

CHAPTER B4

HEARING CONSERVATION

B0401. DISCUSSION

The goal of the hearing conservation program (HCP) is to prevent occupational hearing loss and assure auditory fitness for duty of all Navy personnel.

Noise-induced hearing loss is the fleet's number one occupational health hazard. High intensity noise exposure results from a wide variety of shipboard operations, including gun or missile fire, aircraft noise, and ship's propulsion systems. Operational risk assessment has shown that fleet costs in terms of man hours, personal hearing protector purchases, and noise abatement operations are readily offset by the preservation of effective communication, maintained quality of life, and reduction in disability expense which accompany an effective HCP process. As such, it is incumbent upon leadership to set the right example in their personal protective practices, to enforce compliance, and to ensure HCP receives their full support.

B0402. HEARING CONSERVATION RESPONSIBILITIES

a. The commanding officer shall ensure that HCP is established and maintained within the command.

b. The safety officer shall:

(1) Request assistance from an industrial hygienist or occupational audiologist to conduct noise measurement and exposure analysis (survey) of areas and equipment. These measurements shall be taken by an industrial hygienist, occupational audiologist or by other individuals trained by an industrial hygienist or occupational audiologist.

(2) Maintain a record of noise hazardous areas and equipment. The baseline or subsequent industrial hygiene surveys, where available, shall serve as documentation. Ensure that noise hazardous spaces/equipment are posted and labeled accordingly.

(3) Ensure that all permanent threshold shifts that meet the criteria of paragraph B0409 are reported by medical departments in accordance with reference B4-1. These reports shall be periodically reviewed to determine any trends that could indicate inadequate use of hearing protection or uncontrolled overexposure to excessive noise levels.

c. Industrial hygiene officers shall:

(1) Maintain and ensure proper calibration of sound level measuring equipment.

(2) Annually, certify audiometric testing booths installed aboard the ships.

d. Division officers shall:

(1) Ensure personnel exposed to hazardous noise have and properly use hearing protection devices.

(2) Ensure that a space or piece of equipment that is designated as noise hazardous is properly posted and labeled.

(3) Ensure all personnel required to wear personal hearing protection are trained in the use and maintenance of that protective equipment, regardless of whether they require enrollment in HCP.

(4) Ensure personnel report for scheduled audiometric testing and training.

(5) Ensure that personnel who require hearing retests due to a significant threshold shift (STS) are excluded from hazardous noise areas, defined as areas exceeding 84 dB(A) (A-weighted sound pressure level (SPL) measured in decibels) for continuous or 140 dB SPL peak, for at least 14 hours before the scheduled test. Hearing protection may not be used to meet this requirement.

NOTE:

Noise exclusion should not be imposed for individuals scheduled for annual hearing testing.

(6) Coordinate with the medical department representative to identify personnel routinely exposed to hazardous levels of occupational noise.

e. The Medical Department Representative (MDR) shall:

(1) Coordinate with division officers to identify and maintain a current roster of personnel routinely exposed to hazardous levels of occupational noise, as guided by the baseline or other industrial hygiene surveys. In the absence of an appropriate industrial hygiene survey, or when it is clear that personnel have some level of exposure to hazardous noise, but on an infrequent or short-term basis, consult an industrial hygienist, occupational audiologist, or occupational medicine physician to determine the need for enrollment. The consultation may be informal (for example, by e-mail) as long as a printed record of the request and reply are available for retention by both parties. Convenience shall not be a criterion to determine inclusion in HCP.

(2) Conduct training for all hands during indoctrination that includes the elements of the hearing conservation program. Elements and rationale for the HCP to include: proper wearing and maintenance of hearing protection devices; command program and individual responsibilities; individual's responsibility in protecting their own hearing, and how hearing loss affects career progression, job performance and mission.

(3) Ensure annual refresher training, per B0408b for the HCP-enrolled personnel is performed. Reference B4-2 identifies suitable training materials and provides additional guidance.

(4) Consult the command industrial hygiene survey, or an occupational health professional to determine the type of required hearing protective devices required for personnel. Maintain an adequate stock of various sizes, of non-disposable hearing protective devices to properly fit wearers.

(5) Schedule personnel in HCP for annual audiometric testing. Ensure that all test results have been entered into each individual's health record, uploaded to the defense occupational and environmental readiness system - hearing

conservation (DOEHRS-HC) data repository, and that all appropriate and necessary follow-up actions are completed.

(6) Ensure that personnel who require hearing retests due to a significant threshold shift (STS) are excluded from hazardous noise areas, defined as areas exceeding 84 dB(A) for continuous or 140 dB SPL peak, for at least 14 hours before the scheduled test. Hearing protection may not be used to meet this requirement.

(7) If audiometric testing is performed within the MDR's command, ensure the certification of annual electro-acoustic calibration of audiometers and audiometric test chambers. Technicians conducting testing will hold current DoD occupational hearing conservation certification (CAOHC) through completion of an approved DoD or Navy sponsored course.

(8) Report, to the safety officer, all permanent threshold shifts toward deteriorated hearing, which have been determined to be consistent with occupational origin, to the safety officer. Report must include name, rate or rank, work-center and time onboard.

(9) Enter into the web-enabled safety system (WESS), per reference B4-1, work-related significant threshold shift (STS). This is defined as hearing changes from baseline that average 10 dB or more at 2000, 3000, and 4000 Hertz (Hz) in one or both ears. In addition, OSHA reportable criterion is met when a change in the person's total hearing level reaches 25 dB or greater above audiometric zero in the same ears and frequencies. If an audiologist, otologist, or occupational medicine physician determines that changes are not work related; their names may not be entered or should be removed from WESS.

f. All hands shall:

(1) Comply with hazardous noise warning labels wherever they appear, either in spaces or on equipment, and properly wear assigned hearing protective devices.

