

DEPARTMENT OF THE ARMY
US Army Corps of Engineers
Washington, DC 20314

DAEN-ECS

Regulation
No. 385-1-89

19 January 1983

Safety
HEARING CONSERVATION PROGRAM

Issue of supplements to this regulation by Commanders, Field Operating Activities (FOA), is permitted but is not required. If supplements are issued, DIVCDR and CDR, separate FOA, will furnish one copy of each to USACE (DAEN-ECS) and (DAEN-ASP-R) WASH, D.C. 20314; DISTCDR will furnish required copies to appropriate DIVCDR.

1. Purpose. To prevent occupational noise-related hearing loss among USACE personnel and to reduce the costs of compensation.

2. Applicability. This regulation applies to all OCE/USACE elements and all field operating activities (FOA), both military and civilian. For contractor requirements, see EM 385-1-1.

3. References.

a. Department of Defense Instruction No. 6055.3, 8 Jun 78, Subject: Hearing Conservation.

b. Code of Federal Regulations 29 CFR 1910.95, Occupational Safety and Health Standards, Occupational Noise Exposure.

c. Military Standard 882A, "System Safety Program Requirements", 28 Jun 77.

d. Military Standard 1472C, "Human Engineering Design Criteria For Military System, Equipment, and Facilities", 2 May 81.

e. Military Standard 1474B, "Noise Limits For Army Material", 18 Jun 79.

f. AR 385-10, The Army Safety Program, 1 Feb 79, and USACE Supplement 1.

g. AR 385-30, Safety Color Code Markings and Signs, 18 Nov 71.

h. AR 385-40, Accident Reporting and Records, 1 Sep 80, and USACE Supplement 1.

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- i. TB MED 501, Hearing Conservation, Mar 80.
- j. EP 385-1-58, Medical Surveillance Handbook, 19 Mar 82.

4. Definitions. For the purpose of this regulation, the following term shall mean:

- a. Audiogram. An audiogram is a record of the threshold of audibility of each ear at 500, 1000, 2000, 3000, 4000, and 6000 Hertz(Hz).
- b. Decibel (dB). A unit used to express sound pressure level. The decibel level of sound is related to the logarithm of the ratio of sound pressure to a reference pressure, the reference pressure being the threshold of hearing, 20 uNm².
- c. A-weighted Sound Level (dB(A)). Sound level A is the sound pressure in decibels measured with a sound level meter using the A-weighting network and slow meter response. The A-weighted network closely approximates the human ear's response to sound.
- d. dBp. The unit used to express peak sound pressure level of impulse noise.
- e. Impulse Noise. Impulse noise, such as that produced by pile drivers, consists of short bursts of acoustical energy. Impulse noise is characterized by a rapid rise time of not more than 35 milliseconds to a peak pressure. The total duration of a single pulse is not more than 500 milliseconds. When the interval between peaks is one second or less, the noise source should be considered steady noise.
- f. Significant Threshold Shift. A significant Threshold shift is a 20 dB loss, at any test frequency, with respect to the baseline audiogram.
- g. Steady Noise. Steady noise is a periodic or random variation in atmospheric pressure at audible frequencies. It may be continuous (as with generators), intermittent (as with air compressor), or fluctuating with the sound level varying over a wide range (as with bulldozers).
- h. Time-Weighted Average (TWA) Sound Level or Noise Equivalent (Leq). That sound level, which if constant over an 8-hour exposure, would result in the same noise dose as is measured.

5. Background.

- a. Facts Relating to Noise and its Effects on Hearing.

(1) Noise is primarily transmitted to the ear through air. Under certain conditions, it may permanently injure the hearing mechanism. The hazard from steady noise depends on the frequency and intensity of the noise, whether the exposure is intermittent or continuous, and the duration of exposure. The hazard from impulse noise depends on various factors including peak pressure, rise time and duration of individual impulses and the number of impulses in an exposure period.

The effects on the hearing mechanism from both steady and impulse noise may vary among individuals, the hearing of some being more susceptible to damage than that of others.

