



Ames Procedural Requirements

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COMPLIANCE IS MANDATORY

Ames Health and Safety Procedural Requirements

Chapter 29 - Hearing Conservation Program

Table of Contents

29.1 Overview

29.2 References

29.3 Definitions

29.4 Responsibilities

- 29.4.1 Safety Health and Medical Services Division
- 29.4.2 Ames Health Unit
- 29.4.3 Supervisors and Managers
- 29.4.4 Contracting Officer
- 29.4.5 Employees
- 29.4.6 Procurement Specifications

29.5 Noise Exposure Limits

29.6 Hearing Protection Methods

- 29.6.1 Engineering Controls
- 29.6.2 Administrative Controls
- 29.6.3 Personal Hearing Protection
- 29.6.4 Noise Monitoring

29.7 Medical Monitoring Program

29.8 Audiometric Testing and Evaluation

29.9 Noise Hazard Warning Signs

- 29.9.1 Medical Personnel
- 29.9.2 Pure Tone, Air Conduction Testing
- 29.9.3 Evaluation of Annual Audiogram
- 29.9.4 Criteria for Referral to an Audiologist
- 29.9.5 Criteria for Referral to a Physician or Specialist
- 29.9.6 Conditions that Require Follow-Up Review of Employees with Hearing Illness and Responses

29.10 Employee Training
29.11 Records Maintenance and OSHA Recording
29.12 Signs and Decals

29.13 Appendices

- 29.13.1 [Appendix A: Noise - Measurement Methods](#)
 - 29.13.2 [Appendix B: Audio Testing and Evaluation](#)
-

29.1 Overview

The goal of the NASA-Ames hearing conservation program is to prevent temporary and permanent hearing loss resulting from hazardous noise levels.

[\[Back to Table of Contents\]](#)

29.2 References

1. Occupational Noise Exposure, 29 Code of Federal Regulations (CFR) 1910.95
2. NPD 1820.2, NASA Environmental Health Program, Hearing Conservation
3. NPR 1800.1, NASA Occupational Health Program Procedures

[\[Back to Table of Contents\]](#)

29.3 Definitions

Action Level: An exposure to an 8-hour time-weighted average of 82 decibels measured with a dosimeter or sound-level meter on the A-scale at slow response; or equivalently, a dose of 50 percent. The action level is the criterion for instituting noise surveys and employee participation in the Medical Monitoring Program.

Administrative Control: Any procedure that limits noise exposure by control of work schedules.

Age Adjustment: When determining whether a standard threshold shift has occurred, the current audiogram may be age adjusted using OSHA Tables F-1 or F-2 in Appendix F of 29 CFR 1910.95. Age adjustment may not be used in determining if the employee's total hearing level is 25 dB or more above audiometric zero.

Audiogram: A chart, graphs, or tables that result from an audiometric test. An audiogram shows an individual's hearing threshold level as a function of frequency (Hz).

Audiologist: A professional who specializes in the study and rehabilitation of hearing and who is certified by the American Speech, Hearing, and Language Association, or licensed by a State Board of Examiners.

Audiometer: An electronic instrument that measures hearing threshold levels and conforms to the requirements and specifications of the current ANSI Standard S3.6.

Baseline Audiogram: An audiogram against which future audiograms are compared. It may also be described as a reference, preplacement, preassigned, or entranced audiogram.

Biological Functional Calibration Check: An audiometric test that uses one or more individuals with known, stable hearing levels to check proper functioning and stability of an audiometer and to identify any unwanted or distracting sounds.

Buy Quiet and Quiet by Design" Program: A program that endeavors to achieve long-term reduction of employee noise exposures through purchase and design of equipment with the intention of achieving realistic and achievable noise criteria, which are considered before procurement or design using criteria based on operational conditions as well as the noise outputs of equipment. The "Buy Quiet and Quiet by Design" approach requires designers and engineers to consider noise emission when purchasing and designing equipment that is expected to generate noise emission levels of concern for hearing conservation (80 dBA and higher).

Cut-off Level: All sound levels at or above the cut-off level are averaged into the calculations that relate to noise exposure. All sound levels below the cut-off level are not included.

Deafness: The otological condition in which the hearing threshold for speech, or the average hearing threshold level for pure tones at 500, 1000, 2000, and 3000 Hz, is at least 93 decibels (reference ANSI S3.6-1969). This is generally accepted as representing a 100 percent hearing handicap for normal speech.

A unit of measurement of sound-pressure 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 is 20 micropascals.

Decibel (dB): Decibels, A-Weighted (dBA): A sound level reading in decibels made on A-weighting network of a sound level meter or noise dosimeter at slow response. This A-weighting simulates how the human ear perceiving noise at low levels. Noise regulations require measurement taken with an A-weighted filter.

