



NASA Procedures and Guidelines

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Hearing Conservation

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Preface

P.1 PURPOSE

This NPG establishes minimum requirements for an Agencywide Hearing Conservation Program and is intended to prevent noise-induced hearing loss. Occupational exposure to noise has been shown to be a contributing factor in the development of noise-induced hearing loss. Loss of hearing can result from exposure to impulse or impact noise, as well as from exposure to steady-state (continuous/intermittent) noise. The hearing loss may be temporary or may become permanent through repeated exposure of unprotected personnel to hazardous noise. Initial deterioration of hearing may not be apparent to the individual. By the time there is subjective awareness of the loss, the impairment may be substantial and irreversible. Hearing loss due to noise exposure is almost entirely preventable. Therefore, concerted preventive efforts are warranted to ensure that the hearing of employees is conserved.

P.2 APPLICABILITY

This NPG is applicable to NASA Headquarters and NASA Centers, including Component Facilities, and to JPL to the extent specified in its contract and includes all ground-based and aircraft operations, all aircraft pilots, and crew members. This document does not apply to space and space flight operations. A separate document entitled "NASA Flight Crew Hearing Conservation Program" (JSC-28927) governs this. While, referencing the NASA Occupational Hearing Conservation Program, the noise limits imposed are lower than those for ground operations because space operations must protect not only against the direct otologic effects of noise, but also against its impact on performance including impaired concentration, stress, agitation, and sleep disturbances.

NASA's goal is to control noise generated by NASA operations and to prevent

occupational noise-related hearing loss among employees. To accomplish this, maximum permissible exposure limits have been established as listed in Tables 1 and 2. Priority will be given to engineering procedures to the greatest extent practicable to eliminate, control, or isolate sources of hazardous noise.

All personnel who are routinely, occupationally exposed to noise at levels equal to or exceeding the following noise levels will be identified and placed in a hearing conservation program and be required to wear personal hearing protection in accordance with Paragraph 3.5 of this NPG:

- The action level of 80 Decibel A-Weight (dBA), as an 8-hour Time Weighted Average (TWA), for 30 or more days per year; or
- An equivalent TWA of 85 dBA for 8 hours for any 1 day per year; or
- Impact or impulsive noise in excess of the limits listed in Table 2.

All personnel who enter designated hazardous noise areas or who perform tasks where exposures to continuous noise exceed 85 dBA, regardless of the duration of exposure, will be required to wear personal hearing protection.

P.3 AUTHORITY

- a. 42 U.S.C. 2473 (c) (1), Section 203 (c) (1) of the National Aeronautics and Space Act of 1958, as amended.
- b. 29 U.S.C. 668, Section 19 of the Occupational Safety and Health Act of 1970, as amended.
- c. Executive Order 12196, dated February 26, 1980, "Occupational Safety and Health Programs for Federal Employees," 3 CFR (1980 Compilation).
- d. 29 CFR Part 1960, "Basic Program Elements for Federal Employee

Occupational Safety and Health Programs and Related Matters."

e. 29 CFR 1910.95, "Occupational Noise Exposure."

f. NPD 1800.2A, "NASA Occupational Health Program."

P.4 REFERENCES

a. 5 U.S.C. 552a, the Privacy Act of 1974, as amended (the Privacy Act).

b. 29 CFR Part 1910.1020, "Access to Employee Exposure and Medical Records."

c. NPD 1810.2A, "NASA Occupational Medicine Program."

d. NPD 1820.1A, "NASA Environmental Health Program."

e. NPD 1840.1A, "NASA Workers' Compensation Program."

f. NPG 1441.1C, "NASA Records Retention Schedules."

g. NPG 8715.1, "NASA Safety and Health Handbook Occupational Safety and Health Programs."

h. JSC-28927, "NASA Flight Crew Hearing Conservation Program of April 2000."

i. ANSI S3.6-1969, Specification for Audiometers.

P.5 CANCELLATION

NASA Health Standard, NHS/IH-1845.4, NASA Health Standard on Hearing Conservation, is replaced in its entirety.