(2) Noise-induced hearing loss may be temporary or permanent. The former is commonly referred to as temporary threshold shift and results from auditory fatigue induced by exposure to intensive sound. It is called temporary since there is a return of the individual's pre-exposed hearing level after a period of hours away from intensive sound. Permanent threshold shift is usually the result of damage to the end organ of hearing, the organ of Corti, located in the inner ear. It can be induced by repeated exposure to intensive sound and is not amenable to any known treatment.

(3) The early stages of noise-induced hearing loss are characterized by reduced hearing sensitivity at frequencies above 2000 Hz. Other symptoms may include complaints of tinnitus (a ringing sensation), a temporary muffling of sound after exposure to noise, and/or a sensation of fullness in the ears. In these early stages, individuals with a high frequency hearing loss are usually unaware of any loss and do not have problems in most quiet listening situations. However, when they are in high background noise areas, it sometimes becomes difficult to communicate through hearing alone. They will rely heavily on visual cues from the talker's face, especially the lips. Individuals with a noise-induced, high frequency hearing loss usually complain that they can hear people talking, but they cannot understand what is being said. This hearing without understanding is related to the two principal parts of speech-vowels and consonants. Vowel sounds have a low frequency emphasis, carry most of the acoustic energy of speech, and are more easily heard. In contrast, consonant sounds have a high frequency emphasis, carry little acoustic energy, but are the keys to distinguishing one word from another, especially if the words sound alike. For example, they may be unable to distinguish between "stop" and "shop". If a key sound in a word is missed, this, in turn, could change the meaning of the key word in a sentence. As a result, the entire sentence might be misunderstood. In addition, background noise usually has a low frequency emphasis that can interfere with the understanding of low frequency vowel sounds. Therefore, the hearing masked by the background noise, plus the high frequency hearing loss resulting from damage to the ear, results in a greater hearing problem than one would have with just one of these conditions alone.

(4) Individuals are usually not aware of any impairment of hearing until their hearing threshold levels above 1000Hz become significantly impaired. Continued unprotected exposure to hazardous noise will result in a progression of hearing loss into these lower frequencies with marked loss of communication ability.

b. Essential Elements of Hearing Conservation Program. The following elements are essential in establishing a hearing conservation program.

(1) Noise-hazard evaluations and posting of noise-hazardous areas and equipment.

(2) Engineering control measures to reduce noise levels.

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(3) Use of hearing protective devices.

(4) Audiometric testing for early detection of hearing loss.

(5) Health education on the prevention of hearing loss.

c. Off Work Noise. Exposures to hazardous noise levels are not always confined to the work place. Hobbies such as sportshooting, woodworking or working around racing engines can also cause hearing loss. Training in the prevention of hearing loss should also stress protecting against off duty noise sources.

6. Responsibilities.

a. USACE/OCE.

(1) The Chief, Safety and Occupational Health Division, is responsible for staff planning, development, supervision and review of the Hearing Conservation Program for USACE. He shall:

(a) Provide for staff coordination, policy guidance, and administrative and technical review of the program.

(b) Maintain liaison with Army Staff and other government agencies to insure that the USACE hearing conservation program meets legal statute administrative procedures and adequately protects workers.

(c) Develop educational materials to stress the importance of hearing loss prevention to employees.

(2) The Chiefs, Engineering Divisions, are responsible for providing staff policy and guidance to assure that hearing conservation criteria are incorporated into specifications and designs of new facilities and equipment, and for modifications of existing facilities and equipment. The objective shall be to assure, if feasible, a sound pressure level of less than 85 dB(A) at all locations in which personnel may be present during normal operation.

(3) The Chiefs, Construction and Operation Divisions, are responsible for providing staff policy and guidance to assure that hearing conservation criteria are incorporated into modifications of building and equipment, changes in processes, and purchases of new or replacement equipment. The objective shall be to assure, if feasible, a sound pressure level of less than 85 dB(A) at all locations in which personnel may be present during normal operation.