(2) Undergo hearing testing when designated.

B0403. HEARING CONSERVATION PROGRAM ELEMENTS

Hearing conservation program includes the following elements:

a. Noise measurement and exposure analysis to identify hazardous noise areas or sources and the personnel exposed

b. Application of engineering controls to reduce hazardous noise to the maximum extent feasible.

c. Use of hearing protective devices as an interim measure where engineering controls are not feasible (paragraph B0406).

d. Periodic hearing testing of all personnel at risk to monitor the effectiveness of the process, and timely audiologic and medical evaluation of those personnel who demonstrate significant hearing loss or threshold shift (paragraph B0407). Results of all testing shall be captured electronically and transmitted to the central data repository as prescribed in reference B4-2.

e. Training regarding potentially hazardous noise areas and sources, use and care of hearing protective devices, the effects of hazardous noise levels on hearing, and the command's HCP process (paragraph B0408).

B0404. NOISE MEASUREMENT AND EXPOSURE ASSESSMENT

To effectively control noise, it is necessary that the noise be accurately measured according to standard procedures and that the measurements are properly evaluated against accepted criteria.

NOTE:

For new construction ships, an airborne noise survey conducted by the shipbuilder for contract performance is not an acceptable substitute for the required noise survey and personal noise exposure assessment once the ship is loaded out with personnel and gear.

a. Noise Measurements. Noise measurements shall be taken as part of the industrial hygiene survey described in

chapter A3 of this instruction. A noise survey is required if one has not been performed, if the ship has completed a repair availability with significant work done on engineering systems, or if new equipment has been installed. These measurements shall be taken by an industrial hygienist, occupational audiologist or by other personnel trained by an industrial hygienist or occupational audiologist and shall consult with the cognizant industrial hygienist. Detailed information on noise measurements may be found in appendix B4-A. The safety officer shall retain a copy of noise measurement data per B0409.

b. Exposure Assessment

(1) The analysis of noise measurements to assess the hazard potential is a complex task that shall be performed by an industrial hygienist or occupational audiologist. The exposure assessment shall be accomplished per reference B4-3.

(2) The criteria outlined in appendices B4-A and B4-B shall also be used to determine the degree of compliance with applicable standards.

(3) In the absence of an industrial hygienist's or occupational audiologist's assessment to the contrary, personnel who routinely work in noise hazardous areas or with equipment that produces hazardous noise as defined in appendix B4-A, shall be included in HCP. Implementation of all available measures may not be necessary in every case. For example, visitors to a noise hazardous area shall be required to wear hearing protective equipment, but would not be required to have their hearing tested or be included on a roster of noise exposed personnel. See appendix B4-A for additional information.

(4) Information regarding removal of personnel from HCP is provided in appendix B4-A.

c. Labeling of Hazardous Noise Areas and Equipment

(1) Designated hazardous noise areas and equipment that produce hazardous sound levels (see appendix B4-A) shall be appropriately labeled. NAVMED 6260/2, hazardous noise warning decal (8" x 10") NSN 0105-LF-004-7200 and the NAVMED 6260/2A, hazardous noise labels (2" x 2") NSN 0105-LF-004-7800, or their

equivalents, are approved for marking hazardous noise areas and equipment.

(a) NAVMED 6260/2A or equivalent shall be used to label smaller, individual pieces of equipment or tools that produce hazardous noise.

(b) Noise hazard warning signs and labels shall be annotated as to the circumstances or operations that create the noise hazardous condition when hearing protection is required (e.g., when generator is operating).

(2) Normally the outside of doors/hatches leading into a noise hazardous area shall be posted. However, topside and weather surfaces of a ship shall not be posted. In the event that a particular area is a noise hazardous area and has an entrance from a weather deck, the inside of the weather deck door/hatch shall be posted.

(3) Exteriors of military combatant equipment are excluded from this labeling requirement. However, personnel operating and maintaining combat equipment must be made fully aware of hazardous noise exposure conditions.

B0405. NOISE ABATEMENT

a. Reduction of noise at the source is in the best interests of the Navy and its personnel. Areas and equipment that contain or produce potentially hazardous noise should be modified to reduce noise levels to within acceptable limits wherever it is technologically and operationally feasible.

b. Noise abatement actions will normally be accomplished during ship or equipment design, construction or testing. Hazardous noise areas/equipment not identified during construction or post overhaul noise surveys are most likely due to malfunctioning equipment. Noise abatement actions recommended by the industrial hygienist or resulting from Board of Inspection and Survey (INSURV) inspections shall be documented as required in chapter A4 of this instruction, and implemented as soon as possible.

c. Additional information on noise abatement is available in appendix B4-C.

B0406. PERSONAL HEARING PROTECTIVE DEVICES

a. Personnel working in or entering designated hazardous noise areas or utilizing noise hazardous tools or equipment shall have hearing protective devices available at all times, and wear them without consideration of the duration of the exposure. Exceptions to this requirement must be documented by a qualified professional.

b. A combination of insert type and circumaural (muff) type hearing protective devices (double-protection) shall be worn:

(1) In all areas where sound levels exceed 104 dB(A), unless an occupational audiologist, industrial hygienist, or occupational medicine physician has determined that single protection is adequate for the anticipated duration of the exposure.