/s/ Richard S. Williams, MD, FACS
Acting Chief Health and Medical Officer

CHAPTER 1. Responsibilities

1.1 Manager, Agency Occupational Health Program

The Manager for the Agency's Occupational Health Program is responsible for directing the Agency Hearing Conservation Program and evaluating the adequacy of this program at each NASA Center.

1.2 Associate Administrator for Management Systems

The Associate Administrator for Management Systems is responsible for ensuring that noise control and reduction considerations are integral to the site selection and design of new or modified NASA facilities.

1.3 Associate Administrator for Headquarters Operations and the NASA Center Directors

The Associate Administrator for Headquarters Operations and the Center Directors are responsible for ensuring that the Hearing Conservation Program, as specified by this NPG, is in place. When contracting for clinic operations, ensure that contract requirements include contract compliance with policies, procedures, and standards of this NPG.

1.4 Program and Project Managers

Program and Project Managers are responsible for the following:

- a. Ensuring that, where feasible, the design and development, or selection and purchase, of aeronautical and space hardware, tools, support equipment, engineering controls, and associated procedures will minimize any noise-exposure hazard to personnel.
- b. Notifying Center environmental health personnel where noise exposures are expected to exceed the limits specified in Paragraph 3.3, Tables 1 and 2.

1.5 NASA Center Facilities Managers and Design Engineers

- a. Selecting building equipment with low noise emissions, where feasible.
- b. Notifying environmental health personnel of noisy areas/operations.
- c. Designing and applying engineering controls necessary to reduce noise exposures to acceptable limits or to the maximum extent feasible.
- d. Giving necessary consideration to acoustics in the design and modifications of building.
- e. Providing copies of applicable engineering drawings and operational plans to environmental health personnel for review and assessment of precautions planned to limit noise emissions and control noise exposures.
- f. Ensuring that noise-producing equipment is properly maintained to minimize increased noise levels as equipment ages.
- g. Coordinating the design and implementation of engineering noise control measures with environmental health.

1.6 Center Medical Directors/Officers

Center Medical Directors/Officers are responsible for the following:

- a. Maintaining a registry of all personnel covered under Paragraph P.2 of this NPG, scheduling those persons for audiometric examinations, and notifying employees of the need to avoid exposure to high noise levels preceding the audiometric test.
- b. Providing medical evaluations, obtaining an occupational history of participants in the Medical Monitoring Program, supervising onsite audiometric testing, evaluating test results, and fitting hearing-protection devices, as appropriate.
- c. Notifying employees of significant hearing loss or other medical pathology of the ear and explaining the need and plans for further testing and/or referrals.
- d. Notifying both the employee (in writing) and the employee's supervisor within 21 days if further testing establishes that a permanent standard threshold shift has occurred.
- e. Notifying environmental health personnel when a permanent standard threshold shift is identified, which may be indicative of a work related hearing loss.
- f. Recommending to the Personnel Office/Supervisor the reassignment of employees to work in low noise areas, in accordance with applicable personnel management requirements when necessary to prevent further significant hearing loss or the aggravation of other medical conditions, which could be worsened by work in a noise-hazard area.
- g. Referring employees to an audiologist or physician specialist, as appropriate.
- h. Ensuring that the physicians who conduct or supervise the audiometric testing of employees are familiar with the requirements of this NPG.
- i. Ensuring that personnel who conduct audiometric testing, using manual

audiometers, are certified by the Council on Accreditation for Occupational Hearing Conservation and that oversight is provided by a physician/audiologist.

j. Ensuring that audiometric test equipment is properly calibrated and that ambient noise levels in audiometric test rooms meet the requirements specified in Paragraph 3.10, Table 3.

k. Maintaining audiometric test records and other records as required by Paragraph 3.15 of this NPG.

l. Providing employee access to medical records in accordance with the requirements of Paragraph 3.2 of this NPG.

m. Ensuring that Occupational Safety and Health Administration (OSHA) reportable hearing loss cases are recorded on the C-2 injury log and in Incident Reporting Information System (IRIS) and that employees receive instruction and assistance in filing appropriate Workers' Compensation Claim forms when significant hearing loss is detected.

