

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 DOEHS-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 (NAVENVIRHLTHCEN) 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, COMNAVSEASYSOM, 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/occmed/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)

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	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.

CHAPTER B5

SIGHT CONSERVATION

B0501. DISCUSSION

a. Navy policy requires that personnel working in eye-hazard areas or operations are provided adequate eye protection at government expense. Examples of potentially eye hazardous operations are: warfighting and operational training, cutting and welding, drilling, grinding, milling, chipping, sand blasting, or other dust and particle producing operations and pouring or handling molten metals or corrosive liquids and solids. Personnel in the immediate vicinity of such operations or entering a posted eye hazard area shall wear eye protective equipment.

b. Devices for eye protection, such as safety glasses, chipper's goggles, welder's goggles, chemical goggles, and face shields, shall be selected using the guidance provided in appendix B5-A. This appendix complies with references B5-1 through B5-4. As a minimum, the protective devices provided shall be approved by the American National Standards Institute (ANSI), labeled "Z87" or "Z87+" in the case of ballistic eye protection devices, and adequate for the hazards specified.

c. Refer to specific chapters for eye protection guidance.

B0502. PROGRAM RESPONSIBILITIES

a. The commanding officer shall:

(1) Ensure that an effective sight conservation program is established within his or her command.

(2) Place emphasis on leadership by example regarding wearing of sight protection equipment.

b. The safety officer shall:

(1) Evaluate areas, processes, and equipment for sight hazards if not previously evaluated or modifications have been

made. Determine appropriate sight protective equipment per the baseline industrial hygiene survey, or appendix B5-A. Assistance may be requested from an industrial hygienist if difficulty in making such a determination is experienced.

(2) Maintain a current listing of all areas and processes that require eye protection and those areas that require eye wash or deluge shower facilities. A list of eye hazardous areas and processes and eye wash or deluge shower requirements is provided in the baseline industrial hygiene survey, and shall be updated as needed.

(3) Evaluate the program at least annually. A checklist for program evaluation is provided in appendix B5-B.

c. Division officers shall:

(1) Ensure that areas identified as eye hazardous are properly marked and labeled per paragraph B0504.

(2) Ensure personnel use proper eye protective devices when required.

(3) Ensure that personnel who work in eye hazard areas or operations are trained on the need for and proper use of protective eyewear and on the location and use of eyewash and deluge shower facilities.

(4) Refer personnel who wear corrective eyewear and work in eye hazard areas to obtain prescriptive safety eyewear via the medical department.

d. The medical department representative (MDR) shall provide personnel who require corrective lenses and work in eye hazard areas, with prescription eyewear. Safety eyewear must have permanent side shields that meet the ANSI test requirements for that specific frame. These side shields are not to be removed by employees.

NOTE:

Ballistic eye protection spectacles systems have built-in side impact protection that is part of the primary protector shield.

e. All hands shall:

- (1) Comply with posted eye hazard warning labels.
- (2) Properly wear required eye protective equipment.

B0503. SIGHT CONSERVATION ELEMENTS

- a. List of eye hazard areas and processes.
- b. Medical screening.
- c. Issue and maintenance of sight protection equipment (paragraph B0506).
- d. Procedures for the use and issue of temporary protective eyewear (paragraph B0507).
- e. Establishment of emergency eyewash and deluge shower facilities (paragraph B0508).
- f. Training (paragraph B0509).

B0504. DETERMINATION and DESIGNATION of EYE-HAZARDOUS AREAS and PROCESSES

a. Determination. The baseline industrial hygiene survey will make an initial determination of eye-hazardous areas/processes and eye wash and deluge shower requirements, and list them in the survey report. The list shall include specific eye protection equipment requirements for each area or process. The safety officer will maintain and ensure that this list(s) remains current. The safety officer shall evaluate subsequent equipment/work processes introduced into the workplace to determine if they present an eye hazardous condition. The safety officer will request the assistance of an industrial hygienist, to assist in this determination, as needed.

b. Designation. The ship (or construction/repair yard) shall mark permanently installed equipment and processes that are eye-hazard areas with three-inch deck striping and a CAUTION sign.

- (1) The deck around an immediate eye hazard shall be marked with a three-inch black and yellow striped or

checkerboard tape or similarly painted. This tape is available under NSN 9Q/9905-01-342-5934 (checkerboard) or 9Q/9905-01-342-5933 (striped). Place the deck marking around equipment operator areas in the vicinity of where the eye hazard is generated (i.e., where there are flying chips from a lathe). Avoid placing the deck markings at the entrance of a space or shop if only selected areas of the shop, while equipment is in operation, are eye hazardous.

(2) Mount the eye hazard sign directly above the hazard, component, machinery, boundary bulkhead, or door in a conspicuous location. The CAUTION sign shall conform to NSN 9Q/9905-01-100-8203, "CAUTION, Eye Protection Required in This Area." Eye hazard signs or labels are also available through open purchase. Eye hazard signs and labels are not required on individual tools. Avoid placing the signs at the entrance of a space or shop if only selected areas of the shop, while equipment is in operation, are eye hazardous.

B0505. MEDICAL SURVEILLANCE

Medical surveillance is required only for personnel covered by chapter B9.

B0506. ISSUE AND MAINTENANCE OF SIGHT PROTECTION EQUIPMENT

a. Issue. The ship shall provide and issue appropriate eye protection at government expense. The list of eye hazards the safety officer maintains identifies required eye protective equipment. All eye and face protection including safety glasses (frames), ballistic eye protection devices, chemical splash goggles, welding and chipping goggles, welding helmets, and face shields shall be labeled "Z87" or "Z87+", indicating compliance with American National Standards Institute (ANSI) standard ANSI-Z87. Such eye and face protection equipment is available through the supply system or open purchase. Appendix B5-A contains information that describes the types of protective eyewear frequently used on board ships.

b. Prescription Protective Eyewear. As determined by the safety officer and MDR, prescription safety glasses may be necessary for some individuals. Prescription protective eyewear shall be obtained through the medical department. Open purchase

procedures may be used to obtain refractive services and prescription safety lenses. The eyewear prescription form, DD 771, or as designated by the Bureau of Medicine and Surgery (BUMED), will be used in all services and equipment procurement. The prescription and procurement forms shall be entered into the crew member's medical record. Prescription protective eyewear is only indicated when the individual is required to wear safety glasses for a significant portion of their daily work (e.g., at all times while in a shipyard or routinely machining materials). For intermittent work requiring eye protection, goggles can be worn over regular prescription glasses.

c. Maintenance of Protective Eyewear. Personnel shall maintain personal protective eyewear in a clean and fully operational condition. Before re-issue, non-corrective eye protection shall be sanitized with hot, soapy water and rinsed of all traces of soap or detergent. Eye protection equipment should then be immersed for 10 minutes in a disinfectant, rinsed, and air-dried. Personnel shall immediately report lost or damaged protective eyewear to their work-center supervisor.

B0507. TEMPORARY PROTECTIVE EYEWEAR

Where protective eyewear is necessary, the command shall provide safety glasses or goggles to visitors and others who must enter or pass through eye hazardous areas. In addition, the command shall provide them to personnel awaiting corrective/protective eyewear.