(2) When a medical officer or audiologist determines that double-protection is required.

c. All personnel exposed to gunfire in a training situation or to noise from large caliber gun or missile firing, under any circumstances, shall wear sufficient hearing protective devices (single protection up to and between 140 dB SPL peak and double protection at 165 dB SPL peak and above) to reduce the individual's effective exposure level to below 84 dB(A)/140 dB SPL, administrative controls as discussed in appendices B4-B and B4-C will be required.

d. Assistance in the determination of which hearing protective device, or combination of devices, suitable for use in each situation, is available from an occupational audiologist, industrial hygienist, or occupational medicine physician. Hearing protection recommendations are contained in the baseline and periodic industrial hygiene surveys. Every effort shall be made to issue personal hearing protective devices suited to the location and duration of usage following the guidance contained in appendix B4-D. Appendix B4-D identifies standard stock hearing protective devices. Alternative hearing protective devices that have been evaluated and approved by one of the military services are identified on the Navy Environmental Health Center (NEHC) homepage at <http://www-nehc.med.navy.mil>

e. For situations requiring unique hearing protection devices, guidance and approval shall be requested from Chief, Bureau of Medicine and Surgery (BUMED).

f. In cases where an industrial hygienist, occupational medicine physician or occupational audiologist determines that hearing protective devices do not provide sufficient attenuation to reduce the individual's effective exposure level to below 84 dB(A), administrative controls as discussed in appendices B4-B and B4-C will be required.

B0407. HEARING TESTING AND MEDICAL EVALUATION

Personnel who are routinely required to work in designated noise hazardous areas or with labeled noise hazardous equipment shall be entered into HCP. Appendix B4-A provides detailed information on hearing testing.

a. Reference (Baseline) Hearing Tests. All personnel shall receive a baseline hearing test upon entry into naval service recorded on a reference audiogram (DD Form 2215). Hearing tests performed at military entrance processing stations (MEPS) shall not be used as a baseline hearing test.

b. Monitoring Hearing Tests. All personnel assigned to duties in designated noise hazardous areas or operating noise hazardous equipment shall be included in HCP. These persons shall receive a hearing test annually, beginning within one year of assignment to those duties, unless their exposure has been found to be of insufficient intensity and/or duration to require enrollment, based on a noise survey or the written opinion of an appropriate occupational health professional. Test results shall be uploaded to the DOEHRS-HC central data repository as well as recorded on a Hearing Conservation Data Form (Form DD 2216). Placement in HCP and annual hearing tests and appropriate follow-up testing shall continue for as long as the person remains in a noise hazardous environment.

c. Termination Hearing Tests. Personnel shall receive a hearing test upon termination of service.

d. Other Hearing Tests. Hearing tests performed for reasons other than hearing conservation or routine physicals, such as complaints of hearing difficulties, difficulty

understanding conversational speech or a sensation of ringing or fullness in the ear(s), shall be performed as indicated by a medical provider. The results of these tests should be recorded on a standard form (SF 600) and maintained in the health record.

B0408. TRAINING

a. All personnel included in HCP shall receive training relative to HCP prior to working in noise hazardous areas or with noise hazardous equipment and annually thereafter. Initial training topics shall include:

- (1) The elements and rationale for HCP including the effects of noise on hearing.
- (2) Designated noise hazardous areas and equipment.
- (3) Proper use and maintenance of hearing protective devices, including the advantages and disadvantages of each type of device.
- (4) The necessity for periodic hearing testing, and a description of test procedures.
- (5) Mandatory requirement to wear assigned protective equipment, and administrative actions that may result from failure to comply.
- (6) Off-duty hearing health hazards.
- (7) The effects of hearing loss on career longevity, promotion and retention.
- (8) Communication in high-noise environments.

b. Annual refresher training must be conducted for personnel enrolled in the HCP. Often this training is accomplished in conjunction with the annual audiogram. Reference B4-2 identifies suitable training materials and provides additional guidance.

B0409. RECORDKEEPING

a. Results of hearing tests performed for hearing conservation purposes and the results of exposure assessments shall be permanently recorded, uploaded to the defense occupational health readiness system-hearing conservation (DOEHRS-HC) data repository and retained in the member's health record. Baseline and reference audiograms which have been superseded as a result of the follow-up process shall be retained in the individual's health record along with relevant evaluation, disposition and referral notations.

b. Activities that do not use DOHRS-HC should contact the Navy Environmental Health and Training Center (NAVENVIRHLHCEN) for guidance in including test data in the hearing conservation database.

c. The MDR shall maintain a current roster of personnel who routinely work in designated noise hazardous areas and shall update this roster semi-annually. The MDR shall maintain a "tickler file" for scheduling annual audiometric examinations of these personnel. The MDR shall update the "tickler file" monthly with the results of the audiometric exams.

d. Accordance to the reporting requirements of reference B4-1, an entry into the web-enabled safety system (WESS) must be made for any work-related STS in hearing. This pertains to a STS averaging 10 dB or more at 2000, 3000, and 4000 Hz in one or both ears, and the person's total hearing level is 25 decibels or more above audiometric zero in the same ears (averaged at 2000, 3000, 4000 Hz). Names are not to be added if an audiologist, otologist, or occupational medicine physician confirms the shift is not of occupational origin. When a reportable hearing loss occurs from an instantaneous event (e.g., acoustic trauma from a one-time blast or over-pressure) the hearing loss shall be reported as an injury.