1.7 Center Environmental Health Personnel

Center environmental health personnel are responsible for the following:

a. Conducting baseline surveys of each new operation, job, or procedure having the potential of creating hazardous noise. These surveys should be preoperational, where possible.

b. Monitoring and evaluating noise-hazard areas or operations through noise surveys and personal noise dosimetry.

c. Recommending appropriate means of controlling hazardous noise exposures.

d. Designating noise-hazard areas and notifying appropriate managers/supervisors of such areas.

- e. Maintaining a current inventory of all noise-hazard areas and noise levels recorded in these areas.
- f. Providing employee access to noise survey/dosimetry records.
- g. Notifying supervisors of affected employees and the installation's Medical Director of the requirements for employees to participate in a medical monitoring program, and as a minimum receive annual audiograms, when noise measurement data indicate that noise exposures equal or exceed the following:
 - The action level of 80 dBA, as an 8-hour TWA, for 30 or more days per year; or
 - An equivalent TWA of 85 dBA for 8-hours, for any 1 day per year; or
 - Impact or impulsive noise in excess of the limits listed in Table 2; or
- h. Reviewing facility and operational plans to assess the adequacy of precautions planned/taken to control noise exposures.
- i. Selecting hearing-protection devices (in collaboration with the Medical Director, as necessary).
- j. Ensuring that personnel participating in the Hearing Conservation Program (either through the required use of personal hearing protection or through medical monitoring), and their immediate supervisors receive adequate training.
- k. Coordinating with the Medical Director in determining if the cause of a permanent standard threshold shift in employees is work-related.
- l. Notifying supervisors of the requirement for employees to wear hearing protection in the performance of their tasks.

1.8 Contracting Officers

Contracting Officers are responsible for ensuring that environmental health and clinic contract requirements include contractor compliance with the policies, procedures, and standards of this NPG.

1.9 Personnel Management Organizations

Personnel Management Organizations are responsible for ensuring that employees are transferred from work in a noise hazard area when feasible, upon recommendation by the Medical Director/environmental health personnel.

1.10 Supervisors

Supervisors are responsible for the following:

- a. Reporting suspected hazardous noise in all of their areas of jurisdiction to environmental health personnel.
- b. Supplying environmental health personnel and the NASA Health Clinic with the names of personnel working in designated noise hazard areas (or otherwise exposed to hazardous noise).
- c. Referring personnel who complain of hearing loss or other hearing or ear problems to the NASA Health Clinic for examination and a workplace noise hazard evaluation by environmental health.
- d. Ensuring the wearing of hearing-protection devices and the implementation of administrative controls where required.
- e. Notifying environmental health personnel of any changes in operations requiring noise determinations or evaluations.
- f. Ensuring the provision and availability of hearing-protection devices, as identified by environmental health, for use by employees and visitors to hazardous noise areas, as appropriate.

- g. Ensuring that employees who are participants in the Hearing Conservation Program attend required training.
- h. Attending Hearing Conservation Program training.
- i. Assuring that caution signs are posted in designated noise-hazard areas and that appropriate labels are placed on tools and equipment in accordance with Paragraph 3.13.
- j. Notifying each affected employee of the results of noise dosimetry monitoring.
- k. Ensuring that new employees or employees newly assigned to duties involving hazardous noise receive baseline audiograms before beginning duties. If this is not possible, then ensuring that employees receive baseline audiograms within 30 days of employment.

1.11 Individual Employees

Individual Employees are responsible for the following:

- a. Using effective noise-exposure control procedures, including the proper wearing and maintenance of hearing-protective devices furnished for their protection.
 - b. Cooperating with supervisors, medical, and environmental personnel in actions to evaluate hazardous noise and to prevent hearing loss caused by excessive exposure to workplace noise.
 - c. Notifying supervisors of areas, operations, or equipment that may produce hazardous noise.
 - d. Attending required training.
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CHAPTER 2. Definitions

Action Level - the sound level which, when reached or exceeded, necessitates implementation of activities to reduce the risk of noise-induced hearing loss. NASA currently uses an 8-hour time weighted average of 80 decibels measured with a sound-level meter on the A-Scale, slow response as the criterion for implementing an effective hearing conservation program.

Administrative Control - any procedure that limits noise exposure by control of work schedules.

Audiogram - chart, graph, or table resulting from an audiometric test. An audiogram indicates an individual's hearing threshold levels as a function of frequency.