Decibels, Max (Lmax): The maximum sound level observed during a measurement interval. OSHA specifies that a maximum sound level must not exceed 115dB without hearing protection. If an employee's noise exposure exceeds 115dB during a work activity for any duration, they must be enrolled in a Hearing Protection Program. This also requires protective measures such as engineering/administrative controls and the use of earplugs with earmuffs.

Decibels, Peak (dBP or Lpk): A unit used to express peak sound-pressure level of impact or impulse noise. The highest instantaneous sound pressure level observed during a measurement interval. Under OSHA regulations, unprotected workers may not be exposed to peak sound levels greater than 140dB. Ames impulse/impact Noise Permissible Exposure Limit allows up to 100 impacts at 140dB per day. If an employee exceeds 100 impacts at 140dB, hazard control measurements must be implemented for impact/impulse noise. Also see "Impulse or Impact Noise"

Dose Criterion Sound Level: The average sound level at a given dose criterion length for which the dose represents 100 percent of the allowable exposure. The Federal Occupational Safety and Health Administration (Fed-OSHA) requires a dose criterion sound level of 90 dBA for an exposure duration of eight hours. ARC has a dose criterion level of 85 dBA for an eight-hour exposure, per section 29.6. **Dose Criterion Length:** The permissible exposure duration (in hours) for a given dose criterion sound level for which the dose represents 100 percent of the allowable exposure.

Dosimeter (noise): An instrument that can read noise level as "real time" or continuously collect

noise level information and calculates averages at the end of the shift. Dosimeters can calculate the TWA, maximum decibels, and impulse/impact noise data over the full shift. Eight-hour Dose: The actual dose (as a percentage) accumulated over the duration of the work shift and based on a regulation's defined criterion level and criterion length.

Engineering Control: Any mechanical device, physical barrier, enclosure, or other design procedure 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, plugs, or 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 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 risk to the health or safety of themselves or others.

Frequency: the number of cycles of a periodic motion in a unit of time. The SI unit of frequency is called hertz (Hz). One hertz corresponds to one cycle (or full oscillation) per second.

Hazardous Noise: Noise generated by an operation, process, or procedure that is of sufficient duration and intensity to be capable of producing a permanent loss of hearing in an unprotected person. Generally, this is interpreted as persistent noise levels equal to or greater than 85 dBA or combinations of higher intensities for durations shorter than eight-hours.

Hertz (Hz): A unit of measurement of frequency that is numerically equal to cycles per second. Audible sound waves for humans have a frequency rating between approximately 20 Hz to 20,000 Hz.

Impulse or Impact Noise: Variations in noise levels that involve peaks of intensity that occur at intervals of greater than one second. If the noise peaks occur at intervals of one second or less, the noise is considered continuous. Also see "Decibels, Peak".

Lav: The average sound level (in dBA) computed for a chosen averaging time duration.

Lav (80): The average sound level (in dBA) computed for a chosen averaging time duration, using an 80-dBA cut-off level. The 80-dBA cut-off level is used by Fed-OSHA for hearing conservation compliance requirements.

Medical Pathology: A disorder or disease. For the purposes of this chapter, a condition or disease that affects the , and should be treated by a physician specialist.

Monitoring Audiogram: An audiometric test obtained at least annually to detect shifts in an 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 period, which takes into account both the intensity of the sound and the duration of the exposure.

Noise Dosimeter: An electronic instrument that integrates cumulative noise exposure over time and directly indicates a noise dose.

Noise Hazard Area: Any work area with a noise level of 85 dBA or greater. Otolaryngologist: A physician who specializes in the diagnosis and treatment of disorders of the ear, nose, and throat.

Permanent Threshold Shift (PTS): Any hearing loss remaining after an adequate recovery period (usually within 72 hours). For OSHA recording, PTS must be confirmed within 30 days of initial audiogram indicating an STS (Standard Threshold Shift).

Recordable (OSHA) hearing loss: if an employee's hearing test (audiogram) reveals that the employee has experienced a work-related Standard Threshold Shift (STS) in one or both ears, and the employee's total hearing level is 25 decibels (dB) or more above audiometric zero (average at 2000, 3000, 4000 Hz) in the same ear as the STS, it must be recorded as a hearing loss case on the OSHA 300 log. If the employee is retested within 30 days of the last audiogram, which shows a hearing loss, and the STS is not persistent, then no recording on the Log is required.

Representative Exposure: The measurements of an employee's noise dose, or an eight-hour time-weighted average sound level that a qualified person deems 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 (SLM): An electronic instrument for the measurement of sound levels that conforms to the requirements for a Type II sound-level meter as specified in ANSI S1.4-1971.