B0508. EMERGENCY EYEWASH and DELUGE SHOWER FACILITIES

Emergency eyewashes or eye/face baths are primary first aid for splashes or exposures to corrosive materials. Corrosives may cause severe and progressive damage to the eyes and skin, so immediate, on-site means of washing them from the eyes and skin is vital. Emergency eyewashes are not normally required in areas where non-corrosive liquids, irritants, metal chips, or debris may contact the eyes, since the damage normally does not progress while the person is transiting to medical attention. Emergency deluge showers are primary first aid for significant splashes of corrosives to the skin or body, in addition to the eyes.

a. The ship shall have an adequate number of properly maintained and inspected eyewash facilities, installed in locations with corrosive hazards, and properly posted with signs identifying their locations. According to reference B5-1, approved emergency eyewash equipment (permanent plumbed or portable) shall:

(1) Be capable of flushing the eyes with potable water at a minimum flow rate of 0.4 gallons per minute for 15 continuous minutes.

(2) The velocity of the water shall be low enough not to be injurious to the user's eyes. When the valve is properly set, the flow from both nozzles should meet equidistant at the center of the bowl.

(3) Shall have a one-motion (e.g., paddle or pull strap), stay-open valve, such that when activated the eyewash will remain on to allow the user to hold open their eyelids to facilitate flushing. The valve shall remain open without the use of the operator's hands until intentionally closed.

(4) Shall be on the same level, unobstructed and easily accessible within 100 feet or 10 second travel of the identified eye hazard. For a strong acid or strong caustic, the eyewash shall be immediately adjacent to the hazard.

(5) The travel route to the eyewash shall be free of trip hazards or overhead strike hazards, and positioned in such a way as to pose no hazard to the user (e.g., near electrical fixtures, down a ladder, through a door, obstructed, in a confined area).

(6) The unit shall be positioned with the eyewash nozzle(s) not less than 33 inches or more than 45 inches above the deck, and six inches minimum from the nearest wall or obstruction.

(7) Eyewash nozzles shall be protected from airborne contaminants and debris. Whatever means is used to afford such protection (plastic caps, cups, cover) its removal shall not require a separate motion by the operator when activating the unit.

(8) The eyewash shall deliver tepid flushing water (60-100 degrees Fahrenheit). Temperatures in excess of 100 degrees Fahrenheit have proven harmful to the eyes and can enhance chemical interaction with the eyes and skin.

(9) Potable water valves to eyewash stations and deluge showers shall be locked open with a metal, tamper-proof lanyard and marked as a "W" (or "circle W") fitting.

(10) All emergency eyewash and shower equipment must be maintained through the planned maintenance system (PMS).

(11) Clearly mark eyewash stations with a green sign with white lettering stating "EMERGENCY EYEWASH STATION." These signs are available through the supply system under NSN 9905-01-345-4521. Post signs in a visible location close to the eyewash unit.

b. Eye/Face Wash Units. On surface ships, locations for eye/face wash units will be identified in the baseline industrial hygiene survey. Corrosives are frequently found in the following locations, and these areas should be evaluated for installation of an eyewash or eye/face wash unit:

(1) Main and auxiliary machinery spaces, IC gyro, battery charging areas.

(2) Medical treatment area.

(3) Chemical, water testing, and medical laboratories.

(4) Darkrooms and X-ray developing areas, if liquid chemicals are used.

(5) Hazardous material issue/storerooms, if HM is dispensed.

(6) Paint mixing and issue rooms.

(7) Other areas determine by the baseline industrial hygiene survey.

c. For propulsion plant spaces of nuclear powered submarines, eyewash bottles may be used in lieu of permanent or

portable eyewash stations and shall be readily available in nucleonics/water chemistry rooms and secondary analysis stations. Approved eyewash bottles are available through the supply system under NSN 6515-01-393-0728 or 6540-01-353-9946.

d. Combination Shower/Eyewash Units. As specified in reference B5-1, a combination of emergency shower with eyewash or eye/face wash unit with drain and stay-open valve shall be available in all areas where the eyes and skin of crew members may be exposed to corrosive materials. These locations will be identified in the baseline industrial hygiene survey. Corrosives are frequently found in the following locations, and should be evaluated for installation of a combination of emergency shower with eyewash or eye/face wash unit:

- (1) Oxygen-nitrogen producer room.
- (2) Battery shop or locker (wet cell testing, electrolyte handling).
- (3) Combat systems areas handling Isopar® fluids.
- (4) Boiler repair shop.
- (5) Rubber and plastic shop.
- (6) Composite material repair shop.
- (7) Non-destructive test and inspection shops and other ship spaces as determined by the industrial hygiene survey.

e. Portable Eyewash Stations. For those spaces that require an emergency shower, eyewash, or eye/face wash, but where potable water and drainage is not feasible, the ship shall properly install a self-contained portable eyewash. The portable eyewash unit design must comply with the same criteria for function and installation as listed in paragraph B0508a. They may order the gravity-fed eyewash stations under NSNs 4240-01-258-1245 and 4240-01-234-1796. Use of manufacturer recommended bacteriostatic solutions or powders are optional.

f. The MDR shall examine crew members in sick bay following the emergency use of an eyewash unit or deluge shower.

g. Remotely Located Eyewash Facilities. Permanently plumbed emergency showers, eyewashes, and eye/face washes located in remote locations or minimally manned areas shall be provided with an audible alarm interlocking with the activation device of the unit. The alarm is intended to alert personnel in a manned area that someone is using an eyewash facility in a remote area and may not have anyone in the immediate vicinity to render aid. The alarm shall be located in one of the following appropriate areas: outside the protected area or shop, in the associated enclosed operating station (EOS), in a nearby manned space, or in damage control central.

NOTE:

For remotely located eyewash facilities without an audible alarm, observe the two-man rule when eye-hazard operations are performed until the alarm system is installed. A label plate shall be placed at eye level in the immediate vicinity of the alarm and shall be inscribed:

WARNING

WHEN THE EMERGENCY SHOWER (EYEWASH, EYE/FACE WASH)
IN THE (SHOP OR SPACE LOCATION) HAS BEEN ACTIVATED,
PROVIDE IMMEDIATE ASSISTANCE TO PERSONNEL AND
NOTIFY SICK BAY.

B0509. TRAINING

The division officer or work-center supervisor shall perform training for personnel assigned to work-centers with eye hazard areas/processes at the time that protective eyewear is issued. Training materials are available through the NAVOSHENVTRACEN at www.norva.navy.mil/navosh. Topics they shall cover in the training program include:

- a. Types of eye hazards.
- b. Types of eye protection.
- c. Eyewash location and proper use (particularly personnel working with corrosive materials).

d. Proper action when personnel experience mishaps involving particles or liquids in the eye, or use an eyewash station.

NOTE:

No attempt should be made to remove a particle lodged in the eyeball, or wash an eye that has been cut in any way. Contact the medical department immediately.