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 used for measuring hearing threshold levels that conforms to the requirements and specification of the current American National Standard Institute (ANSI) S3.6-1996.

Baseline Audiogram - an audiogram against which future audiograms are compared.

Biological "Functional" Calibration Check - an audiometric test of one or more individuals with known, stable hearing levels used to check the proper

functioning and stability of an audiometer and to identify any unwanted or distracting sounds.

Deafness - the otological condition in which the hearing threshold level for speech, or the average hearing threshold level for pure tones at 500, 1000, 2000, and 3000 Hertz (Hz) is at least 93 dB (reference ANSI S3.6-1996). This is generally accepted as representing a 100-percent hearing handicap for normal speech.

Decibel (dB) - a unit of measurement of sound pressure level.

Decibel A-weighted (dBA) - a sound level reading in decibels made on the A-weighted network of a Sound Level Meter (SLM) at slow response.

Decibels (dB), Peak - the highest instantaneous sound level measured. Commonly used to measure impulsive or impact noise.

Engineering Control - any mechanical device or physical barrier that reduces the sound level at the source of noise generation or along the path of propagation of the noise to the individual. This does not include protective equipment such as earmuffs or plugs and administrative controls.

Fitness and Risk Evaluations - evaluations performed by medical, environmental health, and safety professionals for the purpose of determining a worker's ability to perform specific job tasks (fitness) and the likelihood of harm, either to the worker or others (risk), in relation to anticipated workplace exposures and job demands. Fitness and risk evaluations are the processes used to evaluate individuals who, if placed at work in hazardous noise, may not be able to adequately perform essential duties or may pose a health or safety risk to themselves or others.

Hazardous Noise - a noise hazard exists wherever any operation, process, or procedure generates noise of sufficient duration and intensity to be capable of producing a permanent loss of hearing to an unprotected person.

Hertz (Hz) - a unit of measurement of frequency numerically equal to cycles per second.

Impulsive or Impact Noise - variations in noise levels that involve peaks of intensity that occur at intervals of greater than 1 second. If the noise peaks occur at intervals of 1 second or less, the noise is considered continuous.

Medical Pathology - a disorder or disease. For the purposes of this NPG, a condition or disease affecting the ear, which should be treated by a physician specialist.

Monitoring Audiogram - an audiometric test obtained at least annually to detect shifts in the individual's threshold of hearing by comparison to the baseline audiogram.

Noise - unwanted sound.

Noise Dose - a measure of cumulative noise exposure over a stated time period which takes into account both the intensity of sound and the duration of exposure.

Noise Dosimeter - an electronic instrument which integrates cumulative noise exposure over time and directly indicates a noise dose.

Noise-Hazard Area - any work area with a noise level at or above 85 dBA TWA.

Otolaryngologist - a physician specializing in the diagnosis and treatment of disorders of the ear, nose, and throat.

Permanent Threshold Shift (PTS) - A change in hearing threshold, primarily due to exposure to high-intensity noise that remains after a lengthy recovery period (over 72 hours).

Representative Exposure - measurements of an employee's noise dose or 8-

hour TWA noise exposure which is representative of the exposure of other employees in that work area or job classification.

Revised Baseline - the most recent audiogram that has established a standard threshold shift. It will be used as the basis of comparison for future audiograms.

Sound Level Meter - an electronic instrument for the measurement of sound levels.

Sound Pressure Level - mathematically equivalent to 20 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). For use with this NPG, slow time response is required in accordance with the current ANSI S1.4.

Standard Threshold Shift (STS) - an average hearing threshold shift of 10 dB or more at 2000, 3000, and 4000 Hz in either ear. This shift can be either permanent (PTS) or temporary (TTS).

Temporary Threshold Shift (TTS) - a change in hearing threshold, primarily due to exposure to high-intensity noise that usually can recover in 14 to 72 hours away from noise exposure.

Time-Weighted-Average (TWA) Sound Level - a sound level which, if constant over an 8-hour workday exposure, would result in the same noise dose as is measured.

