise areas to alert workers and visitors that a noise hazard exists and that proper precautions should be taken.

3.4.3 Signage should comply with 29 CFR 1910.145 – Specifications for Accident Prevention Signs and Tags. Signage (decals or tags), designed for individual pieces of equipment, should be affixed on each piece of equipment which produces hazardous noise levels. Exceptions may be made when an entire space is designated as a hazardous noise area and equipment is stationary.

3.4.4 For sign and decal approval contact SFAB.

### **3.5 Engineering Control Measures**

3.5.1 Effective engineering noise controls shall be the primary methods used to protect personnel from the hazards of noise.

- a. All practical design approaches to reduce levels by acoustical engineering shall be explored and used to reduce steady state noise levels to below 82dB(A) and impulse noise levels to below 140 dB(C), or to the maximum extent possible.
- b. In each instance where, at the design stage, the known or suspected noise level is expected to exceed current maximum allowable limits, the cognizant project or facilities engineer shall document and forward these findings to the HCPO.
- c. Corrective action to abate all hazardous noise levels to acceptable levels shall be included.

3.5.2 New equipment being considered for purchase is to have the lowest noise emission levels that are technologically and economically feasible and compatible with performance and environmental requirements in accordance with the BQ/QBD requirements. (See Section 3.10)

3.5.3 Acoustic considerations shall be included in the criteria of plans and specifications for all new facilities, substantial modification projects for facilities, and for aircraft and spacecraft systems and subsystems.

### 3.6 Hearing Protection Devices

Selection of hearing protection devices depends on the noise level, type of noise (steady state or impulse), and personnel comfort. Devices include, earplugs and earmuffs, which must have a minimum Noise Reduction Rating (NRR) of 27dB.

3.6.1 Hearing protection devices shall be provided to employees for voluntary use whenever there is equipment or operations with steady-state noise exposure levels of less than 85 dB(A).

3.6.2 Approved hearing protection devices shall be used by all employees when exposed to steady-state noise levels of 85 dB(A) or greater. This includes working in designated hazardous noise areas or with hazardous noise producing equipment.

3.6.3 Earplugs shall be worn in combination with earmuffs when personnel work in areas where steady-state noise levels are 110 dB(A) and above.

3.6.4 Occupancy in areas with steady-state noise levels of 120 dB(A) and above requires that both earplugs and earmuffs be worn simultaneously, also a limitation shall be placed on daily exposure time (administrative controls).

3.6.5 Personnel occupancy in areas with steady-state noise levels above 140 dB(A) shall be avoided regardless of the duration of exposure.

3.6.6 The tradeoff rate between noise level and allowable daily exposure is 3 dB(A) for every halving of time. As shown in Table 1.

3.6.7 Hearing protective devices, either earplugs or earmuffs, shall be worn when impulse noise levels exceed 140 dB(C).

3.6.8 Earplugs and earmuffs be worn simultaneously in areas with impulse noise in excess of 165 dB(C).

#### 3.6.9 Types of Hearing Protection Devices

- a. Adequate protective devices (disposable earplugs and earmuffs) shall be maintained by each organization and made available to personnel.
- b. Contractors shall make hearing protection equipment available to their employees.

##### 3.6.9.1 Hand-Formed Earplug Inserts (Disposable)

- a. Hand-formed earplug inserts do not require medical fitting.
- b. Employees should be instructed how to use hand-formed earplug inserts.
- c. Cutting hand-formed plugs into halves should not be permitted since this will result in an inadequate mass and markedly reduced noise attenuation.

- d. For hygienic reasons, hands should be clean when preparing hand-formed earplugs for insertion.

#### 3.6.9.2 Prefomed Earplugs

- a. Prefomed earplugs (single and triple flange) earplugs should be cleaned with a mild soap and water solution and rinsed thoroughly in-between use.
- b. Properly fitted earplugs will not cause damage to the normal ear canal provided the plugs are kept reasonably clean.

#### 3.6.9.3 Earmuffs

- a. Type II earmuffs are designed to be worn with the suspension system over the head, in back of the head, or under the chin.
- b. When earmuffs are used, the headband should be properly adjusted to ensure a snug fit.
- c. When eyeglasses are worn with earmuffs, it is important that the ear cup seals of the earmuffs fit well around the temples of the eyeglasses. Even a small "leak" defeats the purpose of wearing earmuffs.
- d. Earmuffs should be periodically inspected for torn, punctured, or hardened seals.
- e. Damaged units should be discarded and replaced.
- f. Units issued to individuals should be kept clean from dirt or other debris that could cause possible health problems.