CHAPTER B5

REFERENCES

B5-1. American National Standard Practice for Occupational & Educational Eye and Face Protection ANSI Z87.1 (NOTAL)

B5-2. American National Standard Emergency Eyewash and Shower Equipment, ANSI Z358.1-2004 (NOTAL)

B5-3. Military Specification DoD-G-51510: "Goggles, Industrial, Eyecup and Lenses; Goggles, Industrial (Metric)" (NOTAL)

B5-4. Military Standard 1434: "Goggles, Industrial, Safety" (NOTAL)

Appendix B5-A

TYPES OF PROTECTIVE EYEWEAR

Appropriate eye and face protection is required in all areas that are designated as eye hazardous. A selection chart for eye and face protection for different work operations, and a welding filter shade protection chart, are shown in Tables B5-A-1 and B5-A-2. The following is a short description of the various types of protective eyewear:

a. Safety Glasses/Spectacles. Safety glasses are to be worn in those areas where there is a possibility of flying objects, particulates, or dust entering the eye. Those spectacles with suitable filter lenses are permitted for use with gas welding operations on light work and for inspections. Spectacle-type glasses are made both with and without side-shields and may have either a rigid nonadjustable or adjustable bridge. Sun glasses, rate as safety glasses and marked with "Z87", with or without side-shields, may be used for outdoor work when sun protection is desired. NOTE: safety sun glasses are not suitable as ultraviolet (UV) protection from welding, cutting, or burning operations.

b. Chemical Goggles. Chemical goggles provide the eyes and eye area with protection from liquids, splashes, mists, vapors, and spray. Goggles may consist of a flexible frame or a rigid frame with a separate, cushioned fitting surface, and are held in place with a supporting band. Chemical goggles with ventilation must be splash resistant (covered vents vice perforations).

c. Welding Goggles. Welding goggles provide protection against glare and injurious radiation, as well as from flying objects, chips, and metal splashes. Eyecup-type goggles are designed to be worn alone, while cover-type goggles are designed to fit over corrective spectacles. The lens filter of welding goggles is shaded to protect the eyes from ultraviolet, infrared, and visible rays generated by the work operations.

d. Chipping Goggles. Chipping goggles protect the eyes from relatively large flying objects generated by such operations as chipping, lathing, grinding, and chiseling.

Eyecup-type goggles may be worn alone, or cover-type goggles may be fitted over corrective spectacles.

e. Welding Helmets. Welding helmets are made up of a bowl-shaped or modified bowl-shaped device equipped with a shade 14 or greater filter. These helmets are designed for use during various kinds of arc welding and heavy gas cutting and provide the welder's eyes, face, ears, and neck with protection against intense radiation and weld spatter.

f. Face Shields. Face shields provide protection to the face and neck from flying particles, liquids, or sprays. Face shields alone do not provide adequate protection against these hazards and must be worn with protective eyewear.

g. Ballistic Eye Protection Devices. Ballistic eye protection devices provide an additional level of protection above that provided by standard safety eyewear for high impact situations. These devices may replace standard safety glasses. Ballistic eye protection devices are classified as either spectacle or goggle systems. Spectacle systems provide enough frame face form for the primary protector to double as side impact protection. Many of these spectacle and goggle systems accept optical inserts for personnel requiring vision correction. These devices and optical inserts should be qualified as a military approved ballistic protective device prior to procurement.

TABLE B5-A-1 - EYE AND FACE PROTECTION SELECTION CHART

APPLICATIONS		
OPERATION	HAZARDS	PROTECTORS
Acetylene-Burning Acetylene-Cutting Acetylene-Welding	Sparks, Harmful Rays, Molten Metal, Flying Particles	7, 8, 9
Chemical Handling	Splash, Acid Burns, Fumes	2 (For severe exposure Add 10)
Chipping	Flying Particles	1, 3, 4, 5, 6, 7a, 8a
Electric (Arc) Welding	Sparks, Intense Rays, Molten Metal	11 (In combination with 4, 5, 6, In tinted lenses, advisable)
Furnace Operations	Glare, Heat, Molten Metal	7, 8, 9, (For severe exposure, add 10)
Grinding-Light	Flying Particles	1, 3, 5, 6 (For severe exposure, add 10)
Laboratory	Chemical Splash, Glass Breakage	2 (10 when in combina- tion with 5, 6)
Machining	Flying Particles	1, 3, 5, 6 (For severe exposure, add 10)
Molten Metals 6, In advisable)	Heat, Glare, Sparks	7, 8, (10 in combina- tion with 5, tinted lenses,
Spot Welding	Flying Particles, Sparks severe exposure, add 10)	1, 3, 4, 5, 6 (Tinted lenses advisable, for
Warfighting, Combat and Training Operations	Projectiles, Glare, Wind Dust	DoD approved ballistic protection devices

Eye and Face Protectors Key:

- 1 - Goggles, flexible fitting, regular or perforated ventilation
- 2 - Goggles, flexible fitting, covered or indirect ventilation; or goggles, chemical
- 3 - Goggles, cushioned fitting, rigid body
- 4 - Spectacles, without side shields
- 5 - Spectacles, with eyecup type side shields
- 6 - Spectacles, semi/flat fold side shields
- 7 - Welding goggles, eyecup type, tinted lenses
- 7A - Chipping goggles, eyecup type, clear safety lenses
- 8 - Welding goggles, coverspec type, tinted lenses, , various shade numbers
- 8A - Chipping goggles, coverspec type, clear safety lenses
- 9 - Welding goggles, coverspec type, tinted plate lens
- 10 - Face shield, plastic or mesh window
- 11 - Welding helmet, various lenses

TABLE B5-A-2 - WELDING FILTER SHADE PROTECTION CHART

WELDING OPERATION	SUGGESTED SHADE NUMBER*
Shielded Metal-Arc Welding, up to 5/32 in (4 mm) electrodes.....	10
Shielded Metal-Arc Welding, 3/16 to 1/4 in	
(4.8 to 6.4 mm) electrodes.....	12
Shielded Metal-Arc Welding, over 1/4 in (6.4 mm) electrodes.....	14
Gas Metal-Arc Welding (Nonferrous).....	11
Gas Metal-Arc Welding (Ferrous).....	12
Gas Tungsten-Arc Welding.....	12
Atomic Hydrogen Welding	12
Carbon Arc Welding.....	14
Torch Soldering	2
Torch Brazing	3 or 4
Light Cutting, up to 1 in (25 mm).....	3 or 4
Medium Cutting, 1 to 6 in (25 to 150 mm).....	4 or 5
Heavy Cutting, over 6 in (150 mm).....	5 or 6
Gas Welding (Light) up to 1/8 in (3.2 mm).....	4 or 5
Gas Welding (Medium) 1/8 to 1/2 in (3.2 to 12.7 mm).....	5 or 6
Gas Welding (Heavy) over 1/2 in (12.7 mm).....	6 or 8
Fire Watch For Any Welding or Cutting Operation.....	
.....6 (minimum) (A)	

*The choice of a filter shade may be made on the basis of visual acuity and may therefore vary widely from one individual to another, particularly under different current densities, materials, and welding processes. However, the degree of protection from radiant energy afforded by the filter plate or lens when chosen to allow visual acuity will still remain in excess of the needs of eye filter protection. Filter plate shades as low as shade eight have proven suitably radiation-absorbent for protection from the arc-welding processes.

NOTE:

In gas welding or oxygen cutting where the torch produces a high yellow light, it is desirable to use a filter lens that absorbs the yellow or sodium line in the visible light of the operation (spectrum).

CHAPTER B6

RESPIRATORY PROTECTION

B0601. DISCUSSION

a. Many repair and maintenance operations generate air contaminants that are dangerous if inhaled. Engineering controls (e.g., local exhaust ventilation) are the most effective methods of protecting personnel against such contaminants. However, when engineering controls are not practical or feasible, respirators are necessary to assure the protection of personnel.

b. This chapter establishes respiratory protection requirements and applies to all personnel and visitors who enter an area where respiratory protective equipment is necessary. Many of the procedures contained herein are derived from or are similar to the ones detailed in reference B6-1. This chapter does not address damage control, gas free engineering, underwater protection, or respirator use in a chemical, biological, radiological, nuclear and high-yield explosive (CBRNE) emergency response.

c. The provisions of this chapter do not apply to personnel wearing respiratory protection for the sole purpose of protection against airborne radioactive contamination associated with the naval nuclear propulsion program. Guidance for this area is found in reference B6-2.

d. For submarines. Responsibilities and procedures for respiratory protection aboard submarines are contained in paragraph B0614.