Weighted Measurements - two weighting curves that are commonly applied to measurements of sound levels to account for the way the ear perceives the "loudness" of sounds. A-weighting is a measurement scale that approximates the "loudness" of tones relative to a 40 dB SPL 1000 Hz reference tone. C-weighting is a measurement scale that approximates the "loudness" of tones relative to a 90 dB SPL, 1000 reference tone.

CHAPTER 3. Program Requirements

3.1 Written Program

All NASA Centers shall develop their own written implementation plans incorporating the requirements of this NPG.

3.2 Employee Access

Copies of this NPG (or the installation's written Hearing Conservation Program), 29 CFR 1910.95, Occupational Noise Exposure (OSHA Noise Standard), and any appropriate records required by this NPG will be provided upon request to employees, former employees, representatives of employees, representatives of the U.S. Department of Labor, the National Institute for Occupational Safety and Health (NIOSH), and NASA Occupational Health Program personnel, consistent with the requirements of the Privacy Act, and consistent with the restrictions in the Health Information Management System (HIMS) of records in NASA's "Annual Notice and Amendment to Systems of Records," published in the Federal Register.

3.3 Noise Exposure Limits

- a. The permissible exposure limits for continuous noise are listed in Table 1.

Table 1

Permissible Exposure Limits for Continuous Noise

<u>Duration (Hours)</u>	<u>dBA*</u>
-------------------------	-------------

24.3	77
16	80
8	85**
4	90
2	95
1	100
0.5	105
0.25	110
0.125 or less	115

*Sound Level in decibels measured on the A-scale of a Type I/II sound-level meter set at "slow response." The exposure noted at each sound level for the duration noted is equivalent to 100 percent of the allowed noise dose.

** No unprotected exposures to continuous noise in excess of 85 dBA are permitted.

b. Unprotected exposure to impact or impulse noise shall not exceed the limits listed in Table 2. No unprotected exposures to impact or impulse noise in excess of 140 dB sound-pressure level are permitted.

Table 2

Permissible Exposure Limits for Impact or Impulsive Noise

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

* Sound level in decibels measured with a Type I/II sound level meter with peak hold feature using C-weighting or linear at fast response.

c. Exposures should be maintained at or below the action level whenever possible.

d. The action level is equivalent to a noise exposure equivalent to 50 percent of the allowed noise dose and defines one of the criteria for participation in the hearing conservation program.

3.4 Engineering Controls

Where feasible, facilities and equipment will be procured, designed, operated, and/or modified in such a manner as to prevent employee exposure to continuous noise levels above 85 dBA TWA or impulsive noise above 140 dB. Any reduction in employee noise exposure, even if it is not reduced below 85 dBA, is beneficial. If engineering controls fail to reduce sound levels within the limits of Tables 1 and 2, hearing protective equipment and/or administrative methods of noise-exposure protection must be used.

3.5 Personal Hearing Protection

a. Earmuffs and/or plugs will be provided to employees assigned to work in areas where they will be exposed to continuous noise in excess of 85 dBA without regard to duration of exposure. They will also be provided when employees are working in areas where they will be exposed to impulse noise in excess of 115 dB. Earplugs shall be for the exclusive use of each employee and shall not be traded or shared.

b. Hearing protectors must attenuate employee noise exposure to at least an 8-hour TWA of 85 dBA. A combination of both earmuffs and plugs are required where noise levels equal or exceed 110 dBA. For those with STS, protectors must attenuate exposure to an 8-hour TWA of 80 dBA. Estimation of the adequacy of hearing protector attenuation shall be performed according to 29 CFR 1910.95, Appendix B.

c. The adequacy of hearing protector attenuation shall be reevaluated whenever employee noise exposures increase to the extent that the hearing protector provided may no longer provide adequate attenuation. More effective hearing protectors shall be provided when necessary.

d. Special hearing-protective equipment, such as sound-suppression communication headsets, may be used in noise-hazard areas. These devices should be regularly inspected. Sound-suppression headsets that have been damaged, altered, or modified in any way that affects the attenuation characteristics may not be used. Where replacement parts, such as ear cup seals are available, the headsets may be repaired and reused. Where sound-suppression headsets are not permanently issued to individuals, such equipment must be cleaned and sanitized before reissuance.

3.6 Administrative Control

Where hearing protective equipment is not sufficient to attenuate noise to less than 85 dBA, the duration of time spent in the noise hazard area will be limited so as not to exceed the exposure limits in Tables 1 and 2.