### 3.7 Audiometric Testing and Medical Evaluation

**NOTE:** *Audiometric testing is used to identify the presence of early changes in hearing sensitivity. In combination with a history of all noise exposure, including off-duty noise exposure, audiometry makes it possible to determine if the issued hearing protection is being used and if engineering controls are adequate. It may also be possible to identify individuals who are highly susceptible to noise-induced hearing loss.*

3.7.1 Audiometry is a primary element of the HCP.

3.7.2 All monitoring audiometry should comply with OSHA 29 CFR 1910.95 (g), (h), Appendices C, D, and E.

3.7.3 All employees shall be required to take pre-certification and termination audiometric testing who are exposed to:

- a. The action level of 82 dB(A) as an 8-hour TWA, for 30 or more days per year
- b. An equivalent TWA of 85 dB(A) 8-hour TWA exposure using a 3 dB exchange rate (as shown in Table 1 below) for any 1 day per year

<b>Table 1</b>	
<b>Duration (Hours)</b>	<b>dB(A)</b>
16	82
8	85
4	88
2	91
1	94
0.5	97
0.25	100
0.125 or less	103

c. Impact or impulsive noise in excess of the limits (as shown in Table 2 below)

<b>Table 2</b>	
<b>Sound Level dB(C)</b>	<b>Permitted Number of Impacts or Impulses per Day</b>
140	100
130	1000
120	10,000

3.7.4 Civil servant audiograms shall be provided at the LaRC OHC.

3.7.5 Contractors shall provide audiograms to employees by utilizing a qualified vendor that provides audiometric testing services.

3.7.6 All audiometric testing and review shall be performed by personnel certified by the CAOHC.

### **3.8 Training**

Training shall be required for personnel working in, supervising, or managing hazardous noise areas.

3.8.1 All personnel who are assigned to the HCP, shall be trained annually regarding the permanent nature of noise induced hearing loss, type and use of personal protective measures, and the requirements of the HCP. Training shall be performed by OHC at the time of worker audiometric testing.

3.8.2 Symptoms that may be experienced before permanent hearing loss occurs shall be explained and the importance of obtaining early medical/audiometric evaluation of these symptoms shall be stressed.

3.8.3 The HCPO or other trained individuals shall conduct training for supervisors and managers of personnel in hazardous noise areas emphasizing their responsibilities in the program.

3.8.4 Contractor employees shall be trained by their respective employer.

3.8.5 Personnel shall be encouraged to use hearing protective devices whenever they are exposed to hazardous noise during off-duty activities (for example, from lawn mowers, firearms, and so forth).

### **3.9 Records**

3.9.1 CMO should ensure that records pertaining to the HCP are maintained for 40 years.

3.9.2 Records pertaining to the conduct of the HCP shall be maintained in accordance with the guidelines set forth in NPR 1441.1, NASA Records Management Program Requirements.

3.9.3 Records relative to disposition of personnel for whom administrative noise controls have been recommended and those who are being carefully monitored, including:

- a. Special actions and/or recommendations, which are directed at engineering controls.
- b. Data and information concerning the calibration and repair of sound measuring equipment and audiometers.
- c. Data and information on audiometric test booths, personnel hearing protectors, and auditory risk criteria.
- d. Data and information for use in the education program of personnel exposed in hazardous noise areas.

3.9.4 Records and results of all audiometric examinations and all other pertinent information should also be maintained as a permanent part of the individual's medical record and include:

- a. The audiometric test results and training performed for hearing conservation purposes.
- b. An occupational noise exposure history and pertinent noise survey data and/or relevant non-occupational noise exposure.

3.9.5 A current Center-wide register of personnel who are enrolled in the HCP should be kept and appropriate entries should be made in the individual's medical record.

### **3.10 Buy Quiet Requirements for Procurement of New Equipment**

When purchasing new equipment expected to generate noise emission levels approaching the hearing conservation action level of 80 dBA and higher, the steps below shall be taken. The objective of these steps is to conduct a cost benefit analysis to ensure the equipment meets realistic noise emission levels at a reasonable cost.

1. Research available products relative to these questions.
  - a) What is the typical noise levels for available products?
  - b) Is there a product that produces a lower noise level than typical?
  - c) What is the price differential for the quieter version?
  
2. Based on the research, specify realistic noise emission levels that can be purchased at a reasonable cost that will meet required technical specifications. For example, if products can be purchased at a small cost increase that produce noise levels below 80 dBA when most available products have a noise emission above 80dBA, consider a noise specification of less than 80 dBA. On the other hand, if the lower noise level equipment costs significantly more, the increased cost may not be justified.