B0602. RESPONSIBILITIES

a. The commanding officer shall appoint a respiratory protection manager (RPM) in writing.

b. The respiratory protection manager (RPM) shall:

(1) Complete required training course within three months of assuming the position. Respiratory protection managers (RPM) shall attend the Respiratory Protection Program

Management Course (CIN A-493-0072) the Naval Occupational Safety and Health and Environmental Training Center (NAVOSHENVTRACEN).

(2) Ensure a baseline or periodic industrial hygiene (IH) survey has been conducted of all processes and areas where there is the risk of occupational exposure to air contaminants. The IH survey will provide recommendations on the types of respiratory protection required for various processes, areas, and situations. Industrial hygiene will provide a written respirator program evaluation during baseline and periodic industrial hygiene surveys.

(3) Ensure a sufficient supply of National Institute for Occupational Safety and Health (NIOSH) approved respirators, spare parts, and expendable supplies (e.g., cartridges and filters) are maintained to conduct routine and emergency operations. There should be a sufficient number of respirator models and sizes so that the respirator is acceptable to and correctly fits the user.

NOTE:

Respirator parts and filters are not interchangeable. Ensure that all components are of the same manufacturer (e.g., Brand X facepiece must have Brand X filters).

(4) Maintain a current roster of personnel enrolled in respiratory protection program and communicate this information to the medical department representative.

(5) Conduct respirator fit testing and document that fit testing was completed as required in paragraph B0608.

(6) Establish central control points for issuing and maintaining respiratory protection equipment. Divisions that frequently use respirators and personnel who are assigned individual respirators may maintain custody of their own respiratory protection equipment and are responsible for its proper use and storage.

(7) Inspect, clean, disinfect, store, maintain and repair respirators per paragraph B0609.

(8) Ensure breathing air meets the quality requirements of paragraph B0611.

(9) Evaluate the program at least annually. A checklist for program evaluation is provided in appendix B6-A.

c. Division officers shall:

(1) Ensure that personnel have a current fit test and are trained prior to donning a respirator. The industrial hygiene survey and workplace evaluations provide information regarding work tasks which require respiratory protection.

(2) Ensure personnel are provided with/issued required respiratory protective equipment.

d. The medical department representative (MDR) shall:

(1) Confirm that personnel, who are issued respirators have no deployment limiting medical conditions, and have a current annual preventive health assessment (PHA) per reference B6-3 (see paragraph B0613).

(2) Assist the RPM in identifying and evaluating hazards and selecting appropriate respirators, as recommended in the industrial hygiene survey.

e. Personnel issuing respiratory protective equipment shall issue respirators only to personnel who are trained, medically certified per paragraph B0613, and successfully fit tested for the respirator(s) requested.

f. All hands shall:

(1) Inspect the respirator before and after each use per paragraph B0609a.

(2) Perform a positive and negative respirator facepiece seal check prior to each use per paragraph B0607b.

(3) Report any malfunction of the respirator to their immediate supervisor.

(4) Prevent damage to or loss of respiratory protective equipment.

B0603. RESPIRATORY PROTECTION ELEMENTS

a. Appointment of and training of the respiratory protection manager.

b. The industrial hygiene survey.

c. Written standard operating procedures (SOPs) governing the selection, care, issue, and use of respirators, including worksite SOPs.

Note:

The following website includes a generic, fill-in-the-blank, Navy respirator instruction and standard operating procedures for all elements of the respirator program: <http://www-nehc.med.navy.mil/downloads/IH/GENERIC SOP.doc>. Note that this generic SOP is based on requirements of reference B6-4, but would be helpful in writing shipboard respirator program SOPs.

d. Respirator selection (select and issue only NIOSH approved respirators).

e. Respirator availability.

f. Personnel roster.

g. Medical respirator qualification, based on current PHA (paragraph B0613).

h. Initial and annual fit testing and training.

i. Respirator issue.

j. Respirator maintenance.

k. Breathing air requirements.

l. An annual audit of the respirator program by the RPM and a written respirator program evaluation by the industrial

hygiene office performing baseline and periodic industrial hygiene surveys.

Note:

See reference B6-5 for detailed explanations of these respiratory protection elements.

B0604. TYPES OF RESPIRATORS AND THEIR APPLICATIONS

The two basic types of respirators are air-purifying and atmosphere-supplying. Illustrations of typical respirators are provided in appendix B6-B.

a. Air-purifying respirators remove air contaminants by filtering, or by absorbing them as the air passes through the cartridge. In all cases when using air-purifying respirators, adequate oxygen (19.5 percent by volume) must be present. They are available with quarter-, half-, and full facepieces with the full facepiece respirator providing a higher degree of protection than either of the others. Air-purifying respirators are available as filtering facepiece (e.g., disposable) respirators, with the filter or cartridge built-in as an integral part of the respirator, or as reusable facepieces with replaceable cartridges, filters, and pre-filters of many types. They are effective only when used with the appropriate cartridges, filters, and pre-filters for the air contaminants present. Air-purifying respirators may be either non-powered or powered air-purifying respirators (PAPRs). The non-powered type depends on the user's lungs to draw air through the purifying element during inhalation; therefore, the non-powered type has the greatest breathing resistance. The powered type is equipped with a battery-powered fan that forces air through the purifying element, thus reducing the breathing resistance and ensuring a positive pressure inside the facepiece. Whether powered or non-powered, air-purifying respirators may be subdivided by the type of contaminant they protect against as described below.

(1) Particulate air-purifying respirators use cartridges, filters, and pre-filters designed to protect against inhalation of aerosols (e.g., solid or liquid particles dispersed in air). The cartridges, filters, and pre-filters remove nuisance (e.g., non-toxic) and toxic dusts, fogs, fumes, mists, smokes and sprays either singly or in combination. NIOSH

certifies respirators per reference B6-6 (see paragraph B0605). Under reference B6-6, there are nine classifications of non-powered particulate air-purifying respirators certified under three filter classes: N-, R- and P- class. Each class has three levels of filter efficiency: 95%, 99% and 99.97% (designated 100 in this system). N100, R100, and P100 filters are equivalent to high efficiency particulate air (HEPA) filters. P-class series filters can be used in oil aerosols and are the only magenta (purple) colored high efficiency filters. N-class series filters cannot be used in oil aerosols. R-class series filters can be used only for a single shift in oil aerosols. PAPRs must be equipped with filters meeting the criteria for HEPA filters but the filters must have a reference B6-6 approval label. Like the P100 filters for negative pressure, air-purifying respirators, PAPR HEPA filters are magenta in color. Surgical masks (blue or green) do not provide protection against air contaminants. They are for **MEDICAL/DENTAL USE ONLY** and must **NEVER** be used as an air-purifying respirator.

(2) Gas and vapor air-purifying respirators use cartridges and canisters that remove contaminants through absorption and adsorption. Typically, a cartridge removes a specific type or class of gas or vapor (e.g., organic vapors or acid gases).

(3) Combination cartridges and canisters are available which combine the removal capabilities of two or more type cartridges in a single cartridge (e.g., organic vapor and particulate removal, acid gas and organic vapor removal, or acid gas, ammonia, and organic vapor removal). Some manufacturers allow users to create their own combination cartridges by screwing two cartridges together; however, always follow the manufacturer's recommendations when doing this since there may be some limitations.