3.7 Exposure Monitoring

a. Measurement of potentially hazardous sound levels will be conducted when any information, observation, or calculation indicates that an employee may be exposed to a noise level in excess of 80 dBA TWA. This includes, but is not limited to, times where there is a need to document representative noise exposures, where employees complain of excessive noise, or where it is difficult to understand a normal conversation when the speaker and listener face each other at a distance of 2 feet. Any new equipment, operation, job or procedure with the potential for creating hazardous noise should be evaluated with regard to noise emissions prior to startup. All continuous, intermittent, and impulsive sound levels from 80 dB to 130 dB shall be integrated into the noise measurements. Noise-exposure computation is shown in Appendix A of 29 CFR 1910.95.

- 1) Detailed noise analyses (octave band analysis) will be conducted when required to establish the characteristics of the noise source relative to operations in the noise area and to determine appropriate abatement techniques.
 - 2) When an initial determination shows that any employee or group of employees (without hearing protection) may be exposed to noise at or above the action level or at or above a single- day TWA equivalent of 85 dBA for 8 hours, noise monitoring will be conducted to determine the noise dose of the exposed employee and the representative exposure of similarly exposed employees.
 - 3) For designated hazardous noise areas and where employee exposures exceed the limits of Table 1 or Table 2, noise dosimetry and area monitoring will be repeated whenever any changes to facilities, equipment, work practices, procedures, or noise-control measures alter potential noise-exposures. If there are no changes to facilities, equipment, work practices, procedures or noise-control measures, area noise levels should be randomly sampled every year and noise dosimetry performed on a representative employee at least every 3 years.
- b. Employees and/or their representatives will be provided an opportunity to observe noise dosimetry and area monitoring activities.
 - c. Areas determined to have noise levels at or above 85 dBA must be posted as noise hazard areas.
 - d. Affected employees will be notified of the results of noise.

3.8 Methods of Measurement

Instruments used to measure workers' noise exposures shall be calibrated to ensure measurement accuracy and, at a minimum, they shall conform to the ANSI Specification for Sound Level Meters, ANSI S1.4-1983 and S1.4A-1985, Type 2 or, to the ANSI Specification for Personal Noise Dosimeters, ANSI S1.25-1991. If a sound-level meter is used, the meter response shall be set at SLOW.

In determining TWA exposures, all continuous, varying, intermittent, and impulsive sound levels from 80 to 140 dBA shall be integrated into the noise measurements.

3.9 Medical Monitoring Program

- a. Whenever an employee is occupationally exposed to continuous noise at or above the action level or at or above a single-day TWA equivalent of 85 dBA for 8 hours, or to impact or impulsive noise in excess of the limits listed in Table 2, the employee will be enrolled in a Medical Monitoring Program. For the purposes of program enrollment, employee noise exposure shall be determined without regard to any sound attenuation provided by the use of hearing protectors.
- b. Each employee placed in a job requiring participation in the Medical Monitoring Program shall undergo a physical examination prior to assignment of duties involving exposure to high- intensity noise. The examination will include a baseline audiogram, a medical examination to determine any preexisting medical pathology of the ear, and a work history to document past noise exposure. The individual must have no apparent or suspected ear, nose, and throat problems that might compromise the validity of the audiogram. When an employee is determined to be suffering from an acute disease of the ear that may compromise the validity of the test, the baseline audiogram will be delayed until the condition has abated.
- c. When a physical examination cannot be obtained prior to placement in a job requiring participation in the Medical Monitoring Program or when it is discovered that those already assigned to hazardous noise have not had a physical examination, one shall be conducted within 30 days. The audiogram must be preceded by a period of at least 14 hours during which there is no known exposure to continuous sound levels in excess of 72 dBA or to impulsive/impact noise greater than 120 dB. This time interval should be sufficient to allow recovery from noise-induced temporary threshold shift.
- d. Personnel suffering from acute diseases of the ear should not be placed in

hazardous noise areas until the condition has abated, particularly if such diseases preclude the wearing of hearing protectors, cause hearing impairment, or produce tinnitus.

e. All employees who are enrolled in the Medical Monitoring Program will receive an annual audiogram.

f. All NASA employees who have participated in the Medical Monitoring Program will receive a final audiometric examination prior to termination of employment, transfer to another installation, or retirement. An annual audiogram, if completed within 6 months of the termination, transfer, or retirement date, may be substituted for the final audiogram.