Sound-pressure level: The term used to identify a sound measurement (expressed in decibels) obtained with a sound-level meter that has a flat frequency response. This is 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 standard, 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 as compared to the employee's baseline audiogram. A threshold shift can be temporary or permanent. Temporary threshold shift is a change in hearing threshold, primarily due to exposure to high-intensity noise, that is usually recovered in 14 to 72 hours. Any loss that remains after an adequate recovery period is termed permanent threshold shift.

Supervisor: A broad term that can refer to managers, program and project directors, Contracting Officer's Technical Representative (COTR), site managers, supervisors, department heads, group heads, branch chiefs, owners, and/or persons that operate in a management capacity or supervisory roll with respect to affected employees.

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: The sound level that, if constant over an eight-hour workday exposure, would result in the same noise dose as is measured.

TWA (80): The time-weighted average level that corresponds to a noise dose computed with an 80-dBA cut-off level.

[\[Back to Table of Contents\]](#)

29.4 Responsibilities

29.4.1 Safety Health and Medical Services Division

1. Provide guidance to supervisors and employees who jobs expose them to hazardous noise levels.
2. Provide periodic noise monitoring.
3. Review the Hearing Conservation Program and training for adequacy at least every three years.
4. Notify employees of noise survey/dosimetry results.
5. Notify supervisor, or Contractor Officer/and COTR for contractors, when affected employees must participate in Medical Monitoring and Hearing Conservation Programs.
6. Recommend the selection of hearing protection and specify performance (attenuation) requirements.
7. Notify management of all facility sites that have been designated as noise hazard areas.
8. Provide hearing conservation training as needed for Ames employees.
9. Identify noise emission and control requirements procurement specifications for potentially noisy equipment.
10. When notified that an employee has experienced a significant threshold shift (STS) as a result of occupational noise exposure, re-evaluate the adequacy of engineering controls, administrative controls, work practices, and hearing protector usage.

[\[Back to Table of Contents\]](#)

29.4.2 Ames Health Unit

1. Maintain a current registry of all ARC civil servants included in the Hearing Conservation Program (HCP).
2. Schedule those persons for annual audiometric examination, and provided written notification of the need to avoid exposure to noise levels of 80dBA or greater for 14 hours preceding testing.
3. Obtain an occupational history and medical evaluation of each participant in the Hearing Conservation Program.
4. Conduct audiometric testing, and evaluate test results.
5. Provide written notification to both the employee and supervisor within 21 days of receiving audiometric test results indicating significant hearing loss (or other medical pathology of the ear) and explain the need and plans for further testing and/or referral.
6. When employee appears to have a STS, provide re-test audiogram within 30 days to establish that an identified hearing loss is permanent.
7. Provide written notification to both employee and supervisor within 21 days of receiving confirmation that a PTS has occurred.
8. Consult with ARC Industrial Hygiene personnel regarding any employee with PTS to facilitate evaluation of the work place and employee practices to ensure that excess exposures do not continue to occur.
9. Provide for medical examination by a physician or audiologist of employees with PTS to verify proper fit of hearing problem..
10. Recommend reassignment of at-risk employees to low-noise areas, if necessary to prevent

further hearing loss or aggravation of other medical conditions.

11. Refer employees to an Audiologist or Physician Specialist, as appropriate.
12. Medical personnel performing audiometry must be qualified, trained and knowledgeable in operating equipment used, and function under the supervision of a Physician or Audiologist..
13. Hearing threshold levels will be determined by audiometers calibrated to zero reference levels of the ANSI S 3.6 standard for audiometers.
14. Determine annually if the audiometer is within the tolerance permitted by ANSI Standard for audiometers.
15. Maintain audiometric test records and other information pertinent to the Medical Monitoring requirements.
16. Conduct exit audiograms on Hearing Conservation Program enrollees before they terminate employment or when they are transferred to a reduced noise work area.
17. Audiometric test equipment shall be properly calibrated and ambient noise levels in audiometric test rooms and booths shall meet the requirements specified in the latest revision of ANSI S3.6t. Specification for Audiometers and ANSI S3.1 Maximum Permissible Ambient Noise Levels for Audiometric Test Rooms.
18. Maintain all calibration records training records and certifications for medical equipment and personnel.

