Department of the Air Force
HQ AEDC (AFMC)
Arnold AFB, TN 37389

Safety, Health, and Environmental Standard

Title: **HAZARDOUS NOISE AND HEARING CONSERVATION**

Standard No.: F5

Effective Date: 01/17/2012

The provisions and requirements of this standard are mandatory for use by all personnel engaged in work tasks necessary to fulfill the AEDC mission. Please contact your safety, industrial health and/or environmental representative for clarification or questions regarding this standard.

Approved:

Contractor/ATA Director
Safety and Health Group

Air Force Functional Chief

Record of Review/Revision

Date/POC	Description
12/15/2011 L. McEntee	Scheduled review; minor administrative changes.
03/02/10 L. McEntee	Review and update; administrative changes and reformatting: expanded introductory section; clarified definitions; clarified requirements/responsibilities to include addition of AF personnel throughout; relocated training to a separate section; added section to address required audits/inspections; moved tables of ear plugs and muffs available to AEDC employees to the Safety and Health web to expedite updates; no changes to current processes.
02/12/08 L. McEntee	Annual review; minor administrative changes: updated tables of available ear plugs and muffs in the Annex.
03/02/07 B. Bragg	Annual review; no change required.
02/25/05- 12/20/05 E. Chilton	Rewrite and revise format of entire standard to the COI format and incorporate ACGIH criteria; revised annex to include tables
01/04/01	Published

Safety, Health, and Environmental Standard

HAZARDOUS NOISE AND HEARING CONSERVATION

1.0 INTRODUCTION/SCOPE/APPLICATION

1.1 Introduction – AEDC tests areas and equipment generate hazardous noise levels. A Hearing Conservation Program (HCP) is an essential element to protect employees from the effects of hazardous noise. This standard describes the requirements and responsibilities necessary to implement an effective HCP. The HCP includes monitoring for personal noise exposure, employee notification of monitoring results, audiometric testing, provision of hearing protection, employee training and recordkeeping.

1.2 Scope – This standard implements the requirements of 29 CFR 1910.95, *Occupational Noise Exposure, Air Force Occupational Safety and DoDI 6055.12 Hearing Conservation Program* and guidelines put forth by the American Conference of Governmental Industrial Hygienists® (ACGIH). When there are any conflicts noted between this standard and industry standards or regulatory requirements, the operating contractor shall notify the government.

1.3 Applicability – This standard applies to AEDC personnel at the Tennessee location and all remote locations assigned to AEDC and to operations conducted by AEDC personnel outside the confines of Arnold AFB. Any deviations from the standard must be documented and approved by the Air Force (AF).

2.0 BASIC HAZARDS/HUMAN FACTORS

Exposure to high levels of noise may cause temporary or permanent hearing loss. The extent of the damage depends upon the intensity of the noise and the duration of the exposure. An abundance of epidemiological and laboratory evidence indicates that extended exposure to noise above 85 dBA (decibels A scale) causes hearing loss in a substantial portion of the exposed population and that more susceptible individuals will incur hearing loss at lower levels. Noise-induced hearing loss is an irreversible condition that progresses with continued exposure.

3.0 DEFINITIONS/TERMS

Administrative Control—Any procedure that limits daily noise exposure for individuals by control of the work schedule such as rotation of work tasks to reduce the duration of exposure to hazardous noise.

Baseline Audiogram—A hearing test performed for newly hired operating contractor and designated AF employees to establish hearing thresholds at discreet frequencies ranging from 125 Hertz to 8000 Hertz. The baseline audiogram must be obtained within 6 months of hire for the operating contractor employees and within 30 days of the designated AF employee's indication of an exposure to hazardous noise. The employee's hearing must be protected from hazardous noise prior to testing. Testing to establish a baseline audiogram shall be preceded by at least 14 hours without exposure to workplace noise. Hearing protectors may be used as a substitute for this requirement for operating contractor employees. For designated AF employees, hearing protection shall not be used as a substitute for the 14-hour non-exposure requirement.

Decibel (dB)—A unit of measurement of sound pressure level or sound power level. The decibel is a dimensionless unit based on the logarithm of a measured quantity to a reference quantity.

Decibel, A Scale (dBA)—A sound pressure level in decibels as measured on the A scale of a sound level meter. The A scale is an electronic network that combines sound frequency in a manner similar to the human ear. The contribution of lower frequencies to the overall sound pressure level is reduced on the A scale.

Engineering Control—Any procedure or equipment that, through design or inherent quality, limits daily noise exposure by reducing the noise emitted from a noise source such as using quiet fans; silencing exhaust valves; installing mufflers, acoustic enclosures, or vibration dampers; etc.