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REFERENCES

- B4-1. OPNAVINST 5102.1D/MCO P5102.1B, Navy and Marine Corps Mishap and Safety Investigation, Reporting, and Recordkeeping Manual
- B4-2. NEHC Technical Manual, TM-6260.51.99-2, Navy Medical Department Hearing Conservation Program Procedures
- B4-3. NEHC Technical Manual, TM-6290.91-B, Industrial Hygiene Field Operations Manual
- B4-4. American National Standard Specification for Sound Level Meters, S1.4A-1985, American National Standards Institute (NOTAL -- Should be held by commands with sound level meters).
- B4-5. American National Standard Specification for Personal Noise Dosimeters, S1.25-1991, American National Standards Institute (NOTAL -- Should be held by commands with personal noise dosimeters).
- B4-6. DoD Instruction 6055.12, DoD Hearing Conservation Program (HCP) (NOTAL), of 5 March 2004
- B4-7. American National Standard Specification for Audiometers, S3.6-1989, American National Standards Institute (NOTAL -- Should be held by commands with audiometers)
- B4-8. OPNAVINST 4720.2G
- B4-9. NAVSEA T9640-AB-DDT-010/HAB, Shipboard Habitability Design Criteria Manual (NOTAL)

Appendix B4-A

HEARING CONSERVATION DETAILED INFORMATION

This appendix provides detailed information regarding hearing conservation that will be of value to the ship's Medical and Safety Departments.

1. Navy Occupational Exposure Level (NOEL). The NOEL for occupational exposure to noise is listed below:

a. For an eight-hour time-weighted average (TWA) of 84 decibels on the A-weighted scale (dB(A)) for frequencies of 20 to 16,000 Hertz (Hz)

b. For periods of less than 16 hours in any 24-hour period, the NOEL can be determined from the following equation:

$$T = 16 / (2^{[(L - 80) / 4]})$$

Where: T = time in hours (decimal)

L = effective sound level in dB(A)

NOTE:

When two or more periods of noise exposure of different levels comprise the daily noise exposure, their combined effect must be considered. If the sum of the following expression exceeds unity (i.e., >1), then the mixed exposure exceeds the NOEL:

$$C1/T1 + C2/T2 + \dots Cn/Tn$$

Where C indicates the total time of exposure at a specified noise level and T represents the time of exposure permitted at that level.

c. For impact or impulse noise - 140 dB(A) peak sound pressure level.

d. When TWA exposures are likely to exceed 84 dB(A), then personnel shall be included in Hearing Conservation.

2. Noise Measurements and Exposure Assessments. To effectively control noise it is necessary to accurately measure noise according to standard procedures and properly evaluate the measurements against accepted criteria.

a. Noise Measurements. Noise measurements shall be taken as a part of the industrial hygiene survey described in chapter A3.

(1) Sound level meters shall conform, at a minimum, to the Type II requirements cited in reference B4-4. An acoustical calibrator, accurate to within plus or minus one decibel, shall be used to calibrate the instrument before each survey and to revalidate the calibration at the conclusion of the survey. The sound level meter and acoustical calibrator will be electroacoustically calibrated annually. Contact NAVENVIRHLTHCEN Norfolk to schedule the calibration of this equipment.

(a) Continuous or intermittent steady state noise shall be measured in dB(A) with a sound level meter set for slow response. Whenever levels in excess of 84 dB(A) are recorded, C-weighted measurements, dB(C) shall also be taken to permit more accurate determination of hearing protector attenuation requirements.

(b) Impact or impulse noise shall be measured as dB peak sound pressure level (reference: 20 μ Pa) with an instrument capable of accurate impact noise measurement. Reference B4-4 provides specific details.

(2) In cases where high worker mobility, significant variations in sound levels, or a significant component of impulse noise make area monitoring generally inappropriate, personal dosimetry shall be conducted. Personal noise dosimeters shall meet the class 2A-84/80-4 requirements of reference B4-5 and have an operating range of at least 80 dB(A) to 130 dB(A). The assessment of dosimetry results must consider how representative the measured exposure is of the exposure anticipated over longer time periods.

(3) Work environments found to have noise levels greater than 84 dB(A) (continuous or intermittent), or 140 dB peak sound pressure level for impact or impulse noise shall be

analyzed to determine the potential hazard and shall be resurveyed within 30 days of any significant modifications or changes in work routine which could impact/alter the noise intensity/exposure level.

(4) All noise measurements taken to determine an individual's exposure shall be conducted with the microphone of the measuring instrument placed at a height which most closely approximates the position/location of the worker's ear during normal working conditions. Repeated measurements may be required during a single day and/or on different days of the week to account for the variations in noise levels produced by changes in operational schedules and procedures.

(5) The record of noise measurements shall be kept by the measuring activity for a period of 50 years. If measurements are made by a ship's IHO, the records shall be turned over to a supporting shore medical activity for retention. The shore activity will establish a file for each ship. Records shall include, as a minimum the number, type, and location of the noise sources; number and identification of personnel in the work area and their daily noise exposure and duration; type, model, serial number of test equipment, and calibration data; location, date, and time of noise measurements; noise levels measured and hazard radius; and the name and signature of the person(s) who made the survey. Noise survey data will be recorded on NEHC 5100/17 and 5100/18 forms or using a computer-generated equivalent containing all the data fields of these forms.

b. Exposure Assessment. The specialized equipment to be used by an industrial hygienist or occupational audiologist may include octave band analyzers, recorders and personal noise dosimeters.

(1) The criteria outlined in paragraph 1, Navy occupational exposure limits (NOEL) shall be used to determine the degree of compliance with applicable standards.

(2) A noise hazardous area is defined as:

(a) Any work area where the A-weighted sound level (continuous or intermittent) is routinely greater than 84 dB(A).

(b) Any work area where the peak sound pressure level (impulse or impact noise) routinely exceeds 140 dB.

NOTE:

Routinely is defined as those areas/equipment where the noise is of sufficient intensity and duration that it can reasonably be expected exposure will result in a loss of hearing sensitivity.

(3) Noise hazardous equipment is that which produces sound levels greater than 84 B(A) or 140 dB peak sound pressure level.

(4) Per reference B4-6, eight-hour time-weighted average (TWA) noise levels shall be determined for all personnel working in noise hazardous areas at least once during assignment and within 30 days of any change in operations affecting noise levels.