(4) **Prefilters.** All manufacturers allow the user to combine different degrees of particulate removal with any cartridge by attaching a pre-filter to the cartridge by means of a retainer ring. Such systems are commonly used to protect against an aerosol.

(5) **Color Coding.** By federal regulation, each type of respirator cartridge/canister is color coded to identify its

intended use. The color coding may be achieved by coloring all or part of the cartridge/canister case or by affixing a colored label. See reference B6-5 for specific information on color coding.

(6) **Labeling.** Each cartridge/canister is labeled with the contaminant(s) it protects against and the NIOSH approval number. Some labels may provide more information about the cartridge's capabilities and limitations.

(7) **Military gas masks** (e.g., MCU-2A/P, Mark V, M40) are military-unique air-purifying respirators that are only to be used for chemical-biological-radiological (CBR) warfare. MILITARY GAS MASKS MUST NEVER BE USED IN PLACE OF AN AIR-PURIFYING RESPIRATOR. This chapter does not apply to the use and maintenance of military gas masks.

b. Atmosphere-supplying respirators are used when the contaminant has no warning property (e.g., smell, taste, eye irritation or respiratory irritation), the contaminant's concentration is too high to use an air-purifying respirator, or the environment is immediately dangerous to life or health (IDLH). The two types are supplied-air (airline) respirators and self-contained breathing apparatuses.

(1) Supplied-air respirators are further subdivided into hose mask and air-line respirators.

(a) Hose mask respirators consist of a facepiece, breathing tube, harness, and large-diameter, thick-wall, non-kinking, air-supply hose. A blower, either motor or hand driven, may supply the air, or the user, unaided, may simply draw the air into the hose with each breath. This respirator offers no advantages over the air-line respirator and is being removed from the fleet and must not be worn.

(b) Air-line respirators consist of a facepiece, hood, helmet, or suit; breathing tube; regulator; and small-diameter hose provided with some means to attach the hose to the user. A compressor, ambient air breathing apparatus (AABA), or compressed air cylinder(s) provides the air. The maximum length of hose allowed from a compressor or air fitting to the respirator shall be 300 feet unless a shorter maximum length is specified on the NIOSH approval. The NIOSH approval for each

air-line respirator applies to the combination of the respirator and air supply hose as a unit and specifically to the part numbers listed on the approval. Any use of another manufacturer's respirator or hose automatically invalidates the approval. Air-line respirators can be subdivided into three types as follows:

1. **Demand.** Available only with a facepiece, it supplies air to the user on demand (inhalation) which creates a negative pressure within the facepiece. Leakage into the face piece may occur if there is a poor seal between the respirator and the user's face. According to reference B6-5, demand respirators shall not be worn.

2. **Pressure Demand.** Available only with a facepiece, it maintains a continuous positive pressure within the facepiece, thus preventing contaminant leakage into the facepiece. Per reference B6-5, pressure demand respirators have higher assigned protection factors than continuous flow respirators.

3. **Continuous Flow.** Available with a facepiece, hood, helmet, or suit, it provides a continuous positive pressure and flow of air within any of the breathing zone containments, thus preventing contaminant leakage into the containment.

(2) Self-contained breathing apparatuses (SCBAs) consist of a facepiece, helmet, or hood; a breathing tube; and a source of air or oxygen, all of which is carried by the wearer. They may be subdivided into two categories.

(a) **Closed-circuit (rebreathing) SCBAs.** There are two types of this respirator. In both types carbon dioxide (CO₂) in the exhaled breath is removed by a chemical canister prior to rebreathing. The difference between the two is the source of oxygen. In one type, the oxygen is provided by either high-pressure gaseous oxygen or gaseous oxygen converted from liquid oxygen. In the other type, of which the Navy "oxygen breathing apparatus" (OBA) is an example, the water vapor in the exhaled breath reacts with a chemical in the canister to release oxygen. The OBA is not approved by NIOSH for commercial use, and its only authorized uses aboard ship are for damage control, fire-fighting operations, and fixed flooding systems PMS. Even

in emergencies, OBAs must not be used in flammable atmospheres due to the heat generated by the canister.

(b) **Open-circuit SCBAs.** In this type of SCBA, the exhaled air is expelled to the atmosphere and air is provided to the user from a compressed air cylinder. This type of respirator is available in either a demand (negative face piece pressure) or pressure-demand (positive facepiece pressure) model. Per reference B6-5, demand respirators shall not be worn.

(c) **Emergency Escape Breathing Device (EEBD).** This is a special type of SCBA developed for the Navy specifically for emergency escape from shipboard fires. They have a very short duration air supply. **THEY MUST NEVER BE USED FOR ENTRY INTO A HAZARDOUS ATMOSPHERE; THEY ARE FOR ESCAPE ONLY!**

This chapter does not apply to the use and maintenance of the EEBD.

(d) **Supplemental Emergency Escape Device (SEED).** This is another special type of SCBA developed for main propulsion space watchstanders ONLY. They have a very short duration air supply. **THEY MUST NEVER BE USED FOR ENTRY INTO A HAZARDOUS ATMOSPHERE; THEY ARE FOR ESCAPE ONLY!** This chapter does not apply to the use and maintenance of the SEED.

B0605. RESPIRATOR SELECTION

a. Approval. Previously, respirators were jointly approved by NIOSH and the Mine Safety and Health Administration (MSHA). On 8 June 1995, NIOSH updated the respirator certification procedures and reissued them under reference B6-6. NIOSH is now the sole certification agency. only certifies jointly with NIOSH if the respirator is being tested specifically for mine rescue. Both NIOSH approved and NIOSH/MSHA certified respirators are approved for use. NIOSH identifies approved respirators in the NIOSH certified equipment list, which is available electronically at the following website:
<http://www.cdc.gov/niosh/npptl/topics/respirators/CEL/default.html>

If there is any doubt as to the respirator required to protect against a particular contaminant, consult an industrial hygienist.

b. Hazard Assessment. Determining the type of contaminant and its concentration is the most important consideration in the selection of respirators. This determination shall be provided as part of the most current industrial hygiene survey or by an industrial hygienist upon request. The industrial hygiene survey report shall identify and evaluate the respiratory hazard(s) in the workplace; this evaluation shall include a reasonable estimate of personnel exposures to respiratory hazard(s). Where the individual's exposure to respiratory hazard(s) cannot be identified or reasonably estimated by the industrial hygienist, the atmosphere shall be considered "Immediately Dangerous to Life or Health" (IDLH). The following are some chemical, physical and toxicological properties that should be considered in the selection of a respirator:

(1) Warning properties of the contaminant gas or vapor (e.g., smell, taste, eye irritation or respiratory irritation). Some contaminants lack sufficient warning properties to alert the wearer of respirator failure. Vapor- and gas-removing respirators are not approved for these contaminants, which include carbon monoxide, hydrogen cyanide, isocyanates and methyl alcohol.

(2) Whether the contaminant is absorbed through the skin.

(3) Whether any of the contaminants are immediately dangerous to life or health (IDLH) or whether injurious effects would be produced after prolonged exposure.

(4) Concentration of the contaminant in the atmosphere, the hazard ratio, maximum use concentration, and assigned protection factors (see paragraph B0606 and table B6-1).

(5) Occupational exposure limits (OELs) for the contaminant(s). See chapters B1 and B10 for standards for asbestos and lead, respectively.

(6) Whether an oxygen-deficient or oxygen-rich atmosphere exists or may be created.

(7) The nature, extent and frequency of the duties to be performed by personnel (e.g., welding or painting) in the work area.