Exchange Rate—The increase in sound level at which the acceptable exposure duration is divided in half. The ACGIH and the AF specify a 3 dB exchange rate. A 3 dB exchange rate is used for the evaluation and selection of employees for the AEDC Hearing Conservation Program. Unless noted otherwise, 8-hour time-weighted-averages (TWAs) used in this standard refer to calculations using a 3 dB exchange rate.

Hazardous Noise—Sound pressure levels of 85 dBA and above.

Noise Hazard Area—Any area where the noise level exceeds 85 dBA.

Noise Reduction Rating (NRR)—A single number estimate of the noise reduction that may be achieved with a particular hearing protective device. This number is provided by the manufacturer of the device and is determined under laboratory conditions. The NRR is subtracted from the C-weighted sound level to estimate effective noise exposures. For A-weighted exposure data, an additional safety factor of 7 dB must be subtracted from the NRR. (For additional information, see the Annex to this standard.)

Recordable Hearing Loss—A hearing loss in which a standard threshold shift has occurred in either ear or both and the average threshold in the 2, 3, 4 KHz frequencies equals or exceeds 25 dB in that ear. The 25-dB threshold level is not age corrected.

Standard Threshold Shift (STS)—The standard threshold shift is an indicator of hearing loss that may be revealed by an employee's annual audiogram. As defined in 29 CFR 1910.95 (g)(10), a standard threshold shift is "a change in hearing threshold relative to the baseline audiogram of an average of 10 dB or more at 2000, 3000 and 4000 Hz in either ear." An STS may be determined after hearing thresholds are corrected for losses due to aging. Age corrections are not applied for an STS experienced by AF employees.

Threshold Limit Value® (TLV)—The TLV is established by the ACGIH and refers to sound pressure levels and durations of exposure that represent conditions under which it is believed nearly all workers may be repeatedly exposed without adverse effect on their ability to hear and understand normal speech. The TLV is used to identify employees who will be included in the Hearing Conservation Program. The TLV for noise exposure is defined as 85 dBA, for 8 hours/day, using a 3-dB exchange rate.

4.0 REQUIREMENTS/RESPONSIBILITIES

4.1 Requirements

4.1.1 Exposure to Hazardous Noise

4.1.1.1 Protection against the effects of noise exposure shall be provided when the amplitudes (sound levels) and durations exceed those shown in the following table.

ACGIH Threshold Limit Values® for Noise Exposure

Duration of Exposure	Amplitude*
16 hr	82
8 hr	85
4 hr	88
2 hr	91
1 hr	94
0.5 hr	97
0.25 hr	100
7.5 min	103
3.75 min	106
1.88 min	109
56 sec	112
28 sec	115
14 sec	118
7 sec	121
3.5 sec	124
<1 sec	130

*Sound pressure level, A-weighted scale, slow response

When the daily noise exposure is composed of two or more periods of noise exposure at different levels, their combined effect shall be considered. The TLV has been exceeded if the sum of the following fractions exceeds one (1):

$$C_1 /T_1 + C_2 /T_2 + ... + C_n /T_n$$

Where C_n indicates the total time of exposure at a stated level. T_n indicates the total time of exposure permitted at that level.

Unprotected exposure to impulsive or impact noise shall not exceed 140 dB peak sound pressure level. Weapons fire is an example of impulsive type noise that requires hearing protection.

4.1.1.2 Control of employee exposure to noise is to be accomplished using engineering or administrative controls when feasible. The use of hearing-protective devices is considered an adequate method of noise control only when engineering and administrative controls are not practical.

4.1.1.3 Hearing protection shall be worn by any employee exposed to noise levels equal to or exceeding 85 dBA regardless of duration of exposure; and shall be worn when the 8-hour TWA exposure exceeds 85 dBA using a 3 dB exchange rate.

4.1.1.4 Hearing protection shall be selected to reduce the effective noise exposure below 85 dBA. If an employee has experienced a standard threshold shift, the protector must be capable of reducing exposure to at least 85 dBA. OSHA acceptable methods shall be used to estimate the attenuation provided by hearing protection devices. One method for selecting protectors is outlined in the Annex NRR Method for Estimating the Adequacy of Hearing Protector Attenuation.

4.1.2 Types of Hearing Protection

4.1.2.1 **Formable ear plugs** with a stated NRR of at least 30 dB are acceptable for most exposure situations at AEDC. When properly inserted and used correctly these ear plugs provide the best available hearing protection for most people. This type of disposable hearing protector shall be available at convenient locations in noise hazard areas. (A list of approved ear plugs at AEDC may be accessed from the Safety and Health web page.)

