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	Safety HEARING CONSERVATION PROGRAM	
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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.

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 Conti, 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.

(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/Healthpersonnel.

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

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

L = A - weighted sound pressure

d. Noise Measurements.

(1) All noise measurements for determining steady noise exposures will be made at the appropximate 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 fornoise 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'sbaseline 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:

(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.

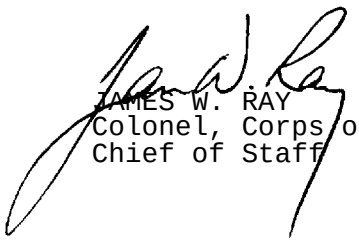
(3) Specific machinery at the jobsite that can produce hazardous noise exposures.

(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.

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

APPENDIX A

NOISE EVALUATIONS

A-1. Noise Surveys. All noise evaluations (surveys) will be recorded on DD Form 2214 (Noise Survey). The form shall be used in accordance with instructions on the reverse side except for the following:

a. Under "Sound Level Data", "Meter Action", record the total work time per day the worker is normally exposed to the noise level recorded on that line under column "dB(A)" (see figures A-1 and A-2).

b. Under "Sound Level Data" "dBC", record the duration of the Noise Dose or Leg measurements when a noise analyzer is used (see figure A-2).

c. Under "Remarks" calculate a Risk Assessment Code for the workers' exposure to the measured sources. If engineering controls are technologically feasible, also calculate a cost effectiveness index for implementation engineering controls to reduce the noise exposure.

A-2. Examples. See figure A-1 for example noise survey using a sound level meter. See figure A-2 example noise survey using a noise analyzer.

NOISE SURVEY
(Sound Level Meter Survey)

DATE (Year, Month, Day): 92/01/20 | TYPE SURVEY: 2 (1-INITIAL SURVEY 2-RE-SURVEY 3-OTHER)

SOUND LEVEL METER		MICROPHONE		CALIBRATOR	
MANUFACTURER		MANUFACTURER		MANUFACTURER	
General Radio		General Radio		General Radio	
MODEL	SERIAL NO	MODEL	SERIAL NO	MODEL	SERIAL NO
1565 B	1057	MK 101	1275	1562	1172
LAST ELECTROACOUSTIC CALIB DATE (year, month, day)	91 09 07	LAST ELECTROACOUSTIC CALIB DATE (year, month, day)	91 09 07	LAST ELECTROACOUSTIC CALIB DATE (year, month, day)	91 09 07

WIND SCREEN ☐ USED ☐ NOT USED | MEASUREMENTS OBTAINED ☐ INDOORS ☐ OUTDOORS

DESCRIPTION OF AREAS/DUTIES WHERE NOISE SURVEY CONDUCTED (Illustrate on additional sheet and attach to form)
Oiler on diesel powered bunkgrader (CLIN II), LM DD
- check equipment every hour
- standby on catwalk

PRIMARY SOURCE OF NOISE: Engine

SECONDARY SOURCE OF NOISE: Drive Train

SOUND LEVEL DATA

LOCATION	METER ACTION	dBC	dBA	RISK ASSESSMENT CODE	PROTECTION REQUIRED (re. dBA Level) NONE less than 85	PLUG OR MUFF 85–108	PLUG AND MUFF 108–118	PLUG + MUFF + TIME LIMIT greater than 118
Inside Superstructure	45min / 24hr		110				✓	
Outside, on catwalk	465min / 24hr		106				✓	

NOTES: Range of levels noted by /, i.e., 102/109. At operator work stations, measure at ear level.
METER ACTION: Enter F for fast meter action and S for slow meter action.

REMARKS (i.e., Area and equipment posted, hearing protection in use, etc.)
RAC: 45/63 + 465/12.6 = 45 > 1, (RAC 2)
Severity/probability multiplier 21 21 x 2 = 44
Number of persons exposed 2 5000 / 44 = 122
Continuous duration both for 15,000 use during standby (CEI = 122)

MORE DETAILED NOISE EVALUATION REQUIRED ☐ YES ☐ NO (If "YES", identify type evaluation needed.)