(8) Degree of protection provided by the particular respirator.

B0606. LIMITATIONS OF RESPIRATORS

Paragraphs B0604 and B0605 mention some general limitations; however, the following provides more specific information:

a. Assigned Protection Factor (APF). The APF is the workplace level of respiratory protection that would be provided by a properly functioning and properly used respirator or a class of respirators when all elements of an effective respiratory protection program are established and are being enforced. Navy adopted APFs are provided in table B6-1. Although table B6-1 applies also to protection against asbestos and lead, refer to chapters B1 and for additional program requirements.

TABLE B6-1.-Assigned Protection Factors⁴					
Type of respirator ^{1,2}	Quarter mask	Half mask	Full Face-piece	Helmet/hood	Loose-fitting Face-piece
Air-Purifying Respirator	5	10	50	.....	.....
Filtering Facepiece Resp.	5	.....	.....	.....	.....
Powered Air-Purifying Respirator (PAPR) .....	.....	50	1000	³ 25/1000	25
Supplied-Air Respirator (SAR) or Airline Respirator					
Demand mode.....	.....	10	50	.....	.....
Continuous flow mode.....	.....	50	1000	³ 25/1000	25
Pressure-demand or other positive-pressure mode	.....	50	1000	.....	.....
Self-Contained Breathing Apparatus (SCBA)					
Demand mode.....	.....	10	50	50	.....
Pressure-demand or other positive-pressure mode			10,000	10,000	

(e.g., open/ closed circuit)					
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¹ RPMs may select respirators assigned for use in higher workplace concentrations of a hazardous substance for use at lower concentrations of that substance, or when required respirator use is independent of concentration.

² The assigned protection factors in table 1 are only effective when the employer implements a continuing, effective respirator program as required by 29 CFR 1910.134, including training, fit testing, maintenance, and use requirements.

³ The RPM must have evidence provided by the respirator manufacturer that testing of these respirators demonstrates performance at a level of protection of 1,000 or greater to receive an APF of 1,000. This level of performance can best be demonstrated by performing a workplace protection factor or simulated workplace protection factor study or equivalent testing. Absent such testing, all other PAPRs and SARs with helmets/hoods are to be treated as loose-fitting facepiece respirators, and receive an APF of 25. For further guidance see reference B6-5

⁴ These APFs do not apply to respirators used solely for escape. For escape respirators used in association with specific substances covered by 29 CFR 1910 subpart Z, RPMs must refer to the appropriate substance-specific standards in that subpart. Escape respirators for other IDLH atmospheres are specified by 29 CFR 1910.134 (d) (2) (ii).

b. Oxygen-deficient Atmospheres. All air-purifying respirators require that sufficient oxygen be present in the atmosphere where they will be used. Sufficient oxygen is defined as at least 19.5% oxygen for use at essentially sea level.

c. Hose Length/Configuration and Air Pressure Requirements for Air-line Respirators. The approval specifies the maximum length of air supply hose that may be used with each respirator and this is a function of the pressure of the supplied air.

NOTE:

The allowed hose length for supplied-air respirators is specified on the NIOSH approval certificate, but in no case shall the length exceed 300 feet maximum. Supplied-air respirators shall be operated at the conditions of pressure and hose length specified in the approval. Only those hoses supplied by the respirator manufacturer shall be used. Air-line couplings shall be incompatible with outlet couplings for other gas systems to prevent inadvertent servicing with non-respirable gases or oxygen.

d. Environmental Temperature Operating Ranges. Atmosphere-supplying respirators have specific temperature ranges for which they are approved. Consult the manufacturer's specifications before use in extreme temperatures.

e. Maximum Use Concentrations. The maximum use concentration (MUC) for a class of respirators determines the maximum level of protection that a class of respirators can provide against a contaminant. The MUC is calculated by multiplying the APF by the OEL. However, if the IDLH concentration is lower than the MUC, then the IDLH concentration takes precedence over the calculated MUC.

f. Hazard Ratio. Another useful calculation in respirator selection is the hazard ratio, which indicates the minimum APF required. Hazard ratio is calculated by dividing the exposure concentration by the OEL.

B0607. USE OF RESPIRATORS

a. Prior to using a respirator to perform work that requires respiratory protection, the following requirements shall be met:

(1) The user shall pass a fit-test with each type of respirator to be used per paragraph B0608.

(2) The user shall be trained per paragraph B0612.

(3) Wearing contact lenses in contaminated atmospheres with respiratory protection is permitted.

(4) Tight fitting respirators shall not be worn when conditions such as facial hair, facial scars, or prescription eyeglasses prevent a good respirator seal.

(5) Wearing SCBAs during shipboard firefighting or other emergencies, including shore training for these emergencies, is military-unique. Fit-testing and medical certifications are not required prior to wearing SCBAs for these scenarios.

b. User Seal Checks. Prior to each use, perform a positive and negative user seal check prior to each use.

(1) **Positive Pressure User Seal Check.** Place your palm or thumb over the exhalation valve and press lightly. Exhale gently. The respirator is properly sealed if no air leaks around the edges and a slight positive pressure is felt inside the facepiece.

(2) **Negative Pressure User Seal Check.** Place your palm(s) over the cartridge(s) or canister inlet. Inhale gently. The respirator is properly sealed if no air leaks around the edges and a slight negative pressure is felt inside the facepiece as it collapses slightly towards the face.

c. Warning Signs of Respirator Failure

(1) **Particulate Air-purifying Respirator.** When breathing difficulty is encountered with a particulate air-purifying respirator (increased resistance due to partial clogging), the filter(s) must be replaced. If the respirator is a filtering facepiece (e.g., disposable) respirator then the respirator must be discarded.

(2) **Vapor or Gas Air-purifying Respirator.** When using a vapor or gas air-purifying respirator, if the user notices any of the warning properties (e.g., odor, taste, eye irritation (with a full facepiece respirator)), or respiratory irritation, he/she should promptly leave the area and replace the cartridge or canister before returning.

(3) **Service Life of Air-purifying Respirator Filters, Canisters, and Cartridges.** Filters, canisters, and cartridges for air-purifying respirators are intended to be used until filter resistance precludes further use, or the chemical sorbent is expended as signaled by the detection of a specific warning property (e.g., odor, taste, and/or irritation).

(a) Change end-of-service-life indicator cartridges and canisters when indicated by the appropriate color change. End-of-service-life (ESLI) indicator cartridges and canisters that are located on the front of the cartridges must be worn belt mounted or chest mounted, respectively, so that the ESLI indicator can be seen. More recently developed ESLIs are located on the upper edges of cartridges so that they are visible to the respirator wearer while cartridges are worn on the facepiece.

(b) Air-purifying cartridges shall be replaced whenever the user can detect contaminant warning properties, such as, odor, taste, or irritation. Cartridges shall also be replaced if the user has difficulty inhaling air through the cartridge, which may indicate filter overloading. The RPM may impose time limitations for cartridge use not to exceed eight hours. When in doubt about the previous use of the respirator, replace the filter, canister, or cartridge.

(4) **Air-line Respirator.** Leave the area immediately when the compressor failure alarm is activated or if an air pressure drop is sensed.

(5) **Self-contained Breathing Apparatus.** Leave the area as soon as the air pressure alarm activates.