4.1.2.2 **Ear muffs** are good for intermittent exposure to noise due to their ease of use. The muffs available at AEDC have an NRR of at least 28 dB. A list of approved ear muffs may be accessed from the Safety and Health web page.)

4.1.2.3 The **combination of ear muffs and ear plugs** can provide protection above that of individual protectors. As a general rule, the combination of plugs and muffs provides an improvement in the NRR of approximately 3-5 dB over the greater of the NRRs of the individual protectors. Combination plugs and muffs shall be used any time the 8 hour TWA exposure exceeds 110 dBA.

4.1.2.4 **Communication headsets** are required in some noise-hazard areas and provide an NRR of 23 to 27 dB, depending upon the headset. Double hearing protection is required where noise exposures exceed 102 dBA TWA or administrative controls are required to reduce exposures to 85 dBA TWA with these hearing protectors.

4.1.3 Exposure to Extreme Noise:

Employees shall not be exposed to noise levels of 130 dBA for more than 15 minutes in a 24-hour period with the use of double hearing protectors.

4.1.3.1 **Signage:** Signs shall be posted in consultation with operating contractor SHG Industrial Hygiene, in noise hazard areas and on equipment as required by *DoDI 6055.12 Hearing Conversation Program* (examples shown below). Specific additional information may be inserted as needed.

For noise levels 85-109 dBA	For noise levels 110-129 dBA	For noise levels at 130 dBA
CAUTION **Noise Area** **Wear Muffs or Plugs**	**CAUTION** **High Noise Area** **Wear Muffs and Plugs** **Limit Exposure Time**	**CAUTION** **Extreme Noise** **Wear Muffs and Plugs** **Limit Exposure Time to** **15 Minutes Total Daily**

4.1.3.2 **Noise Considerations:** The noise produced by new equipment, systems or facilities shall be considered during planning and design and as a factor in the purchase decision. The target sound pressure level for new equipment shall be 85 dBA or less at a distance of 3 feet from the equipment. For facilities the objective is a sound pressure level less than 85 dBA in locations routinely occupied by personnel. Engineering specifications for design and selection of equipment shall incorporate either a limit on the acceptable noise level or a requirement for the vendor to provide noise performance data.

4.1.4 Hearing Conservation Program:

4.1.4.1 Operating contractor employees whose 8-hour TWA noise exposure exceeds 85 dBA, and/or classified as industrial employees and/or identified by SHG, are included in the AEDC Hearing Conservation Program. AF employees who are exposed to industrial noise from test area site visits are also included in the AEDC Hearing Conservation Program. Determination of AF employee inclusion is based on responses gathered from a workplace exposure questionnaire and known data from representative test area monitoring. For the purpose of inclusion in the Hearing Conservation Program, a 3 dB exchange rate is used. Frequency of exposure is a consideration when evaluating employees for inclusion in the Hearing Conservation Program; however, those with intermittent exposures will routinely be included.

4.1.4.2 Operating contractor employees shall receive a baseline hearing test at the time of initial employment. Designated AF employees receive a baseline hearing test as they are included in the program. Employees whose exposures exceed 85 dBA TWA receive an annual audiogram thereafter. Employees who are transferred or otherwise removed from hazardous noise exposure receive an audiogram at the time they are removed from exposure. All employees who have been in the Hearing Conservation Program shall receive termination audiograms.

4.1.4.3 **Audiograms:**

4.1.4.3.1 Operating contractor personnel reporting to the Dispensary for an audiogram should be protected from high noise exposure for a minimum of 14 hours immediately preceding the audiogram. The use of hearing protectors may be used as a substitute for this requirement.

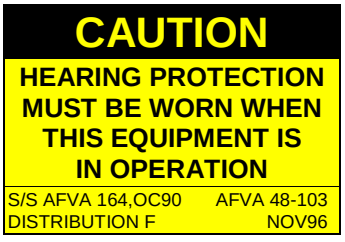
4.1.4.3.2 AF personnel shall receive a noise-free audiogram (NFA) in accordance with DoDI 605512. The NFA shall be performed after a worker has not been exposed to noise greater than 72 dBA or impulse noise greater than 120 dBP for a minimum specified amount of time. (e.g., 14-hour NFA, requires a minimum of 14 hours noise-free prior to the test). Hearing protection devices cannot be used to reach this noise-free status. All noise-free follow-up audiograms must be completed within 30 days of the annual audiogram.