NAME(S) OF PERSONS IDENTIFIED FOR AUDIOMETRIC MONITORING (Use additional sheet if more space is needed and attach to form)
Jim Jones, John Smith (Alternate)

NAME, PHONE NO. AND ORGANIZATION OF SUPERVISOR OF NOISE-HAZARDOUS AREA OR OPERATION
Frank Doe 634-0000, Plant Engineer

SURVEY PERFORMED BY (Last Name, First Name, MI): Al Pilens

HEARING CONSERVATION MONITOR (Last Name, First Name, MI): Fred Ellis, Safety Officer

DD FORM 1 SEP 79 2214

Figure A-1. Example of Completed DD Form 2214 Using a Sound Level Meter.

NOISE SURVEY
(Sound Level Meter Survey)

DATE (Year Month Day): 82 01 20 | TYPE SURVEY: 2 (1-INITIAL SURVEY 2-RE-SURVEY 3-OTHER)

SOUND LEVEL METER	MICROPHONE	CALIBRATOR
MANUFACTURER: Metrosonics	MANUFACTURER: Metrosonics	MANUFACTURER: Metrosonics
MODEL: DB 306 / SERIAL NO: 1526	MODEL: MK301P / SERIAL NO: 261	MODEL: CI 302 / SERIAL NO: 14571
LAST ELECTROACOUSTIC CALIB DATE (year month day): 81 09 17	LAST ELECTROACOUSTIC CALIB DATE (year month day): 81 09 17	LAST ELECTROACOUSTIC CALIB DATE (year month day): 81 09 17

WIND SCREEN ☐ USED ☐ NOT USED | MEASUREMENTS OBTAINED ☐ INDOORS ☐ OUTDOORS

DESCRIPTION OF AREAS/DUTIES WHERE NOISE SURVEY CONDUCTED (Illustrate on additional sheet and attach to form)
Ciler on diesel powered bantam grader (CLIN #), limited
- Check equipment every hour
- Standby on catwalk

PRIMARY SOURCE OF NOISE: Engine

SECONDARY SOURCE OF NOISE: Drive Train

SOUND LEVEL DATA

LOCATION	METER ACTION	dBC	dBA	RISK ASSESSMENT CODE	PROTECTION REQUIRED (re dBA Level): NONE (less than 85)	PLUG OR MUFF (85–108)	PLUG AND MUFF (108–118)	PLUG + MUFF + TIME LIMIT (greater than 118)
1 work cycle (engine check + standby)	5-16 min 60 min 24 hrs		107				✓	

NOTES: Range of levels noted by /, i.e., 102/109. At operator work stations, measure at ear level. METER ACTION: Enter F for fast meter action and S for slow meter action.

REMARKS (i.e., Area and equipment posted, hearing protection required, etc.)
RAC: 51.6 / 10.6 = 48 > 1, RAC 2
severity probability multiplier 21 — 21 × 2 = 44
Number of persons exposed 2
Cost for sound booth for user during standby $5000 — 5000 / 44 = 122
CEE = 122

MORE DETAILED NOISE EVALUATION REQUIRED ☐ YES ☐ NO (If "YES", identify type evaluation needed.)

NAME(S) OF PERSONS IDENTIFIED FOR AUDIOMETRIC MONITORING (Use additional sheet if more space is needed and attach to form)
Jim Jones, John Smith (Alternate)

NAME, PHONE NO. AND ORGANIZATION OF SUPERVISOR OF NOISE-HAZARDOUS AREA OR OPERATION
Frank Doe 634-0000, Plant Engineer

SURVEY PERFORMED BY (Last Name, First Name, MI)	HEARING CONSERVATION MONITOR (Last Name, First Name, MI)
Al Peters	Fred Ellis, Safety Officer