[\[Back to Table of Contents\]](#)

29.4.3 Supervisors and Managers

1. Report suspected hazardous noise to the Safety, Health, and Medical Services Division.
2. Ensure that employees who work in designated hazardous areas receive pre-placement, annual and termination audiograms.
3. Refer personnel who complain of hearing loss or ear problems to the Ames Health Unit.
4. Ensure that employees in noise areas use hearing protection devices adequate for hazardous noise exposure level.
5. Notify the Safety, Health and Medical Services Division of plans to acquire any equipment that produces >80dBA at >1meter.
6. Ensure that hearing protection devices are available in hazardous noise areas for use by employees and visitors.
7. Ensure that employees enrolled in the Hearing Conservation Program complete required training annually.
8. Attend Hearing Conservation Program Training.
9. Ensure that caution signs are posted at entrances in designated hazardous noise areas, appropriate labels, decals, or placards are placed on noisy tools and equipment, unless it is used only in posted hazardous noise areas.
10. Engineering controls that are recommended by ARC industrial hygiene personnel to reduce noise exposures to acceptable limits or to the maximum extent feasible.
11. Give necessary consideration to acoustics in the design and modification of buildings and facilities, and to noise emission levels when purchasing equipment.
12. Properly maintain noise-producing equipment and controls to preclude noise increases.

[\[Back to Table of Contents\]](#)

29.4.4 Contracting Officer

1. Include requirements for a written hearing conservation that meets requirements in APR 1700.1, Chapter 29 in all contracts unless the contractor can demonstrate there is no noise hazard for their employees.
2. Ensure that "Buy Quiet and Quiet by Design" provisions are included in all contracts and in the purchase of new equipment, as appropriate.

[\[Back to Table of Contents\]](#)

29.4.5 Employees

Civil service employees who work in hazardous noise areas must:

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[\[Back to Table of Contents\]](#)

29.4.6 Procurement Specifications

Include noise emission and control requirements in procurement specifications and designs, except for specialized research items on flight hardware, which may be expected to produce large amounts of noise.

[\[Back to Table of Contents\]](#)

29.5 Noise Exposure Limits

Protection against the effects of noise exposure shall be provided when sound levels exceed those in the tables below. Noise exposure limits are generally applied as an eight-hour exposure limit of 85 dBA. For exposures of shorter or longer durations, the exposure limit may be adjusted as indicated in the table. Hearing Conservation Program elements are required to be implemented at the Action Level; that is whenever employee noise exposures equal or exceed an eight-hour time-weighted average of 82 dBA. Hearing Conservation Program elements include exposure monitoring, audiometric testing, medical monitoring, and training. Participation in the medical monitoring program for hearing conservation is specified in Section 29.7 of this Chapter

Continuous Noise Permissible Exposure Limits

Duration (Hours)	Sound Level (dBA)*
16	80
8	85
4	90
2	95
1	100
0.5	105
0.25	110
0.125 or less	115

* Measured on the A-scale of a standard sound-level meter set at slow response.

Impulse Noise Permissible Exposure Limits

Sound Level (dBP)*	Permitted Impulses/Day
140	100
130	1,000
120	10,000

* Peak sound-pressure level.

[\[Back to Table of Contents\]](#)

29.6 Hearing Protection Methods

29.6.1 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 over an eight-hour TWA or impulsive noise above 140 dBP. Any reduction in employee noise exposure, even if not reduced below 85 dBA, is beneficial. If engineering controls fail to reduce sound levels to within the limits of section 29.6, hearing-protective equipment and/or administrative methods of noise-exposure protection must be used.

[\[Back to Table of Contents\]](#)

29.6.2 Administrative Controls

If hearing-protective equipment or engineering controls are not sufficient to attenuate noise to less than 85 dBA, the duration of time spent in the noise hazard area shall be limited, so as not

to exceed the exposure limits specified in this Chapter (Section 29.6), whenever feasible

[\[Back to Table of Contents\]](#)