(4) The Director, Water Resource Support Center, is responsible for providing staff policy and guidance to assure that hearing conservation criteria (for 24 hour exposures) are incorporated into specifications and designs of new vessels and dredging equipment and substantial modifications of existing vessels and equipment (see MIL STD 1472C).

b. FOA.

(1) Commanders/Directors. Each FOA Commander/Director is responsible for implementing the Hearing Conservation Program and providing adequate resources and procedures for program administration.

(2) Occupational Safety and Health Office. Each FOA Occupational Safety and Health Office will oversee the FOA Hearing Conversation program and will assure that:

(a) Initial noise evaluations are made of areas and operations which are potentially noise-hazardous.

(b) Annual noise evaluations are made of areas and operations designated as noise-hazardous.

(c) Areas designated as noise-hazardous are posted.

(d) Noise measurement and evaluation data are maintained.

(e) Hearing conservation requirements are included in the FOA Safety Program Document.

(3) Supervisor. All supervisors will:

(a) Review job duties and notify the personnel and safety offices of positions which require employees to work in hazardous noise (see EP 385-1-58 for procedures).

(b) Include a provision for the use of safety equipment, such as hearing protectors, in employee job performance standards.

(c) Request noise evaluations of areas suspected of being noise-hazardous.

(d) Enforce the use of hearing protectors.

(e) Orient new employees on the hazards of noise and the requirement for wearing hearing protectors.

(4) Employee. All employees who work at operations or in areas designated as noise-hazardous will:

(a) Wear hearing protectors when required.

(b) Take appropriate audiograms.

(c) Notify their supervisor of suspected noise hazards or any hearing problems.

7. Inclusion Criterion.

a. Hazardous Steady Noise Exposures. For the purpose of simplifying the administration of the hearing conservation program, all exposures to Steady Noise Levels 85 dB(A) or Greater are Considered Hazardous. Any employee who routinely works with noise hazardous equipment or in a noise-hazardous area must be provided audiometric tests, be given a formal orientation in the prevention of hearing loss, and be required to wear hearing protectors. In situations where employees are infrequently exposed to hazardous noise or exposed to short durations (such as walk-through noise), audiometric testing and formal training may not be practical or necessary. In these situations, 15 minute exposure in any 24-hour period to hazardous noise of 85-101 dB(A) will not require audiometric testing or formal training, but the use of hearing protectors is still mandatory. Judgments concerning exclusion from audiometric testing and training should only be made by Safety/Health personnel.

b. Hazardous Impulse Noise Exposures. Impulse Noise Levels that Exceed 140 dBP are Considered Hazardous. Employees routinely exposed to hazardous levels of impulse noise must be included in the hearing conservation program.

8. Noise Evaluations.

a. Initial Determination. Noise measurements must be made whenever there is difficulty in communicating at distances greater than two feet, a worker complaint of excessive noise, or a reason exists to suspect a noise hazard. An initial determination shall also be made when a new facility is placed in service.

b. Reevaluations.

(1) Areas identified as noise-hazardous must be resurveyed annually.

(2) Noise measurements are required within 30 days of any change in process, equipment or personnel assignment which will increase the potential for exposing employees not previously exposed, or will potentially increase exposure to the extent that personal protective equipment being used may no longer provide sufficient attenuation.

c. Noise Measurement Equipment.

(1) Only acoustically calibrated sound measuring equipment which meets Type II requirements of ANSI S1.4 will be used.

(2) Field calibrations are required before and after use.

(3) Electroacoustical calibrations are required annually.

(4) Noise analyzers.

(a) Noise analyzers which measure as Leq must have a 4 dB(A) exchange rate.

(b) Noise analyzers which have a dosimeter function (measure as noise dose) must have a threshold ≤ 80 dB(A) with a time weighting of

$$T = 16 \div 2 \left(\frac{L-80}{4} \right); \text{ where } T = \text{time in hours, and}$$

$$L = A - \text{weighted sound pressure}$$

d. Noise Measurements.