B0608. RESPIRATOR FIT TESTING

Each individual who is required to use a tight-fitting respirator shall be qualitatively or quantitatively fit tested before being issued a respirator and annually thereafter unless the user is to wear a SCBA. Per paragraph B0607(5), SCBAs are exempt from the requirement to fit test. When conditions, such as facial hair, can reasonably be expected to interfere with the proper fit of respiratory protective equipment, the user shall not be permitted to do work requiring a respirator. Personnel with facial hair that could interfere with face seal or valve function will not be fit tested because the length and condition of facial hair changes daily and would necessitate daily fit testing. For all ships, anyone trained to fit test via training detailed in paragraph B0612 can perform fit testing. Fit testing can also be obtained via the supporting tender, local Navy environmental and preventive medicine units (NEPMUs), the cognizant medical treatment facility (MTF), or other sources. Fit testing results will be documented and contain the following minimum elements:

Name, rate/rank, division, department.

Date of current PHA

Date of fit test and by whom.

Fit test medium (material used, e.g., Bitrex™ (denatonium benzoate solution), irritant smoke) and type of cartridge(s) or filter used in the test.

Make (brand), model, and size of respirator(s) fitted.

a. Qualitative Fit Testing. Qualitative fit testing may be performed using irritant smoke, isoamyl acetate (banana oil), saccharin mist, or the Bitrex™ method. Fit testing shall conform to the procedures in appendix B6-C.

b. Quantitative Fit Testing. To wear full face, negative pressure, air-purifying respirators in atmospheres up to their assigned protection factor of 50, personnel must be quantitatively fit tested and the respirator must achieve a fit factor of at least 500, which equates to a safety factor of 10. This type of fit testing can only be performed by, and shall be requested from, shore activities.

B0609. INSPECTION, CLEANING, STORAGE AND MAINTENANCE OF RESPIRATORS

To ensure adequate performance and proper sanitation, respirators shall be maintained as follows:

a. Inspections. All respirators shall be inspected routinely before and after each use. Emergency use respirators shall be inspected after each use and at least monthly. Emergency respirator inspection records must be maintained for the life of the respirator. SCBAs shall be inspected periodically to ensure proper function during an emergency response and after each use and at least monthly. Follow manufacturer's recommendations for respirator inspection. General inspection guidance to identify respirator deficiencies is listed below:

(1) **Head Straps or Head Harness**. Examine straps or harness for breaks, loss of elasticity, broken or malfunctioning buckles and attachments (full facepiece only), excessively worn serrations on the head harness which might permit slippage.

(2) **Facepiece**. Examine facepiece for excessive dirt; cracks, tears, holes, or distortion from improper storage; inflexibility (stretch and massage to restore flexibility); cracked or badly scratched lenses in full facepieces; incorrectly mounted full facepiece lens or broken or missing mounting clips; cracked or broken air-purifying element holder(s), badly worn threads, or missing gasket(s) (if required).

(3) **Inhalation and Exhalation Valves.** Examine exhalation valves for foreign material, such as detergent residue, dust particles, or human hair under the valve seat; cracks, tears, or distortion in the valve material; improper insertion of the valve body in the facepiece; cracks, breaks, or chips in the valve body, particularly in the sealing surface; missing or defective exhalation valve cover; improper installation of the valve in the valve body.

(4) **Cartridge, Canister, or Filter.** Incorrect cartridge, canister, or filter for the hazard; incorrect installation, loose connections, missing or worn gaskets, or cross-threading in holder; expired shelf-life date on cartridge or canister; evidence of prior use of sorbent cartridge or canister, indicated by absence of sealing material, tape, foil, etc., over inlet.

(5) **Corrugated Breathing Tubes.** Broken or missing end connectors; missing or loose hose clamps; deterioration, determined by stretching the tube and looking for cracks.

(6) **Harness of a Front- or Back-mounted Gas Mask.** Damage or wear to the canister holder which may prevent its being held securely in place; broken harness straps or fastening.

(7) **Hoods, Helmets, Blouses, or Full Suits.** Examine for rips and tears and seam integrity; examine the protective headgear, if required, for general condition, with emphasis on the suspension inside the headgear; examine the protective face shield, if any, for cracks or breaks or impaired vision due to rebounding abrasive particles; ensure the protective screen is intact and secured correctly over the face shield of abrasive blasting hoods and blouses.

(8) **Air Supply Systems.** Examine for integrity and good condition of the air supply lines and hoses, including attachments and end fittings; correct operation and condition of all regulators, valves, or other air-flow regulators.

b. Cleaning, Sanitizing, and Storage. Respirators shall be cleaned and sanitized according to manufacturer's instructions or as follows:

(1) Remove and discard all used cartridges and filters.

(2) Disassemble and hand wash the facepiece and parts in a warm water and mild dishwashing detergent solution. Strong cleaning agents can damage respirator parts. Temperatures above 43°C (110°F) and vigorous mechanical agitation shall be avoided. Solvents (e.g., paint removers) that can affect rubber and other parts, shall not be used. Ultrasonic or other suitable washers may be used per manufacturer's instructions.

(3) Sanitize the facepiece using one of the following methods:

(a) Immerse the facepiece for two minutes in a warm water (43° C or 110° F) solution of hypochlorite solution (approximately one milliliter of liquid laundry bleach to one liter of water); or

(b) Immerse the facepiece for two minutes in a warm water (43° C or 110° F) solution of iodine (add 0.8 milliliters of tincture of iodine to one liter of water); or

(c) Immerse the facepiece for two minutes in a warm water (43 °C or 110° F) solution of approved commercially available cleansers of equivalent disinfectant quality when used as directed, if their use is recommended or approved by the respirator manufacturer.

(4) Rinse in clean warm water not to exceed a temperature above 43°C (110°F).

(5) Air-dry in a clean uncontaminated area in such a way as to prevent distortion of the facepiece. If drying cabinets are used, the drying temperature shall not exceed 43°C or 110°F.

(6) Reassemble and reinspect respirator. If replacement parts are necessary, they shall be obtained and installed or the respirator shall be removed from service until the unserviceable parts are replaced. If parts are not available and cannot be replaced, discard the entire facepiece as it cannot be used without all parts in place. Interchanging of parts is prohibited.

(7) Place respirator in a clean plastic bag or other container and seal. Zip-lock plastic bags are preferred. Ensure the respirator is completely dry before sealing to prevent mildew.

(8) Store flat in a clean, dry, uncontaminated area without crowding which may distort the respirator facepiece.

c. Repair and Maintenance

(1) Personnel shall not service/repair any respirators for which they have not been specifically trained.

(2) No work shall be performed on reducing valves, regulators or alarms of atmosphere-supplying respirators (e.g., air-line respirators and SCBAs). These items shall be returned to the manufacturer for all repairs and adjustments.

B0610. ENTRY INTO IMMEDIATELY DANGEROUS TO LIFE OR HEALTH (IDLH) ATMOSPHERES

a. Respirators. Should it become necessary to enter an IDLH atmosphere, only the following two types of respirators shall be used:

(1) A full facepiece, pressure-demand self-contained breathing apparatus (SCBA).

(2) A full facepiece pressure demand air-line respirator equipped with an auxiliary self-contained air supply having a minimum rated service life of 15 minutes. The self-contained air supply of 15 minutes must be sufficient to ensure escape from the IDLH area. These may only be used to enter an IDLH atmosphere when connected to the supplied air (airline) source. The auxiliary self-contained air supply may only be used for egress purposes. If the self-contained air supply (15-minute supply) is insufficient to ensure escape, then a SCBA with a minimum service life of 30 minutes must be used.