DD FORM 1 SEP 79 2214

Figure A-2. Example of Completed DD Form 2214 Using a Noise Analyzer

APPENDIX B

PROCEDURE FOR DETERMINING RISK ASSESSMENT CODES IN NOISE HAZARDOUS AREAS

B-1. A Risk Assessment Code (RAC), as defined in reference f to include a cost effective index, will be assigned to all noise-hazardous areas to aid in establishing priorities for implementing engineering control measures. They will be based on exposure to personnel if hearing protection is not worn, and will depend on both the intensity and durations of the noise exposure. The RAC assigned will fall into one for two categories: RAC 2 (IIB, Significant hearing loss will probably occur) which applies to noise hazardous areas where the 8-hr TWA noise exposure equals or exceeds 85dB(A) as computed using Table B-1, or RAC 4 (IIIC, Midl hearing loss may occur in time) which applies to areas where the 8-hr TWA noise exposure is less than 85dB(A). All sound level measurements must be precise since they are used to determine inclusion in the Hearing Conservation program and type of hearing protective devices to be used, whereas a reasonable approximation of the duration of exposure will suffice for the purpose of determining into which of the two RAC categories the noise exposure falls. The RAC number and other factors listed in para 10 of this document should be considered in assigning priorities for implementing engineering control measures.

B-2. Assigning a RAC when a sound level meter is used for noise measurements. Sufficient noise measurements should be made to be able to reasonably approximate the exposure time at various noise levels. The exposure to work place noise in any 24-hour period is then calculated according to the following formula:

$$\text{Noise Dose} = \frac{A1}{T1} + \frac{A2}{T2} + \ldots + \frac{An}{Tn}$$

where A is the approximate total time of exposure in minutes at a particular noise Level L, and T is the time limit value in minutes for a particular noise level L. The limiting values T for any noise level L are listed in Table B-1. If the calculated noise dose is less than 1.0, this corresponds to an 8-hr TWA<85. If the calculated exposure is 1.0 or greater, this corresponds to an 8-hr TWA>85dB(A).

B-3. Assigning a RAC when a noise analyzer/dosimeter is used. Sufficient measurement in time should be allowed to project the work day noise equivalent or noise does.

B-4. A Cost Effectiveness Index (CEI) will be calculated as defined in AR 385-10.

Table B-1. Time Limiting Values, T, For Various Values of Noise Level

Noise Level dBA	Value of T, min	Noise Level dBA	Value of T, min
80	No Limit	99	42
81	960	100	36
82	807	101	30
83	679	102	25
84	571	103	21
85	480	104	18
86	404	105	15
87	339	106	12.6
88	285	107	10.6
89	240	108	9
90	202	109	7.5
91	170	110	6.3
92	143	111	5.3
93	120	112	4.5
94	101	113	3.7
95	85	114	3.1
96	71	115	2.6
97	60	116	2.2
98	50	117 or greater	RAC 2 any exposure

B-5. Examples.

Job: Oiler on a diesel-powered bankgrader.

Duties: Check and lubricate equipment in the revolving superstructure of the bankgrader. This consists of an equipment check every hour which takes approximately 5 minutes. The remainder of the time he is on standby on the catwalk outside the superstructure. The oiler works a ten-hour day, which includes an hour for lunch and two 15 minute breaks.

1. Sound Level Meter Method.

Sound level measurements.

110dB(A) inside the superstructure.

106dB(A) on the catwalk.

Workplace noise exposure.

5 minutes/check X 9 checks/day = 45 minutes/day at 110dB(A).
600 minutes/work day - 90 minutes for lunch ∧ breaks - 45 minutes inside superstructure = 465 minute/day at 106dB(A).

From the equation

Work Day Exposure = $\frac{A1}{T1} + \frac{A2}{12} \ldots \frac{An}{Tn}$ and Table B-1

the work Day Exposure = $\frac{45}{6.3} + \frac{465}{12.6} = 44>1,$

therefore a RAC 2 is assigned.

2. Analyzer/Dosimeter, Noise Equivalent (Leq) Method.

Exposure measurement.

60 minute measurement of one work cycle (equipment check and standby time gives a noise equivalent (Leq) of 107 dB(A).