(5) A risk assessment code (RAC) shall be assigned to all potentially hazardous noise areas and operations (see chapter A4). This will normally be accomplished as part of the industrial hygiene surveys described in chapter A3.

(6) Since there are a wide variety of noise measuring instruments in use, any one of the following methods should be used. In each case, it is necessary to take a sufficient number of measurements to achieve a representative noise sample.

(a) When using a dosimeter that is capable of C-weighted measurements:

1. Obtain the C-weighted dose for the entire workshift, and convert to TWA sound level (see dosimeter instruction manual for conversion table).

2. Subtract the NRR from the C-weighted TWA to obtain the estimated A-weighted TWA under the ear protector.

(b) When using a dosimeter that is not capable of C-weighted measurements, the following method may be used:

1. Convert the A-weighted dose to TWA (see dosimeter instruction manual).

2. Subtract 7 dB from the NRR value.

3. Subtract the remainder from the A-weighted TWA to obtain the estimated A-weighted TWA under the ear protector.

(c) When using a sound level meter set to the A-weighted network:

1. Obtain the A-weighted TWA.

2. Subtract 7 dB from the NRR and subtract the remainder from the A-weighted TWA to obtain the estimated A-weighted TWA under the ear protector.

(d) When using a sound level meter set on the C-weighting network:

1. Obtain a representative sample of the C-weighted sound levels in the environment.

2. Subtract the NRR from the C-weighted average sound level to obtain the estimated A-weighted TWA under the ear protector.

The effective reduction of any combination of insert plugs with circumaural muffs (double protection) is considered to be approximately 30 dB. If the result of subtracting the estimated reduction value of a particular device or combination of devices from the measured workplace sound level is determined to be below 84 dB(A) or 140 dB peak, the protection is considered to be adequate. However, should the eight-hour (protected) TWA exceed 84 dB(A), administrative controls shall be instituted to reduce personnel exposure to acceptable levels.

c. Removal of Personnel from Hearing Conservation. A conservative approach will be taken in making a decision to remove personnel from hearing conservation.

(1) Judgments shall be based on repeated and representative measurements that indicate that the individual is exposed to less than 70 percent noise dose or has an eight-hour time-weighted average (TWA) of less than 82 dB(A). This ensures,

with an approximate 95% confidence level, that individuals will not be overexposed.

(2) Recommendations for removal of individuals who are already included in the hearing conservation will be made only by professionals qualified to perform or evaluate noise exposure assessments. In no case will individuals already included in hearing conservation be disenrolled based upon exposure assessment alone without concurrence from an audiologist or qualified physician. Such concurrence is necessary to avoid exclusion of personnel who are noise susceptible or at exceptional risk due to pre-existing hearing loss. See paragraph 4d for hearing tests for personnel being removed from hearing conservation.

3. Personal Hearing Protective Devices. In cases where personal hearing protection devices do not sufficiently reduce personnel effective exposure levels to less than 84 dB(A) administrative control of exposure time will be necessary. A table of noise exposure limits is found in appendix B4-B.

4. Hearing Testing and Medical Evaluation

a. **Hearing Test.** Audiometers used in the performance of hearing tests shall conform to the standards defined in the most current edition of reference B4-7. Hearing tests shall be pure tone, air conduction hearing threshold examinations to include, as a minimum, test frequencies of 500, 1,000, 2,000, 3,000, 4,000 and 6,000 Hz and shall be taken separately for each ear. Tests shall be performed by an audiologist, otolaryngologist, qualified physician or by a person certified by the NAVENVIRHLTHCEN Norfolk or the equivalent organization of another U.S. military service. Hearing tests shall be conducted in an audiometric chamber with internal ambient sound levels not exceeding those prescribed in reference B4-6.

(1) Audiometric booths must be certified annually by an industrial hygienist, audiologist or other qualified personnel under their direct supervision.

(2) The use of noise excluding audiometric earphones is not permitted to augment the performance of a deficient (e.g., non-certifiable) audiometric test room. Their use for

minimizing ambient noise masking effects during testing is allowed within a certified room.

b. Reference (Baseline) Hearing Tests

(1) All personnel included in hearing conservation program shall have a reference hearing test (form DD 2215) in their medical record.

(2) All reference hearing tests shall be preceded by at least 14 hours without exposure to workplace noise. This requirement may not be met by wearing hearing protective devices. Reference (baseline) hearing tests will not be conducted if there is evidence of a transient medical condition that would affect hearing threshold.

(3) Personnel who do not have a reference audiogram filed in their health record shall not be assigned to duty in a designated hazardous noise area involving exposure to hazardous noise until a reference hearing test has been performed. In these cases, hearing threshold levels in either ear in the excess of an average of 25 dB for the frequencies of 500 - 3000Hz or 45dB at any frequency greater than 4000Hz must be evaluated by an audiologist.

c. Monitoring Hearing Test. All personnel included in hearing conservation program will receive annual monitoring hearing tests for as long as they remain enrolled, unless otherwise indicated in the following paragraphs. Additional hearing tests may also be conducted when there are individual complaints of hearing difficulties (e.g., difficulty in understanding speech or a sensation of ringing or fullness in the ear(s)). At the discretion of an audiologist or medical officer, evaluation and medical record entries will be necessary to discover and document the existence of occupational versus non-occupational etiology.

NOTE:

All personnel shall bring their personal hearing protective devices with them when they report for monitoring audiometry.

(1) Consult reference B4-2 for detailed Medical Department guidance for the provision of monitoring audiometry,

follow-up testing, and case management of personnel with noise-induced hearing loss.

(2) The monitoring audiogram shall be compared to the most current reference audiogram to determine if a significant threshold shift (STS) has occurred.