4.1.4.4 **Hearing Threshold Shift:** Employees who demonstrate a standard threshold shift as defined by OSHA 1910.95, Occupational Noise Exposure, shall be notified in writing of this change in hearing ability within 21 days of the determination. The hearing change shall be evaluated by operating contractor SHG or AEDC/TSD-SG depending on the affected employee. The appropriate organization, will perform follow-up and individual training session. A standard threshold shift accompanied by an average threshold of 25 dB or greater shall be recorded on the OSHA 300 Log. Standard threshold shifts (10 dB) shall be recorded by operating contractor SHG or AF Safety as a first aid case for tracking purposes. Age correction will be applied in determining a standard threshold shift as allowed by OSHA. The 25-dB threshold shall not be subject to age correction. Age corrections are not applied for an STS experienced by AF employees.

4.2 Responsibilities

4.2.1 Operating Contractor or AF Management shall:

4.2.1.1 Label hazardous noise producing equipment using AFVA 48-103 (example below), and post signs in hazardous noise areas as required by this standard.



4.2.1.2 Post a copy of OSHA *29 CFR 1910.95 Occupational Hazardous Exposure*, in the workplace as required by the standard. The copy shall be accessible to all employees on the Hearing Conservation Program.

4.2.1.3 Enforce the use of personal hearing protection as required in noise-hazard areas.

4.2.1.4 Ensure that proper hearing-protective devices are easily accessible to any employee who must enter or work in a noise-hazard area.

4.2.1.5 Consider hazardous noise emissions when specifying or purchasing new equipment and ensure that the lowest feasible noise levels are obtained.

4.2.1.6 Request noise surveys within 30 days of any change in process, equipment or controls that may affect employee noise exposure.

4.2.1.7 Effect engineering and administrative controls to reduce employee noise exposure below 85 dBA.

4.2.1.8 Ensure that all affected employees receive initial training and those on the Hearing Conservation Program receive annual training in Hearing Conservation.

4.2.2 Operating Contractor Occupational Health shall:

4.2.2.1 Schedule and provide initial, periodic and termination audiometric examinations for those employees included in the Hearing Conservation Program. The exam must be conducted by a licensed or certified audiologist, otolatyngologist, physician or by a technician certified by the Council for Accreditation in Occupational Hearing Conservation (CAOHC).

4.2.2.2 Notify operating contractor SHG or AEDC/TSD-SG and the affected employee in writing within 21 days when it is determined that an employee has experienced a standard threshold shift.

4.2.2.3 Maintain audiometric examination records for duration of employees' employment plus 30 years afterward.

4.2.2.4 Provide assistance with selection and fitting of special hearing protectors if required.

4.2.2.5 Notify operating contractor SHG or AF Safety, depending on the affected employee when a standard threshold shift is experienced and the hearing threshold is 25 dB or more so that the hearing loss may be recorded on the OSHA 300 Log as an occupational illness within 7 days of the determination.

4.2.2.6 Ensure the audiometric booth is tested and equipment is calibrated as required by OSHA 1910.95 *Occupational Noise Exposure* and *DoDI 6055.12 Hearing Conversation Program*. Document all verifications, calibrations, and maintenance of the audiometric booth to ensure data integrity.

4.2.3 Operating Contractor SHG shall:

4.2.3.1 Conduct and document noise measurements and noise exposure monitoring.

4.2.3.2 Determine by the use of noise monitoring data, the operating contractor employees to be included in the Hearing Conservation Program. Inform employees in writing of the results of monitoring.

4.2.3.3 Furnish the names of operating contractor employees who require annual hearing examinations to Occupational Health.

4.2.3.4 Approve the types of hearing protection for use including attenuation requirements.

4.2.3.5 Advise operating contractors of noise control requirements and, when requested, assist in establishing control measures by engineering or administrative methods. If engineering controls are to be considered, an octave band analysis may be required.

4.2.3.6 Maintain records of noise monitoring and of noise control by engineering and administrative methods for at least two years. Older noise monitoring records shall be archived.

4.2.3.7 Provide initial training for all operating contractor employees. Assist management with updating the annual Hearing Conservation CBT required for employees on the Hearing Conservation Program.

4.2.3.8 Evaluate the exposure and use of hearing protection for operating contractor employees who have had a standard threshold shift. Document the evaluation in the operating contractor SHG files and the employee's medical record.

4.2.3.9 Provide assistance with noise specifications for new equipment and evaluation of manufacturer's noise data.

4.2.4 AEDC/TSD-SG shall:
NOTE: The following shall be accomplished in coordination with operating contractor SHG.

4.2.4.1 Determine the AF employees to be included in the Hearing Conservation Program.

4.2.4.2 Furnish the names of employees who require annual hearing examinations to Occupational Health.

4.2.4.3 Evaluate the exposure and use of hearing protection for employees who have experienced a standard threshold shift. Document the evaluation in the employee's medical record.