29.6.3 Personal Hearing Protection

1. Temporary Use. Personal protective equipment is to be used only temporarily or if engineering controls are not feasible or practical.
2. Availability. All personnel who enter designated areas, or who perform tasks where exposure to noise is greater than, or equal to, 80 dBA, regardless of the duration of exposure, shall be provided with personal hearing protection. All personnel who enter designated hazardous noise areas or who perform tasks where exposure to noise is greater than, or equal to, 85 dBA or 140 dB peak, regardless of the duration of exposure or number of impulses, shall be provided with and shall be required to wear personal hearing protection.
3. Effectiveness by Noise Attenuation. Hearing protectors must attenuate employee noise exposure to a level of 85 dBA (8-hour time-weighted average) or below. Double hearing protection is required where noise levels equal or exceed 110 dBA (8-hour time-weighted average). For employees with STS, protectors must attenuate exposure to an eight-hour TWA of 80 dBA. Estimation of the adequacy of hearing-protector attenuation should be performed according to OSHA-specified methods (see Appendix A of 29 CFR 1910.95).
4. Re-evaluation. The adequacy of hearing protectors attenuation shall be reevaluated whenever employee noise exposures are measured.
5. Earplugs. Various styles of foam and formed earplugs are available to employees in hazardous noise areas. Both disposable and non-disposable earplugs are available. Employees must be instructed in the proper method of insertion, storage, and cleaning of the earplugs.
6. Earplugs (custom). If reusable preformed earplugs are used, they will be permanently issued to the employee and fitted to the employee under medical supervision. During fitting, the employee will be instructed in the proper method of insertion, storage, and cleaning of the earplugs.
7. Earmuffs. Earmuffs will be provided for employees when analysis of noise environments shows that the attenuation provided by earplugs is not sufficient to reduce noise exposures below 85 dBA or when muffs are more efficient for the operation. The user shall inspect earmuffs on a regular basis.
8. Special Equipment. Special hearing-protective equipment, such as sound-suppression communication headsets, may be used in hazardous noise areas. These devices should be inspected regularly. Sound-suppression headsets may not be used if they have been damaged, altered, or modified in any way that affects the attenuation characteristics. If replacement parts (such as ear cup seals) are available, the headsets may be repaired and reused. If sound-suppression headsets are not permanently issued to employees, such equipment must be cleaned and sanitized before re-issuance.

[\[Back to Table of Contents\]](#)

29.6.4 Noise Monitoring

1. Measurement of Exposure. Measurement of potentially hazardous sound levels shall be conducted when any information, observation, or calculation shows that an employee could be exposed to a noise level in excess of 80 dBA over an eight-hour TWA. Any new equipment, operation, job, or procedure with the potential for creating hazardous noise

should be evaluated with regard to noise emissions before startup. All continuous, intermittent, and impulsive sound levels from 80 to 140 dBA will be integrated into the noise measurements. Noise exposure computation is shown in Appendix A of 29 CFR 1910.95.

2. Repeated Measurement of Exposure. Both noise dosimetry and area monitoring will be repeated, or whenever any changes to facilities, equipment, work practices, procedures, or noise-control measures alter potential noise exposures. If there are no changes to facilities, work practices, or noise control measurement, area noise levels should be randomly sampled every year and noise dosimetry performed and representative employee at least every three years.
3. Open Observation. Employees and/or their representatives will be provided an opportunity to observe noise dosimetry and area monitoring activities.
4. Posted Noise Areas. Areas determined to have noise levels at or above 85 dBA must be posted as hazardous noise areas.
5. Employee Notification. Affected employees (employees whose exposures have been determined to exceed the Action Level) shall be notified of the results of noise monitoring in writing.

[\[Back to Table of Contents\]](#)

29.7 Medical Monitoring Program

1. Program Participation. Whenever an employee (contractor employees included) is routinely occupationally exposed to noise at levels equal to or exceeding the criteria below, the employee will be identified, placed in a hearing conservation program (HCP), and be required to wear personal hearing protection:
 - The action level of 82 db A-Weight (dBA), as an 8-hour Time Weighted Average (TWA).
 - Impact or impulsive noise in excess of the limits listed in Section 29.5 of this Chapter.
 - Exposures exceed the noise duration described in Section 29.5 Tables.
 - Civil servants are enrolled in the Ames HCP; contractors are enrolled in their company's HCP.
2. Regarding Noise Attenuation. Employee noise exposure shall be determined without regard to any sound attenuation provided by the use of hearing protectors.
3. Initial Audiogram, Physical Exam, and Medical History. Each employee placed in a job that requires participation in a Medical Monitoring Program shall undergo a physical examination before being assigned to duties that involve exposure to high-intensity noise. The examination shall include a baseline audiogram, a medical examination to determine any pre-existing medical pathology of the ear, and a work history to document past noise exposures. The history shall include a detailed review of past work histories and possible occupational and non-occupational noise exposures. Each annual examination, conducted on ARC employees by the ARC Health Unit, shall include an interim history of ARC noise exposures, a history of the use of personal protective equipment, and a history of other possible occupational work or non-occupational exposures to noise. The employee must have no apparent or suspected ear, nose, or throat problems that might compromise the validity of the audiogram. When an employee is determined to be suffering from an acute disease, which may compromise the validity of the test, the baseline audiogram will be delayed until the condition has abated.