(a) Significant threshold shift (STS) is defined as a change of 15 dB or greater at any test frequency from 1000 to 4000 Hz in either ear or a change in hearing averaging 10 dB or more at 2000, 3000 and 4000 Hz in either ear.

(b) When an STS is identified, additional monitoring hearing tests shall be performed to determine if the threshold shift is temporary or permanent in nature. The member's division officer or MDR will be informed of the time and place for follow-up testing.

(c) A significant threshold shift will be considered permanent when so determined by an audiologist or appropriately trained physician. Individuals will be informed in writing within 21 days of any permanent threshold shift toward deteriorated hearing. When the permanent threshold shift results from exposure to hazardous noise levels, the hearing loss shall be reported to the safety officer and department head by memo that a possible breach in the hearing conservation control procedures has occurred, resulting in a hearing loss.

(3) Any individual who has hearing loss in both ears in which the sum of thresholds at the frequencies of 3000, 4000 and 6000 Hz exceeds a total of 270 dB or has their reference hearing test (form DD 2215) re-established three times will not be assigned to duties involving exposure to hazardous noise until evaluated and waived by an audiologist, otologist, or occupational medicine physician.

d. **Removal Hearing Tests.** Individuals who are removed from hearing conservation will be given a hearing test to document auditory status at the time of removal from noise hazardous duties. Results of this test will be recorded on DD 2216.

e. **Disposition Following Monitoring Hearing Tests.** Pure tone air conduction monitoring hearing tests are designed to

detect small changes in hearing and identify problems before the individual suffers hearing loss that interferes with verbal communications. Detection is made by comparing the current monitoring audiogram with the reference audiogram to determine STS.

(1) Annual

(a) If the annual audiogram shows no significant threshold shift, the individual shall be returned to duty and recalled for hearing testing in one year.

(b) If the annual audiogram shows STS toward improved hearing, then the individual should be re-tested immediately to determine if the baseline/reference test was in error, hearing has actually improved, or the annual test was invalid. If the repeat audiogram continues to show STS and is plus or minus 5 dB from the annual test, re-establish the reference based on the first follow-up test and repeat the test in one year. Nothing else is required.

(c) If the annual audiogram shows a significant threshold shift toward deteriorated hearing, then the individual must be re-tested following at least 14 hours of exclusion from noise levels in excess of 80 dB(A). Because the presence of a STS implies that hearing protective equipment used may be inadequate, physical exclusion from noise may not be accomplished by the use of hearing protective equipment. The physical exclusion period is referred to as "auditory rest." The required 14 hours of "auditory rest" is usually sufficient to allow a temporary STS to return to pre-exposure levels.

(2) Follow-up No. 1

(a) If the first follow-up audiogram shows no significant threshold shift relative to the reference audiogram (i.e., STS has resolved), personnel shall have their hearing protective devices refitted, be re-indoctrinated in their use, and returned to duty to be recalled for a hearing test in one year.

(b) If the first follow-up supports the existence of STS, then a possible conductive or mechanical basis for the shift must be ruled out before proceeding with follow-up. The preferred method to rule out conductive hearing loss is through

screening tympanometry and otoscopy, provided by the audiometric technician or MDR. Subjects who demonstrate normal otoscopy and tympanometry should have that fact noted on a SF 600, and may then immediately receive their second follow-up hearing test. If tympanometry is unavailable, then any health care provider can provide examination and clearance to continue the audiometric test sequence. Otoscopic/tympanometric anomaly requires medical evaluation prior to resuming the test sequence. Again, the second follow-up may be given on the same day as the first follow-up if middle ear function is normal.

(c) At any point in the monitoring process, a health care provider has the option of discontinuing the sequence and referring the patient to an audiologist for further evaluation, if results appear invalid or a severe condition is suspected.

(3) Follow-up No. 2

(a) If the second follow-up test shows no STS relative to the reference audiogram, personnel shall have their hearing protective devices refitted, be re-trained in their use, and be returned to duty.

(b) If the second follow-up test continues to show STS relative to the reference audiogram, the health care provider will refer the individual for diagnostic evaluation or consultation with an audiologist. However, for personnel who continue to demonstrate essentially normal hearing sensitivity despite their threshold shift, the audiologist or suitably trained physician who would otherwise receive the referral may elect to provide a written protocol for case management. The protocol may include the option of shipboard counseling and revision of the reference audiogram without additional testing or review.

f. **Re-established Reference Audiograms.** Monitoring audiograms are compared to the baseline or reference audiogram to determine changes in hearing levels. When, in the opinion of an audiologist or medical officer, the change in hearing (for the better or worse) is permanent, a new reference audiogram may be established for future hearing level comparisons. This re-established reference audiogram does in no way replace the original baseline or reference audiogram established at the

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start of service, which may still be used to determine hearing losses at the termination of military service.

g. **Termination Hearing Tests.** Personnel shall receive a hearing test upon termination of service.

Appendix B4-B

**ADMINISTRATIVE CONTROL OF NOISE EXPOSURE
WITH HEARING PROTECTIVE DEVICES (STAY TIME)**

Limiting time (hr: min per 24 hour day)

Sound level	Hearing protector noise reduction (dB)			
dB (A)	10	20	30	40
90	16	--	--	--
94	8	--	--	--
98	4	--	--	--
102	2	11:18	--	--
106	1	5:39	--	--
110	0:30	2:49	16	--
114	0:15	1:25	8	--
118	--	0:42	4	--
122	--	0:21	2	11:18
126	--	--	1	5:39
130	--	--	0:30	2:49
134	--	--	0:15	1:25
138	--	--	--	0:42

NOTE: Values other than those given above may be calculated using the formula:

$$T = 16 / (2^{((L-80)/4)})$$

Where: T = Time in hours (decimal)
L = Effective sound level, (dB(A))

Intermediate values may be interpolated by adding or subtracting the decibel difference to the appropriate column.