(1) All noise measurements for determining steady noise exposures will be made at the approximate ear position of the employee using sound measuring equipment set at slow response, A-weighted sound pressure level. If a sound level meter is used, sufficient readings must be obtained to be able to approximate the employee's normal time weighted daily exposure for the purpose of assigning a risk assessment code to the hazard (see Appendix B).

(2) All noise measurements for determining impulse noise will be made at the employee's approximate ear position. It should be noted that measurement of impulse noise requires special equipment such as an impact noise analyzer.

(3) All noise measurements will be recorded on DD Form 2214 (Noise Survey) and maintained until further notice (See Appendix A). Measurements from previous surveys do not have to be transposed to this form. The Safety Office will maintain the original copy of the survey and will provide a carbon copy to the facility surveyed within 15 days of the survey with a summary of necessary action. The medical records of exposed personnel will be either noted to indicate that noise exposure data is maintained at the FOA Safety Office or noted to indicate actual exposure data.

e. Risk Assessment Codes (RAC). All noise hazardous areas will be assigned a RAC and cost effective index to be used in prioritizing the implementation of engineering controls. The RAC will depend on the sound intensity and duration of exposure. The procedure for assigning risk assessment codes for noise hazards can be found in Appendix B.

f. Evaluator Qualifications. Personnel who perform noise evaluations must have 8 hours training in noise survey techniques. This training may be part of a longer Industrial Hygiene, Safety, or Hearing Conservation Course.

9. Posting of Noise-Hazardous Areas and Equipment.

a. Each noise-hazardous area shall be posted conspicuously with appropriate caution signs (IAW AR 385-30), such as:

"Caution
Hazardous Noise
Hearing Protection Required"

(Additional descriptive information such as "when equipment is in use", "within 15 feet", etc. may be added when appropriate)

b. Each tool or piece of equipment which produces hazardous noise levels shall be marked to alert personnel, except in those instances where the entire area is designated noise-hazardous.

10. Engineering Control Measures.

a. When technologically and economically feasible, engineering controls shall be the primary means used to protect personnel from the hazards of noise. The objective will be to obtain a sound pressure level of less than 85 dB(A) at all industrial locations at which personnel may be present during normal operation. This applies to the design of new facilities, modifications to existing facilities and equipment, and purchase of new or replacement equipment. For noise exposure criteria for other than industrial work sites, see MILSTD 1472B.

b. In determining which existing noise hazards should be corrected by engineering controls (if reduction is technologically feasible), priorities must be established so that available funds will yield the greatest benefits. Priorities must be based on such factors as the number of personnel exposed to a particular noise source, future use of the facility, and risk assessment code and cost effective index assigned to that source.

11. Hearing Protective Devices. Hearing protective devices, such as earplugs, ear-canal caps, or earmuffs, will be provided to all personnel who work in hazardous noise areas. They will be worn whenever steady noise levels are 85 dB(A) or greater, or impulse noise levels exceed 140 dBP. Exposure to noise levels greater than 108 dB(A) or 165 dBP requires dual protection, earplugs and earmuffs in combination. Exposure to noise levels greater than 118 dB(A) also requires a limitation on the exposure time. Contact DAEN-ECS for information on time limitation. A list of approved ear protective devices, available through the Federal Supply System, can be found in Appendix C. These devices have been tested and found to provide adequate protection by The Army Surgeon General when used as stated above. If ear protective devices are procured locally, the adequacy of their attenuation must be determined.

12. Audiograms.

a. Personnel who meet the inclusion criteria (para 7) will be given baseline, annual, and pretermination audiograms. All audiograms will be made a part of the employee's permanent medical record. EP 385-1-58, Medical Surveillance Handbook, outlines basic procedures which may be used for scheduling audiograms.

(1) Baseline Audiograms. New hires or transfer employees will be given baseline audiograms before being allowed to start work in noise-hazardous areas. Existing employees, for which baseline audiograms are not available, will be given a baseline audiogram, as soon as possible, but within 30 days. The baseline audiogram must be preceded by a period of at least 14 hours away from workplace noise, and employees should be instructed to avoid loud noises during off-duty hours prior to taking the audiogram.