4.2.3.4 Notify operating contractor Occupational Health to schedule termination audiograms for those individuals no longer requiring an audiogram.

4.2.5 Operating Contractor Design/Purchasing shall:

4.2.5.1 Ensure that specifications for new equipment require the lowest possible noise emissions and that feasible engineering controls are provided when facilities or equipment are renovated, retrofitted, or redesigned.

4.2.5.2 Request noise data from manufacturers or suppliers for equipment emitting over 85 dBA including decibel levels and octave band analysis.

4.2.5.3 Request an evaluation from operating contractor SHG when new equipment or processes produce noise levels of 85 dBA or above as determined by the supplier data.

4.2.6 Employees shall:

4.2.6.1 Use provided hearing protection when working in noise-hazard areas.

4.2.6.2 Maintain hearing protectors including cleaning and storing them properly.

4.2.6.3 Inform management when hearing protectors are worn out or ineffective due to deterioration or are inadequate for the noise levels experienced, and obtain effective hearing protection.

4.2.6.4 Participate in required training

5.0 TRAINING

Operating contractor or AF management shall ensure a training program is available for all AEDC employees identified for the Hearing Conservation Program. Training shall be repeated annually for each employee in the program. Information provided in the training program shall be updated to be consistent with changes in protective equipment and work processes. Training shall include the following information:

- The effects of noise on hearing
- The purpose of hearing protectors, the advantages, disadvantages and attenuation of various types, and instructions on selection, fitting, use and care
- The purposes of audiometric testing, and an explanation of the test procedures

Training records are maintained in PeopleSoft for operating contractor employees. Training records are recorded on AF Form 55 Employee Safety and Health Record or equivalent for AF/Department of Defense employees.

6.0 INSPECTIONS/AUDITS

Annual industrial hygiene surveys are conducted by the operating contractor SHG and will document any noise monitoring.

7.0 REFERENCES

29 CFR 1910.95, Occupational Noise Exposure

DoD Instruction 6055.12, DoD Hearing Conservation Program (HCP), March 5, 2004

ACGIH 2009 TLVs® and BEIs® Based on the Documentation of the Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices

8.0 ANNEX

NRR Method for Estimating the Adequacy of Hearing Protector Attenuation

ANNEX

NRR METHOD FOR ESTIMATING THE ADEQUACY OF HEARING PROTECTOR ATTENUATION

Several methods are available to estimate the adequacy of hearing protector attenuation. This annex provides a simple but conservative method using the Noise Reduction Rating (NRR). Selection is based on the type and availability of noise monitoring data. The NRR was developed by the Environmental Protection Agency (EPA) and according to regulation must be shown on the hearing protector package. The NRR is related to an individual worker's noise environment to assess the adequacy of the attenuation of a given hearing protector. Use the following procedure to calculate attenuation:

When C-weighted noise exposure data are available:

- Obtain employee's C-weighted dose for the entire work-shift, and convert to time-weighted-average (TWA).
- Subtract NRR from the C-weighted TWA to obtain the estimated A-weighted TWA under-the-ear protector.

When A-weighted noise exposure data only are available, the following method may be used:

- Convert the A-weighted dose to TWA.
- Subtract 7 dB from the NRR to account for the lack of differences between A and C weightings.

Examples

Assume an employee's 8-hour TWA noise exposure is 110 dBA. What is the effective noise dose using formable ear plugs with an NRR of 30 dB?

- In the absence of C-weighted data, subtract 7 dB from the NRR. The result is 23.
- Subtract 23 from 110dBA to obtain the effective noise dose.
- The resulting effective exposure is 87 dBA. The plugs do not provide adequate protection for hearing conservation (do not meet OSHA compliance) and shall be worn with muffs.

What is this employee's effective noise exposure if the employee uses ear muffs with an NRR of 21 dB?

- Subtract 7 from the NRR of 21. The result is 14.
- Subtract 14 from the TWA of 110 dBA.
- The effective noise exposure is 96 dBA. Muffs are not adequate hearing protection for this level of exposure.

What is this employee's effective noise exposure if the employee uses ear muffs with an NRR of 21 dB and ear plugs with an NRR of 30 dB?

- Add 5 dB to the greater NRR of the two protectors. The result is 35 dB.
- Subtract 7 from the NRR of 35. The result is 28.
- Subtract 28 from the TWA of 110 dBA.
- The effective noise exposure is 82 dBA. The combination of plugs and muffs is adequate protection even if the employee has experienced a significant threshold shift.