Appendix B4-C

ADDITIONAL NOISE ABATEMENT INFORMATION

1. Introduction. The primary means of protecting Navy personnel from hazardous noise levels shall be through the application of engineering controls. Administrative controls (e.g., the adjustment of work schedules to limit exposure) are also effective but often result in some loss in productivity. Personal protective equipment (earplugs or muffs) shall be the permanent solution only when engineering or administrative controls are considered to be infeasible or cost prohibitive. General hazard (including noise) control techniques are discussed in more detail in chapter A3; therefore, this chapter will address only specific concepts.

2. Preventive Measures. It is much less costly to eliminate potential noise problems in the design or procurement stage for new processes, equipment, and facilities than it is to make retrofits or modifications after the fact. The following guidance is provided to meet this objective.

a. **Procurement specifications** for all new machinery and equipment to be located in spaces where personnel are required to perform work shall prescribe the noise emission level that will ensure, within reasonable accuracy, an A-weighted sound level of 84 dB or less at all locations in which personnel are required to work.

b. **New ship design**

(1) Low noise emitting equipment and acoustical treatment shall be incorporated during the various design stages for all new construction ships so that the equivalent noise level at watch-stander stations is less than 84 dB(A) under full power operating conditions.

(2) Procurement specifications for all new machinery and equipment to be located in spaces where personnel are required to perform work shall prescribe the noise emission level that will ensure an A-weighted sound level of less than 84 dB at all locations in which personnel are required to work.

c. **Repeat ship design.** The policy cited above shall apply and incorporate the noise control technology and personnel noise dosages learned from previous ship designs.

d. **Ship alteration.** Ship alteration prioritization policy established in reference B4-8 shall form the basis of selecting ships for noise control. All watch-stander stations in machinery spaces will not exceed a maximum, equivalent noise level of 84dB(A) under full power operation conditions. Where achieving no more than 84 dB(A) under full power operating conditions is not economically and technologically feasible, watch-stander stations will not exceed a maximum, equivalent noise level of 90 dB(A) at sustained speed operating conditions.

e. The policy stated in paragraphs 2b, c, and d does not apply to high performance ships, experimental ships or special purpose ships for which noise reduction technology application is not feasible. In these uniquely military situations, COMNAVSEASYSKOM, in conjunction with BUMED, will study and develop suitable noise requirements, engineering controls, and hearing protective devices to protect personnel from hazardous noise levels based on ship operating requirements and personnel rest-duty cycles.

3. Abatement of Existing Noise Hazards

a. Abatement of hazardous noise levels shall be undertaken, to the extent possible or practicable, by one or more of the following methods:

(1) By engineering design to eliminate or reduce the noise level of machinery, equipment, and other operating devices/facilities to acceptable levels.

(2) By damping the noise by means of lamination, mufflers, mountings, couplings, supports, insulation or application of acoustic materials.

(3) By acoustical enclosure of the noise producer.

(4) By isolation of the noise producer to a point where the noise will affect fewer personnel.

(5) By substitution of less noisy operations (e.g., welding in lieu of riveting).

(6) By administrative controls which limit exposure (e.g., control of work schedules).

4. Airborne Noise Criteria for Navy ships and submarines.

In accordance with reference B4-9, noise levels have been established as acceptable compartment noise levels for habitability and occupational health. They are categorized according to personnel functional requirements and apply under all ship operating conditions. These criteria apply to steady-state noise and do not apply to impact or impulsive type noise. This information is provided to aid in assessing noise abatement priorities.

a. Definitions of Airborne Noise Categories.

(1) Category A. Spaces in which direct speech communication must be understood with minimal error and without need for repetition. Acceptable noise levels are based on approximate talker-listener distances of either three feet or twelve feet. Category A-3 shall be assigned when extreme talker-listener distance is less than six feet. Category A-12 shall be assigned when the extreme talker-listener distance is six feet or greater. A-3 or A-12 designators are dependent on compartment size and arrangement which influence talker-listener distances.

(2) Category B. Spaces in which comfort of personnel is the primary consideration.

(3) Category C. Spaces in which it is essential to maintain especially quiet conditions.

(4) Category D. High noise level areas in which prevention of hearing loss is the primary consideration.

(5) Category E. High noise level areas in which voice communication is at high vocal effort and short distance and where amplified speech mechanisms and telephones are normally available.

b. Noise Category Assignments. Airborne noise categories are based upon the functional requirements of shipboard spaces. Typical assignments are identified below. Ship spaces not specifically listed shall be assigned the same airborne noise category as a listed space which supports a similar function.

- (1) Category A-12.
 - Air traffic and tactical control centers
 - Briefing rooms
 - Chart room
 - Bridge/Pilot House
 - Combat information center (CIC)
 - Communication
 - Control center
 - Enclosed operation station
 - Missile compartment
 - Squadron ready room
 - Training space
 - Wardroom mess and flag officer's mess and lounge
- (2) Category A-3.
 - Chart room
 - Close-in Weapon System (CIWS) control room
 - Conference room
 - Computer room and DPC
 - Control rooms
 - Damage control central
 - Dental/medical offices
 - Electronic shop
 - Maneuvering room
 - Missile compartment
 - Missile control center
 - Offices
 - Radio room
- (3) Category B.
 - Barber shop
 - Berthing and living spaces
 - Library multimedia resource center
 - Lounges
 - Medical wards
 - Messrooms
 - Recreation areas
 - Ship store

- (4) Category C.
 - Chapel and chaplain offices
 - Libraries
 - Medical spaces
 - Sonar control room or areas