(2) Annual audiograms will be required as long as the employee is exposed to hazardous noise. Annual audiograms do not have to be preceded by the 14-hour quiet period.

(3) Prior to termination, a final audiogram will be given to employees if more than 60 days has elapsed since their last audiogram.

b. Personnel who perform or interpret audiometric tests must be either (1) a licensed audiologist, otolaryngologist, or physician or (2) a technician who is certified by the Council of Accreditation in Occupational Hearing Conservation, or state certified, if applicable. The technician must work under the supervision of an audiologist, otolaryngologist, or physician.

c. Audiometric Test Equipment --

(1) Audiometric test equipment must meet the specifications of and be maintained and used in accordance with ANSI S3.6-1969. Pure-tone and self-recording audiometers, if used, must also meet the requirements in Appendix D, para D-1.

(2) Required functional tests and calibrations are listed in Appendix D, para D-2.

(3) Background noise levels in audiometric test rooms must be less than those specified in Appendix D, para D-3.

13. Evaluation of Audiograms.

a. Each employee's annual audiogram shall be compared to the employee's baseline audiogram by a person who meets the qualifications in para 12b above to determine if a significant threshold shift has occurred.

b. If an audiogram indicates a significant threshold shift, the employee will be removed from working in a noise-hazardous area or at a noise-hazardous operation, retested as soon as possible after a 14-hour period away from workplace noise, but within 30 days. The purpose of the retest is to determine if the threshold shift is temporary.

c. If a retest still indicates that a significant threshold shift exists, then:

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(1) The employee will be referred (at government expense) for a clinical audiological evaluation or otological examination, whichever is appropriate, to determine whether the significant threshold shift is permanent and/or work-related, whether the type of hearing protection being used by the employee is adequate, and whether the employee should be allowed to return to work in hazardous noise. A copy of the employee's most recent audiogram, baseline audiogram, noise exposure data, and information on the type of hearing protection used by the employee will be provided to the audiologist or otolaryngologist performing the evaluation. If the threshold shift is determined to be permanent and work-related, the injury must be recorded on OSHA Log 100F (Log of Federal Occupational Injuries and Illness) and ENG Form 3394, Accident Investigation Report, (RCS: DAEN-SO-8(R2)). OSHA Log 100F forms are available from the Occupational Safety and Health Administration's Area Offices.

(2) The employee must be informed in writing of any significant threshold shift within 21 days of its determination.

(3) If the employee is allowed to return to work in hazardous noise, then:

(a) The employee will be retained in the use of hearing protection and the hazards of noise.

(b) The retest audiogram will be substituted for the baseline audiogram in determining further threshold shift.

(c) A reevaluation will be made to determine if engineering controls can be implemented to reduce noise levels (see para 10).

14. Training.

a. Initial Orientation. Each employee included in the hearing conservation program shall receive an orientation on the hearing conservation program. This orientation shall include information on:

(1) The USACE hearing conservation program.

(2) The effects of noise on hearing.

(3) Specific machinery at the jobsite that can produce hazardous noise exposures.

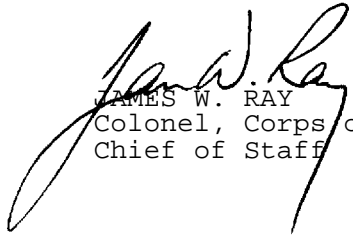
(4) The purposes of hearing protectors, their advantages, disadvantages, and instruction on use and fitting.

(5) The purpose of audiometric testing and an explanation of the test procedure.

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b. Periodic Training. Each employe in the hearing conservation program shall also be given refresher training on the subject at least annually.

FOR THE COMMANDER:



JAMES W. RAY
Colonel, Corps of Engineers
Chief of Staff

4 Appendixes
APP A Noise Evaluations
APP B Risk Assessment Codes
APP C Hearing Protective Devices
APP D Audiometric Test Equipment