Contact the Safety Office (4-7233) for assistance with conducting the steps above.

## APPENDIX A: DEFINITIONS AND TERMINOLOGY

**Administrative Controls.** Any procedure that limits daily exposure to noise by control of the work schedule.

**Audiogram.** A record of the threshold of audibility as a function of frequency obtained for each ear during an audiometric examination.

**Audiologist.** A professional specializing in the study and rehabilitation of hearing, who is certified by the American Speech, Hearing and Language Association, or licensed by a state board of examiners.

**Audiometer.** An electronic instrument that conforms to the requirements and specifications of ANSI Standard S3.6-1969 used for measuring hearing threshold levels.

**Baseline Audiogram.** The audiogram against which future audiograms are compared.

**Decibel.** A unit of measurement of sound level. The decibel level of a sound is related to the logarithm of the ratio of sound pressure to a reference pressure. The dB has meaning only when the reference is known. The internationally accepted reference pressure used in acoustics and at LaRC is 20 micropascals ( $\mu\text{Pa}$ ).

- **dB(A) (decibels - A-weighted).** A unit of measurement of sound level corrected to the A-weighted scale, as defined ANSI/ASA S1.4-2014/Part 1 / IEC 61672:1-2013, using a reference of 20 micropascals.
- **dB(C).** A unit of measurement of sound level corrected to the C-weighted scale. The C scale discriminates very little against low frequencies, approximating a uniform response over the frequency range from 25-8,000 Hertz (Hz).

**Engineering Control.** Any design procedure that reduces the sound level either at the source of the noise or within the hearing zone of the individuals.

**Hazardous Noise.** This noise consists of the following two types:

- **Steady-State Noise** is continuous/intermittent noise equivalent to 85 dB or greater A-weighted sound pressure level (dBA) and is considered hazardous.
- **Impulse or Impact Noise** is sound with a rise time of not more than 35 milliseconds to peak intensity and a duration of not more than 500 milliseconds to the time when the level is 30 dB below the peak. If the impulses recur at intervals of less than one-half second, they will be considered as steady-state noise. Noise equivalent to 140 dB or greater peak sound pressure level (dBp) is considered to be hazardous.

**Hearing Threshold Level.** The amount, in decibels, by which the threshold of audibility for an ear differs from the standard audiometric level.

**Hertz (Hz).** The international symbol for cycles per second. It is the unit of measurement for the frequency of tones.

**Listening Checks.** Preliminary checks of the audiometer, performed by the audiometric technician, to detect noise, distortion, intermittent tones, and other audiometer malfunctions, which would preclude valid testing.

**Monitoring Audiogram.** Periodic audiometric tests, obtained subsequent to the reference audiogram, which are used to detect shifts in the individual's threshold of hearing.

**Noise Reduction Rating (NRR)** is a unit of measurement used to determine the effectiveness of hearing protection devices to decrease sound exposure within a given working environment

**Sound Pressure Level.** A sound measurement expressed in decibels obtained with a sound level meter that has a flat frequency response (slow time) equivalent to twenty times the common logarithm of the ratio of the measured A-weighted sound pressure to the Standard Reference pressure of 20 micropascals (measured in decibels).

**Sound Level Meter.** An electronic instrument, which measures sound levels conforming to the requirements for a Type II sound level meter as specified in ANSI SI.4-1971.

**Time-Weighted Average (TWA).** The constant sound level, over an 8-hour workday exposure, which is equivalent to the percent noise exposure as is measured by an audio dosimeter.

**APPENDIX B: ACRONYMS**

ANSI	American National Standards Institute
BQ/QBD	Buy Quiet and Quiet by Design
CFR	Code of Federal Regulations
CAOHC	Council for Accreditation in Occupational Hearing Conservation
CIH	Certified Industrial Hygienist
CMO	Chief Medical Officer
LPR	Langley Research Center Procedural Requirements
LaRC	Langley Research Center
NIHL	Noise Induced Hearing Loss
NRR	Noise Reduction Rating
HCP	Hearing Conservation Program
HCPO	Hearing Conservation Program Officer
NPR	NASA Procedural Requirements
OHC	Occupational Health Clinic
OSHA	Occupational Safety and Health Administration
OHCM	Office of Human Capital Management
SFAB	Safety and Facility Assurance Branch
SMAO	Safety and Mission Assurance Office
SPL	Sound Pressure Level
TWA	Time-weighted average