- (5) Category D.
 - Auxiliary machinery rooms
 - Document destruction room
 - Electronic equipment space (Note 1)
 - Engine rooms
 - Fire rooms
 - Galley spaces
 - Laundry spaces
 - Main machinery rooms
 - Passages
 - Power supply/power conversion room
 - Scullery
 - Steering gear room
 - Storerooms, unmanned/unoccupied (Note 2)
 - Workshops (Note 3)

- (6) Category E.
 - Armory/magazine/munitions storeroom/weapons stowage areas
 - Boatswain workshop (Note 4)
 - Bridge wings
 - Decontamination station
 - Electronic equipment space (e.g., radio and radar equipment rooms) (Note 1)
 - Enclosed operating station (if not feasible to meet category A-12)
 - Flag bridge
 - Issue rooms
 - Officer of the deck stations
 - Open bridge and topside watch stations
 - Physical fitness spaces
 - Propulsion plant maneuvering areas
 - Refueling and replenishment stations
 - Repair lockers
 - Signal bridge and signal shelter
 - Torpedo room
 - Workshops (Note 3)

NOTE 1: Wherein command communications do not occur and no routine operator attention to the equipment is required.

NOTE 2: Except for rooms which contain hazardous materials such as munitions and flammable liquids.

NOTE 3: Except wherein hazardous materials are handled or a high degree of concentration is necessary, e.g. electronic repair workshop, decontamination workshop, CIWS workshop [with repair equipment secured].

NOTE 4: If normally occupied or used as an issue room, with repair equipment secured.

(3) Acceptable Airborne Noise Levels. The following indicates acceptable "A" weighted airborne noise levels for all shipboard categories. For design, engineering, and procurement purposes, other more detailed or specific criteria, such as octave band, may be used to supplement these A-weighted criteria.

Noise Category Level	Sound Pressure Level (dBA)
A-12	60
A-3	70
B	65
C	60
D	84
E	75

Appendix B4-D

HEARING PROTECTIVE DEVICES

This table identifies standard stock hearing protective devices. Alternative hearing protective devices that have been evaluated and approved by one of the military services are identified on the Navy Environmental Health Center (NEHC) homepage at (http://www-nehc.med.navy.mil/occmec/index_audiology.htm) under Hearing Protection

	Manufacturers Nomenclature/NSN	Type of Protector	Federal Nomenclature
1	Ear Defender V-51R 6515-00-442-4765	Insert Earplug (sized)	Plug, Ear, Noise Protection 24's (X-Small) (White)
2	Ear Defender V-51R 6515-00-467-0085	Insert Earplug (sized)	Plug, Ear, Noise Protection 24's (Small) (Green)
3	Ear Defender V-51R 6515-00-467-0089	Insert Earplug (sized)	Plug, Ear, Noise Protection 24's (Medium) (Intl. Orange)
4	Ear Defender V-51R 6515-00-442-4807	Insert Earplug (sized)	Plug, Ear, Noise Protection 24's (Large) (Blue)
5	Ear Defender V-51R 6515-00-442-4813	Insert Earplug (sized)	Plug, Ear, Noise Protection 24's (X-Large) (Red)
6	Comfit, Triple Flange 6515-00-442-4821	Insert Earplug (sized)	Plug, Ear, Noise Protection 24's (Small) (Green)
7	Comfit, Triple Flange 6515-00-442-4818	Insert Earplug (sized)	Plug, Ear, Noise Protection 24's (Medium) (Intl. Orange)
8	Comfit, Triple Flange 6515-00-467-0092	Insert Earplug (sized)	Plug, Ear, Noise Protection 24's (Large) (Blue)

	Manufacturers Nomenclature/NSN	Type of Protector	Federal Nomenclature
9	Silaflex (Blister Pack) 6515-00-133-5416	Non-Hardening Silicone	Plug, Ear, Noise Protection, Cylindrical, Disposable 200's
10	EAR or Deci-Damp 6515-00-137-6345	Foam Plastic Insert	Plug, Ear, Noise Universal Size, Yellow 200 pr
11	Sound-Ban 6515-00-392-0726 6515-00-181-8058	Headband, Earcaps	Plug, Ear, Hearing Protection Universal Size
12	Straightaway Muffs 4240-00-759-3290 4240-00-674-5379 4240-00-979-4040	High Performance Circumaural Muffs For 9 AN/2 For 9 AN/2	Aural Protector Sound 372-9 AN/2 Replacement Filler, Dome Replacement Seal, Dome
13	Ear Plug Cases 6515-01-100-1674		Case, Earplug
14	Circumaural Muff 4240-00-22-2946	Type II Headband/Napeband	Aural Protector, Sound

POSITIVE AND NEGATIVE FEATURES OF HEARING PROTECTIVE DEVICES

Type Wear	Positive	Negative	Length of Wear
Earplug (V-51R or Triple Flange)	After adaptation can be used for long periods. Relatively inexpensive	Individual fitting by medical personnel. May cause initial soreness/irritation	Long term (3-4 hours)
Headband Ear Caps (Sound-Ban)	Quickly fitted without touching	Uncomfortable after 1 hour	Short term. Easily carried
Circumaural Muffs	Comfortable. May be worn over plugs. Most universal fit for most users	Expensive. Heavy. Difficult to carry. Fit may be compromised by long hair or eyeglasses	Long or short-term

One single type of hearing protective device will not meet the needs of all noise-exposed personnel. The appropriate type of hearing protective device should be selected based upon a consideration of the factors listed above in

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addition to the degree of attenuation required in a particular situation. The most convenient method of making this determination is the Noise Reduction Rating (NRR) developed by the Environmental Protection Agency (EPA). The NRR is usually shown on the hearing protector package. The NRR is then related to an individual worker's noise environment in order to assess the adequacy of the attenuation of a given hearing protector.