4. Initial Audiogram after Placement. When it is discovered that employees have been working where they encounter hazardous noise or incur exposures that exceed the Action Level and have not had a physical examination, one shall be conducted within 30 days. The audiogram must follow at least 14 hours of no known exposure to sound levels in excess of 82 dBA or to impulsive/impact noise greater than 120 dBA. This interval should be sufficient to allow recovery from noise-induced temporary threshold shift.
5. Acute Disease of the Ear. Personnel who suffer from acute diseases of the ear shall 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.
6. Annual Audiogram. All employees who are enrolled in the Medical Monitoring Program must receive an annual audiogram.
7. Final Audiogram and Termination of Employment. All ARC employees who have participated in the Hearing Conservation Program shall receive a final audiometric examination before termination of employment with ARC, job changes within the installation that would alter noise exposure, 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

[\[Back to Table of Contents\]](#)

29.8 Audiometric Testing and Evaluation

29.8.1 Evaluation of Annual Audiogram

1. Physician Review. A physician or other qualified person shall compare annual audiograms with the employee's baseline audiogram, to determine if it is valid and if a standard threshold shift has occurred. It is desirable to review the employee's audiogram record for patterns of change over time.
 - a. Effects of Aging. When determining if a standard threshold shift has occurred, allowances for the effects of aging to the hearing threshold level may be made using the procedure described in 29 CFR 1910.95, Appendix F.
 - b. ASA-ANSI Conversion. Audiograms referenced to ASA-1951 must be converted to ANSI S3.6-1969 before hearing threshold levels can be properly determined (see the table below for conversion).

Threshold Audiogram Conversion ASA-1951 to ANSI-1969

Frequency	dB Difference
250	15
500	15
1000	10
2000	10
3000	10
4000	5

6000	10
8000	10

To convert an ASA-1951 reference threshold audiogram to ANSI-1969, add the difference in values.

To convert ANSI-1969 to ASA-1951, subtract the values.

2. Discovering an STS. When evaluation of an audiogram indicates that a standard threshold shift has occurred, a retest shall be scheduled within 30 days to determine if the shift is temporary or permanent. A medical evaluation may be warranted at this time to determine if an acute medical condition is a contributing factor. The retest shall be proceeded by a period of at least 14 hours without 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.
3. Persistent STS. If the retest indicates a PTS, the employee may be referred for further medical evaluation, per Section 29.9.4 of this Chapter. Medical evaluation is required to validate the existence of a noise-induced PTS and to determine if further medical referral is indicated. A Physician shall determine if the PTS has been aggravated by occupational noise exposure.
4. New Baseline (Reference) Audiogram. A new reference audiogram shall replace the original reference audiogram when the medical evaluation confirms that the STS is permanent.
 - Follow-up. 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 follow-up actions described Section 29.9.5 of this Chapter will be followed. The employee will be encouraged to use hearing protection for non-work activities involving noise exposures.
 - Substitutions. An annual audiogram shall be substituted for the baseline when, in the judgment of the audiologist, otolaryngologist, or physician who is evaluating the audiogram, the hearing threshold shown on the annual audiogram indicates significant improvement over the baseline audiogram, using criteria specified in NPR 1800.1A, Chapter 4, Section 4.9.3.
 - Fitness and Risk Evaluation. When a new baseline is established, a fitness and risk evaluation will also be performed.
5. Repeated STS and Employee Reassignment. Employees who experience a second STS, after having a new baseline established, will complete a fitness and risk assessment before returning to work in a hazardous noise environment.
6. Employee Notification of PTS. The health care provider must notify the employee, and their supervisor, of audiometric testing results in writing within 21 days of determination of a permanent threshold shift.
7. Safety Division Notification of permanent PTS. The Ames Health Unit notifies the Safety Health and Medical Services Division of any permanent standard threshold shift. The Safety Division records the STS on the OSHA 300 Log.

[\[Back to Table of Contents\]](#)

29.8.2 Criteria for Referral to an Audiologist

The Ames Health Unit may refer an employee to an audiologist for more comprehensive testing if any of these criteria are met:

1. Average hearing threshold level greater than 25 dB at 500, 1000, 2000 and 3000Hz.
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 more than 30 dB at 3000, 4000, and 6000 Hz.
4. Reduction in hearing threshold level in either ear from the baseline or previous monitoring audiogram of more than 15 dB at 500, 1000, or 2000 Hz; or more than 30 dB at 3000, 4000, or 6000 Hz.
5. Variable or inconsistent responses or unusual hearing-loss curves.

[\[Back to Table of Contents\]](#)

29.8.3 Medical Criteria for Referral

If the Ames Health Unit does not have the internal resources to diagnose or treat a detected or potential hearing illness or prefers, for other reasons, to refer an employee to another hearing professional for evaluation or treatment, it may do so. The medical criteria for referral to a qualified physician or otolaryngologist for more comprehensive testing/examinations include:

1. The presence and persistence of (or a history of) these conditions within the last 12 months:
 - Ear pain
 - Drainage
 - Dizziness
 - Severe persistent tinnitus
 - Sudden or fluctuating hearing impairment
 - A feeling of fullness or discomfort in one or both ears
 - Rapidly progressing hearing loss
 - Unusual or inconsistent audiometric findings
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.
4. 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 used of hearing protection.