Workplace Noise Exposure.

600 minute work day - 90 minutes for lunch and breaks = 510 minutes/day at Leq of 107 dB(A).

From the equation

Work day Exposure = $\frac{A1}{T1} + \frac{A2}{T2} \ldots \frac{An}{Tn}$ and Table B-1

Work day Exposure = $\frac{510}{10.6} = 48>1,$

therefore a RAC 2 is assigned.

3. Analyzer/Dosimeter Noise Dose Method.

Exposure measurement.

60 minute measurement of one work cycle (equipment check and standby time give a noise dose of 5.7)

Workplace noise exposure.

600 minute work day - 90 minutes for lunch and breaks = 510 minutes/day at a noise dose of 5.7

$\frac{5.7}{60 \text{ minutes}}$ x 510 minutes/day = 48>1, therefore a RAC of 2 is assigned.

APPENDIX C

HEARING PROTECTIVE DEVICES IN THE FEDERAL PROCUREMENT SYSTEM

C-1. The following hearing protective devices can be procured through the Federal Supply System. They have been thoroughly tested for attenuation of characteristics, durability, and possible toxic effects and are approved by The Army Surgeon General for use by DA personnel in noise levels up to 108dB(A) (see para 11 of the basic document for greater exposures).

C-2. Earplugs and Earcanal caps are listed in Federal Supply Catalog C-6515-IL and CTA-8-100.

Plug, Ear, Hearing Protection, Single-Flange, 24S (Fitting Required)*

NSN 6515-00-442-4765 (extra small, white)
NSN 6515-00-467-0085 (small, green)
NSN 6515-00-467-0089 (medium, international orange)
NSN 6515-00-442-4807 (large, blue)
NSN 6515-00-442-4813 (extra large, red)

Plug, Ear, Hearing Protection, Triple-Flange, 24S (Fitting Required)(*)

NSN 6515-00-442-4821 (small, green)
NSN 6515-00-442-4818 (regular, international orange)
NSN 6515-00-467-0092 (large, blue)

Plug, Ear, Hearing Protection, Universal Size, Yellow/White, 400S

NSN 6515-00-137-6345

Plug, Ear, Silicone Rubber, Hearing Protection, Cylindrical, Disposable, 48S and 200S

NSN 6515-00-135-2612
NSN 6515-00-133-5416

Plug, Ear, cotton, Impregnated, Disposable, 100S

NSN 6515-00-721-9092

*Gauge, Earplug, NSN 6515-00-117-8552 is available to aid in the fitting of earplugs.

EAR-CANAL CAPS

Plug, Ear, Plastic, Hearing Protection, Universal Size, Single-Flange

NSN 6515-00-392-0726

Plug, Ear, Hearing Protection, Universal Size, 12S

NSN 6515-01-059-1821

Earmuffs are listed in the Army Master Data File (AMDF).

Aural Protector, Sound, Type II

NSN 4240-00-022-2946

C-3. Worker comfort should be a consideration when selecting the type of hearing protection to be used.

APPENDIX D

AUDIOMETRIC TEST EQUIPMENT

D-1. Pulse Tone and Self-Recording Audiometric Test Equipment.

a. In the event that pulsed-tone audiometers are used, they shall have a tone on-time of at least 200 milliseconds.

b. Self-recording audiometers shall comply with the following requirements:

(1) The chart upon which the audiogram is traced shall have lines at positions corresponding to all multiples of 10dB hearing level within the intensity range spanned by the audiometer. The lines shall be equally spaced and shall be separated by at least 1/4 inch. Additional increments are optional. The audiogram pen tracings shall not exceed 2dB in width.

(2) It will be possible to set the stylus manually at the 10dB increment lines for calibration purposes.

(3) The slewing rate for the audiometer attenuator shall not be more than 6 dB/sec except that an initial slewing rate greater than 6dB/sec is permitted at the beginning of each new test frequency, but only until the second subject response.