3.10 Audiometric Testing

Audiometric testing will be performed in accordance with 29 CFR 1910.95 Sections g, and h, and Appendices C, D, and E. Rooms used for audiometric testing shall not have background sound-pressure levels exceeding those in Table 3.

Table 3

**Maximum Background Sound Pressure Levels
for Audiometric Test Rooms**

<u>Octave Band Center Frequency (Hz)</u>	<u>Sound Pressure Levels (dB)</u>
500	27
1000	30
2000	35
4000	42
8000	45

3.11 Evaluation of Annual Audiogram

- a. Each employee's annual audiogram shall be compared to that employee's baseline audiogram to determine if the audiogram is valid and if a Standard Threshold Shift (STS) has occurred. The certified technician performing the test may perform this comparison.
- b. If the employee experiences STS, the employee shall be rescheduled within 30 days for a retest to determine if the shift is persistent. The retest shall be preceded by a period of at least 14 hours during which there is no known exposure to continuous sound levels in excess of 72 dBA or to impulsive/impact noise greater than 120 dB. All personnel with an STS will receive reeducation on the harmful effects of hazardous noise and will be refitted with hearing protection.
- c. If the retest indicates a persistent STS, the STS will be considered a Permanent Threshold Shift (PTS), and the employee shall be referred for further medical evaluation.
 - 1) Medical evaluation is required to validate the existence of a PTS noise-induced and (or) to determine if further medical referral is required. Audiologist, Otolaryngologist, or other physician shall perform that evaluation. A physician shall make any determination that the noise-induced STS is not work-related or has not been aggravated by occupational noise exposure.
 - 2) The criteria in Paragraph 3.12 should be used as a guideline for referral, or a physician may otherwise determine there is a need for further medical evaluation.
 - 3) A new reference audiogram shall replace the original reference audiogram when the medical evaluation confirms that the STS is permanent.
- d. Any employee assigned a new baseline audiogram shall be scheduled for retest in 6 months to determine if further hearing threshold shifts have occurred. Additionally, the actions described in Paragraph 3.13. Followup Review, will be done. The employee will be encouraged to use hearing protection for nonwork

activities involving noise exposures.

e. No employee shall be reassigned a new baseline more than once in their employment at a NASA site. Employees who continue to experience threshold shifts, after having a new baseline established, will be assigned to duties which do not involve exposure to hazardous noise to prevent further hearing impairment.

f. If any employee is determined to have an average hearing loss of 25 dB or more at 2000, 3000, and 4000 Hz, as compared to their original baseline audiogram, the hearing loss will be logged as an OSHA-reportable event. The hearing test technician must ensure that any employee who has been assigned a new baseline has his/her current hearing levels compared to the new baseline audiogram as well as the original baseline.

3.12 Referral Criteria

a. Audiological criteria for referral to an Audiologist for more comprehensive testing is as follows:

- 1) Average Hearing Threshold Level at 500, 1000, 2000, and 3000 Hz greater than 25 dB.
- 2) Single frequency loss greater than 55 dB at 3000 Hz or greater than 30 dB at 500, 1000, or 2000 Hz.
- 3) Difference in average Hearing Threshold Level between the better and poorer ear of more than 15 dB at 500, 1000, and 2000 Hz, or of more than 30 dB at 3000, 4000, and 6000 Hz.
- 4) Reduction in Hearing Threshold Level in either ear from baseline or previous monitoring audiogram of more than 15 dB at 500, 1000, or 2000 Hz, or of more than 30 dB at 3000, 4000, or 6000 Hz.
- 5) Variable or inconsistent responses or unusual hearing loss curves.

b. Medical Criteria for Referral to a Qualified Physician or Otolaryngologist for more comprehensive testing/examination:

- 1) Presence and persistence of ear pain, drainage, dizziness, severe persistent tinnitus, sudden or fluctuating hearing impairment, rapidly progressing hearing loss, a feeling of fullness or discomfort in one or both ears, unusual or inconsistent audiometric findings or a history of these conditions within the last 12 months.
- 2) When an employee has received an otologic evaluation previously on the basis of failing any of the above criteria, and ear pain, drainage, dizziness, or severe persistent tinnitus develops; or if a significant change in hearing level is observed.
- 3) When an employee suspects that a medical pathology of the ear is caused or aggravated by the wearing of hearing protectors.

c. The employee will be informed of the need for an otological examination if a medical pathology of the ear is suspected that is unrelated to the use of hearing protection.

d. When an employee is referred to a specialist by the examining physician, communication of relevant medical data will be provided by NASA upon request.

e. If during the baseline audiogram the employee has a hearing profile equal or worse than that listed below, then the employee shall receive a fitness and risk evaluation.

Frequency (Hz)	500	1000	2000	3000	4000	6000
Hearing Level (dB)	25	25	25	35	45	45

f. If during a medical evaluation, the employee, for medical reasons, may be identified as not being able to perform their job capably or safely in a hazardous noise environment, the employee shall receive a fitness and risk evaluation.

3.13 Followup Review

When a permanent threshold shift is detected, a followup review will be conducted.

- a. The employee will be provided (and fitted as necessary) with hearing protectors and trained in their use, when hearing protectors are not currently being used.
- b. The employee will be provided/refitted with hearing protectors offering greater sound attenuation, as warranted, when hearing protectors are already in use.
- c. The employee will be trained/retrained on the hazardous effect of noise and the need to use hearing protection.
- d. The employee's work area will be investigated to determine if work practices, or changes in equipment or procedures, have increased the noise hazard. Abatement actions will be instituted as necessary.
- e. The employee will be reassigned to work in a low noise area, as necessary, to prevent further hearing impairment. These employees will continue to participate in the Hearing Conservation Program.

3.14 Signs

Caution signs that clearly indicate the hazard of high noise levels and state the requirement to wear hearing protection will be posted at the entrance(s) to, or the periphery of, noise hazard areas. Decals or placards with similar statements will be affixed to power tools and machines which produce hazardous noise levels.

3.15 Employee Training

- a. Each employee who participates in the Hearing Conservation Program will receive annual training. The training must include, as a minimum, an overview of the NASA Hearing Conservation Program; a review of the effects of noise on hearing (including permanent hearing loss); noise control principles; the purpose

of hearing protectors; the advantages, disadvantages, and attenuation characteristics of various types of protectors; instructions on selection, fitting, use, and care of hearing protectors; an explanation of the audiometric testing procedure and the purpose of audiometric testing.

b. An education program shall be provided for supervisory and managerial personnel of hazardous noise areas and their responsibility in the Hearing Conservation Program will be emphasized.

c. Personnel shall be encouraged to use hearing protectors whenever they are exposed to hazardous noise during off-duty activities (e.g., lawn mowing, use of firearms).

3.16 Records

a. Audiograms and noise-exposure records shall be maintained as a permanent part of an employee's medical records. When noise-exposure-measurement records are representative of the exposures of other individuals participating in the Hearing Conversation Program, the range of noise levels and the average noise does will be made a permanent part of the medical records of those individuals also. These records will be maintained for the duration of employment plus 30 years in accordance with 29 CFR 1910.1020.

b. In addition to audiometric test data, each audiogram will, as a minimum, identify the audiometric reference level to which the audiometer was calibrated at the time of testing; the date of the audiogram; the examiner's name; the date of the last calibration of the audiometer; the name, employee number, and job classification of the individual tested; the employee's most recent noise-exposure assessment; and the date of last training received by the individual.

c. Accurate records of the measurements of the background sound pressure levels of audiometric test rooms and data and information concerning calibration and repair of sound-measuring equipment and audiometers will be maintained for the duration of employment plus 30 years in accordance with 29 CFR 1910.1020

requirements.

d. Accurate records of noise surveys/monitoring, results of special noise studies, and records of special actions or engineering controls installed to control noise exposures will be maintained for the affected employees for 30 years, in accordance with 29 CFR 1910.1020 requirements.

e. All records will be retained as specified in the applicable records retention schedules for NPG 1441.1.