[\[Back to Table of Contents\]](#)

29.9 Noise Hazard Warning Signs

Caution signs that clearly indicate a hazard of high noise levels and the requirements to wear hearing protection shall be posted at the entrance(s) to, and the periphery of, noise hazard areas. Decals or placards with similar statements shall be affixed to power tools and machines that produce hazardous noise levels. Signs and decals shall have wording in black letters on a yellow background. Wording other than that in Section 29.12 may be used if approved by Safety, Health and Medical Services Division. (Refer to section 29.12 for noise hazard warning sign specifications.)

[\[Back to Table of Contents\]](#)

29.10 Employee Training

1. Each employee who participates in the Hearing Conservation Program shall receive annual training. The training must include, but not be limited to:
 - An overview of the ARC Hearing Conservation Program
 - A review of the effects of noise on hearing (including permanent hearing loss)
 - Noise control principles
 - The purpose, advantages, disadvantages, and attenuation characteristics of various types of ear protectors
 - Instruction on selection, fitting, use, and care of hearing protectors
 - An explanation of the audiometric testing and its purpose
2. Supervisory personnel of employees who work in hazardous noise areas shall be provided an education program, and their responsibilities in the Hearing Conservation Program will be emphasized.
3. Personnel will be encouraged to use hearing protectors when exposed to hazardous noise in non-occupational settings (e.g., from lawn mowers, firearms, tools, etc.).
4. Refresher training can be completed either on the web or in the classroom. The Code QH training web page has options for enrolling in either training.

[\[Back to Table of Contents\]](#)

29.11 Records Maintenance and OSHA Recording

1. Permanent Records. Audiograms and noise-exposure records shall be maintained as a permanent part of employee medical records. If noise-exposure measurement records are representative of the exposures of other employees participating in the Hearing Conservation Program, the range of noise levels, and the average noise dose will be made a permanent part of the medical records of the other employees as well.
2. Contents of Medical Records. In addition to audiometric test data, each medical record will, as a minimum, identify:
 - The audiometric reference level to which the audiometer was calibrated at the time of testing
 - The date of the last calibration of the audiometer
 - The name, the identification number, and job classification of the employee tested
 - The employee's most recent noise exposure assessment

3. Audiometric Test Room. Accurate records of the background sound-pressure levels in the audiometric test rooms, and data and information concerning calibration and repair of sound-measuring equipment and audiometers (as well as all audiometric test data) will be maintained for the duration of the affected employee's employment, plus 30 years.
4. Industrial Hygiene and Control Methods. 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 duration of the affected employee's employment, plus 30 years.
5. OSHA Recordable Hearing Loss. If an employee's hearing test (audiogram) reveals that the employee has experienced a work-related 10-dB Standard Threshold Shift (STS) in hearing in one or both ears, and the employee's total hearing level is 25dB or more above audiometric zero (average at 2000, 3000, and 4000 Hz) in the same ear(s) as the STS, then a hearing loss illness must be recorded on the OSHA 300 Log when a retest indicates it.
 - a. A retest should be performed on the employee's hearing within 30 days of the first test. If the retest does not confirm the recordable STS, then recording the hearing loss case on the OSHA 300 Log is not required. However, if the retest confirms the recordable STS, record the hearing loss case within seven (7) calendar days of the retest.
 - b. If subsequent audiometric testing performed under the testing requirements of 29 CFR 1910.95 (OSHA noise standard) indicates that an STS is not persistent, then erase or line-out the recorded entry.

[\[Back to Table of Contents\]](#)

29.12 Signs and Decals

29.12.1 Noise Hazard Warning Sign Specification

Warning signs are recommended to read

CAUTION

NOISE AREA

MAY CAUSE HEARING LOSS

USE PROPER

HEARING PROTECTION

IN THIS AREA

The lettering is almost always all caps, black, and on a yellow background.

[\[Back to Table of Contents\]](#)

29.11.2 Noise Hazard Warning Decal Specifications

Decals must have a yellow background and black lettering (ALL CAPS). The decal must be self-adhesive on the side opposite the written warning. The written warning is recommended to read:

CAUTION

NOISY EQUIPMENT MAY CAUSE HEARING LOSS

USE PROPER

HEARING PROTECTION

The word caution is in yellow lettering with a black background superimposed on the yellow background of the label. As shown, the word caution is two point sizes larger than the lettering in the rest of the warning.