(4) The audiometer shall remain at each required test frequency for 30 seconds (±3 seconds). The audiogram shall be clearly marked at each change of frequency and the actual frequency change of the audiometer shall not deviate from the frequency boundaries marked on the audiogram by more than ±3 cycles.

(5) It must be possible at each test frequency to place a horizontal line segment parallel to the time axis on the audiogram, so that test audiometric tracing crosses the line segment at least six times at that frequency. At each test frequency, the threshold shall be the average of the midpoints of the tracing excursions.

D-2. Audiometer Calibrations.

a. Daily Functional Test. The functional operation of the audiometer shall be checked before each day's use by testing a person and by listening to the audiometer's output to make sure that the output is free from distortion or unwanted sounds. Deviations of more than 5dB shall require an acoustical calibration.

b. Annual Acoustical Calibration. Audiometer calibration shall be checked acoustically, at least annually, according to the following procedures. The equipment necessary to perform these measurements is a sound level meter, octave-band filter set, and a National Bureau of Standards 9A coupler. In making these measurements, the accuracy of the calibrating equipment shall be sufficient to determine that the

audiometer is within the tolerances permitted by American Standard Specification for Audiometers, S3-1969.

(1) Sound Pressure Output Check.

(a) Place the earphone coupler over the microphone of the sound level meter and place the earphone on the coupler.

(b) Set the audiometer's hearing threshold level (HTL) dial to 70dB.

(c) Measure the sound pressure level of the tones at each test frequency from 500 Hz through the 6000 Hz for each earphone.

(d) At each frequency the readout on the sound level meter should correspond to the levels in Table D-1 or Table D-2, as appropriate, for the type of earphone in the column entitled "sound level meter reading."

(2) Linearity Check.

(a) With the earphone in place, set the frequency to 1000 Hz and the HTL dial on the audiometer to 70dB.

(b) Measure the sound levels in the coupler at each 10-dB decrement from 70dB to 10 dB, noting the sound level meter reading at each setting.

(c) For each 10-dB decrement on the audiometer, the sound level meter should indicate a corresponding 10dB decrease.

(d) This measurement may be made electrically with a voltmeter connected to the earphone terminals.

3. Tolerances. When any of the measured sound levels deviate from the levels in Table D-1 or Table D-2 by $\pm$3 dB at any test frequency between 500 and 3000 Hz, 4 dB at 4000 Hz, or 5 dB at 6000 Hz, an exhaustive calibration is advised. An exhaustive calibration is required if the deviations are greater than 10dB at any test frequency.

c. Exhaustive Calibration. An exhaustive calibration shall be performed at least every two years in accordance with sections 4.1.2; 4.1.2; 4.1.4.3; 4.4.1; 4.4.2; 4.4.3; and 4.5 of ANSI 3.6-1969. Test frequencies below 500 Hz and above 6000 Hz may be omitted from the calibration.

D-3. Audiometer Test Room Background Noise Levels. Rooms use for audiometric testing shall not have background sound pressure levels exceeding those in Table D-3 when measured by equipment conforming at least to the Type 2 requirements of American National Standard Specification for Sound Level Meters, S1.4-1971 (R1976), and to the Class II requirements of American National Standard Specification for Octave, Half-Octave, and Third-Octave Band Filter Sets, S1.11-1971 (R1976).

Table D-1. Reference Threshold Levels for Telephonics - TDH-39 Earphones

Frenquency (HZ)	Threshold Level (dB)	Meter Reading (dB)
500	11.5	81.5
1000	7	77
2000	9	79
3000	10	80
4000	9.5	79.5
6000	15.5	85.5

Table D-2. Reference Threshold Levels for Telephonics - TDH-49 Earphones

Frenquency (HZ)	Threshold Level (dB)	Meter Reading (dB)
3000	9.5	79.5
4000	10.5	80.5
6000	13.5	83.5

Table D-3. Maximum Allowable Octave Band Sound Pressure Levels for Audiometric Test Rooms

Octave-band center frequency (Hz)	500	100	2000	4000	8000
Sound pressure level (dB)	40	40	47	57	62