[\[Back to Table of Contents\]](#)

29.13 Appendices

29.13.1 Appendix A: Noise-Measurement Methods

1. Sound-level meters must meet Type II requirements of ANSI S1.4 and must be capable of measuring sound in the range of 80 to 140 dBA.
2. Noise dosimeters must meet Class 2A-90/80-5 requirements of ANSI S1.25 and be capable of integrating sound levels of 80 dB and above.
3. Accurate Reflection of Exposures. Employee noise doses may be ascertained by using either a noise dosimeter or sound-level meter. If a sound-level meter is used to estimate an employee's dose, the noise survey will include a time and motion study to document the variations in the employee's noise exposure during the working shift. If an employee moves about or noise intensity fluctuates over time, noise exposure is more accurately estimated by personal dosimetry. Regardless of the method chosen, a sufficient number of readings/measurements will be made to accurately reflect noise exposure.
4. Accurate Representation of Exposures. Employee exposure measurements will be made in such a manner as to accurately represent the actual exposure to noise.
 - When using a noise dosimeter to determine an employee's noise exposure, the microphone will be attached to the employee in the area of the employee's shoulder.
 - When using a sound-level meter, the microphone should be positioned not less than two inches, nor more than two feet, from the employee's ear.
 - Measurements will be made with the employee at his/her regular work station(s).
5. Calibration. Before and after each use, dosimeters and sound-level meters will be calibrated using acoustical calibrators to verify the accuracy of the measuring equipment.
 - If any sound-level meter or noise dosimeter is dropped, or if the microphone receives a sharp impact, a calibration check shall be performed to ensure that it is still working properly, before taking additional measurements.
 - Sound-level meters and noise dosimeters that are not working properly, or are out of calibration, shall not be used to determine an employee's noise exposure.

[\[Back to Table of Contents\]](#)

29.12.2 Appendix B: Audiometric Testing and Evaluation

Calibrating of Audiometric Equipment

Medical personnel who perform audiometric tests must be qualified, trained, and knowledgeable in operating equipment used and be under the supervision of an audiologist or physician. If manual audiometers are used, the Council for Accreditation in Occupational Hearing Conservation must certify qualifications of personnel who operate the audiometer. Hearing threshold levels will be determined by audiometers calibrated to zero reference levels of the ANSI S3.6 standard for audiometers.

<http://server-mpo.arc.nasa.gov/Services/CDMSDocs/Centers/ARC/Dir/APR/ - Anchor-13320>

29.12.2.1 Pure Tone, Air Conduction Testing

Pure tone, air conduction testing shall be conducted at test frequencies of 500, 1000, 2000, 3000, 4000, 6000, and 8000 Hz for each ear. Audiometric test equipment shall meet the specification, maintenance, and use requirements of ANSI S3.6. Where a pulsed-tone, self-recording audiometer is used, it will also meet the requirements of 29 CFR 1910.95, Appendix C.

1. A listening check shall be performed daily before use to ensure that the audiometer is free from distorted or unwanted sounds.
2. A functional check shall be performed each day either by using an "acoustical ear" calibrator (dBA sound-level meter with 9A Type Earphone Coupler) or by testing an individual with a known and stable hearing baseline (a "biological check"). A record will be kept of the daily checks. Deviations of 5 dB or more require an acoustical calibration test.
3. An acoustical calibration test (using a sound-level meter, octave-band filter set, and a National Bureau of Standards 9A Coupler) shall be performed at least annually (semi-annually for self-recording audiometers), or when a functional check indicates a deviation of 5 dB or more. The acoustical calibration test shall conform to the requirements of 29 CFR 1910.95, Appendix E. Deviations of 10 dB or more will require an exhaustive calibration.
4. An exhaustive calibration shall be performed at least every two years, or whenever an acoustical calibration test indicates an error of 10 dB or more. The test will meet the criteria of the current ANSI S3.6 guidelines appropriate for the instrument. Following calibration, the front panel of the audiometer shall be labeled with a tag indicating that it has been calibrated to ANSI S3.6 guidelines and the date of the calibration.
5. Booths or rooms used for audiometric testing shall not have background sound-pressure levels that exceed those in the table below. Sound-pressure levels for rooms used for audiometric testing must be checked at least annually.
6. Maximum Background Sound-Pressure Levels for Audiometric Test Booths

Frequency (Hz)	Sound-Pressure Level (dBA)
500	27
1,000	30

2,000	35
4,000	42
8,000	45

6. Employees must receive advance written notification of the need to avoid high levels of occupational and non-occupational noise during the 14 hours immediately preceding an audiometric test. Properly fitted hearing protectors and/or other hearing-protective devices may be used to prevent excessive noise exposures during this period.

[\[Back to Table of Contents\]](#)

END OF DOCUMENT

THIS DOCUMENT IS UNCONTROLLED WHEN PRINTED