NOTE:

Although specified by reference B6-7, the equipment required in paragraphs B0610a(1) and (2) is not on the allowance lists of many ships. If the respirators

required are not carried aboard ship, an oxygen breathing apparatus (OBA) may be used for entry into atmospheres which are or are potentially IDLH when all of the following three conditions are met: underway, required by an emergency or for operational readiness reasons, and approved by the commanding officer. For situations which are not an emergency or operational readiness, entry shall be delayed until the ship returns to port and the entry may be made by an activity which has proper respiratory protection equipment. The above requirements do not apply to use of an OBA for damage control or firefighting.

b. Standby Personnel. At least one trained standby person, with a suitable respirator per paragraph B0610a, shall be present in the nearest uncontaminated area. If the standby person enters the IDLH atmosphere, there shall be a second standby person with a suitable respirator in the uncontaminated area.

c. Communications. The standby person and those persons working in the IDLH atmosphere shall be able to communicate continuously with each other (i.e., visually, by telephone or radio or signal line).

d. Rescue Equipment. Persons who enter any IDLH atmosphere shall also be equipped with safety harnesses and lines that can be used to rescue them should they lose consciousness. A hoist shall be present for removing personnel from the IDLH atmosphere. For more information on rescue operations and gas free engineering, refer to chapter B8.

CAUTION

Tanks, voids, compartments and other confined spaces may contain atmospheres that are hazardous to life or health. This may be due to the presence of flammable or toxic air contaminants or the absence of sufficient oxygen to sustain life. No one shall be permitted to enter any such area until tests of the atmosphere are completed by a qualified gas free engineer and entry by personnel is authorized by competent authority.

CAUTION

Educators located in remote spaces, if activated, can remove all breathing air. Ensure sufficient make-up air is provided and the space has adequate oxygen prior to entry in all educator-equipped remote spaces.

B0611. BREATHING AIR REQUIREMENTS

a. Air Quality. Breathing air or the air output of pumps or compressors which are sources of breathing air for air-line respirators or SCBAs shall meet at least the minimum requirements for Grade-D breathing air per references B6-1 B6-8 and B6-11. For SCBAs on submarines, the breathing air shall meet the minimum requirements of reference B6-11.

b. Ship's Low Pressure (LP) Air Compressors. Ship's LP air is not suitable for use as breathing air unless specifically tested and certified to meet the purity standards in paragraph B0611.a.

c. Ambient Air Breathing Apparatus (AABA). Air intakes for portable pumps such as the AABA shall be placed in an area free of contaminants. Periodic testing of the air quality from an AABA is not required. AABAs shall not be used for entry into IDLH atmospheres.

d. Frequency of Testing. The air output of compressors used by breathing air shall be tested quarterly. Quarterly testing of breathing air does not apply to the Navy's diving program or AABAs. Reference B6-9 addresses diving air requirements.

e. Carbon Monoxide or High Temperature Alarms for Breathing Air Compressors Containing Oil. Ships shall equip compressor systems with either high-temperature or carbon monoxide monitor and alarm systems or both, to control carbon monoxide levels. High-temperature cut-off switches on fixed compressors, which shut down the compressor at a temperature below which the lubricating oil breaks down (i.e., thermal degradation point), meet the requirement for high-temperature alarms, provided that quarterly monitoring meets the requirements for Grade-D breathing air. Ships shall equip all new and/or upgraded FIXED breathing air compressor systems with

high-temperature cut-off switches. New and/or upgraded PORTABLE breathing air compressor systems will be equipped or operated with carbon monoxide monitor and alarm systems during SCBA air cylinder charging operations. Calibrate monitor and alarm systems on compressors used for supplying breathing air according to the manufacturer's instructions.

B0612. RESPIRATORY PROTECTION TRAINING

a. Proper respirator training is essential for personnel required to wear respirators and for supervisors of those wearing respirators. Documented training shall be given prior to respirator use and annually thereafter, and shall include the following topics:

(1) Proper fitting and wearing of the respirator, including how to perform user seal checks. Each person shall demonstrate the capability to don and wear each type of respirator to be worn in the performance of normal and emergency duties including situations in which the respirator malfunctions.

(2) Respirator capabilities and limitations.

(3) Why the respirator is necessary, including the nature and degree of respiratory hazards and how improper fit, usage, or maintenance can compromise the protective effect of the respirator

(4) Proper respirator selection according to intended use.

(5) Respirator care, cleaning, maintenance, inspection, and storage.

(6) Prohibition against facial hair.

(7) How to recognize medical signs and symptoms that may limit or prevent the effective use of respirators.

(8) Wearing of spectacles, corrective glasses, face shields, goggles or other eye and face protection equipment shall not interfere with the seal of the facepiece to the face.

(9) Wearing of contact lenses in contaminated atmospheres is permitted.

(10) The general requirements of this chapter.

b. RPM's shall attend the Respiratory Protection Program Management Course (CIN A-493-0072) available from NAVOSHENVTRACEN.

c. Personnel assigned to issue respiratory protective equipment shall be trained on respirator selection, and care and maintenance prior to assignment and annually thereafter. The facility RPM should give the training.

d. See chapter A5 for training aids to assist in respiratory protection training.

B0613. MEDICAL EVALUATIONS

a. Military personnel, who have been confirmed by the MDR as having no deployment limiting medical conditions, and with a current annual PHA per reference B6-3 are considered qualified to wear any type of respiratory protection. Shipboard personnel undergoing shore firefighting training are not required to obtain medical qualification or respirator fit testing for self-contained breathing apparatuses (SCBA), including the oxygen breathing apparatus (OBA), prior to reporting for training.

Special evaluations shall be performed after prolonged absences from work for medical reasons or whenever a potential respirator-related medical problem has been identified.

b. In cases where individual medical readiness (IMR) status is not known, a formal respirator certification using the medical matrix examination #716 in reference B6-10 should be performed as in the past. In these cases, the following medical care providers can perform examination #716: a physician or a registered/occupational health nurse, physician's assistant, preventive medicine technician (NEC 8432), or a hospital corpsman (independent duty technician NEC 8425, or submarine medical technician (NEC 8402) only) under the supervision of a physician may conduct the medical evaluation.

B0614. SUBMARINE RESPIRATORY PROTECTION

a. Respiratory protection program requirements are only applicable to submarine operations in port. When respiratory protection is required at sea, the installed emergency air breathing (EAB) system is the primary protection. Nuclear system welders may use metal fume respirators with their welding goggles.

b. Submarine squadrons or naval submarine support commands (NSSCs) activities shall serve as the respiratory protection manager (RPM) activities for the submarines assigned. NSSC or squadron commander shall designate a RPM to provide support to all submarine units under their cognizance. Submarines shall designate an individual to serve as the respiratory protection assistant (RPA) for that unit.

c. Submarine respiratory protection programs shall comply with the following requirements:

(1) Proper respirator training is essential for personnel required to wear respirators and for supervisors of those wearing respirators. Required training shall be given and documented prior to respirator use and annually thereafter, and shall include the following topics:

(a) Proper fitting and wearing of the respirator, including how to perform user seal checks. Each person shall demonstrate their capability to don and doff each type of respirator to be worn in the performance of normal and emergency duties including situations in which the respirator malfunctions.

(b) Respirator capabilities and limitations including respirator and cartridge service life and warning signs of respirator failure.

(c) Nature and degree of respiratory hazards and the effects from exposure to the hazardous atmosphere.

(d) Proper respirator selection according to intended use.

(e) Respirator care, cleaning, maintenance and storage.

(f) Prohibition against facial hair.

(g) How to recognize medical signs and symptoms that may limit or prevent the effective use of respirators.

(h) Wearing of corrective glasses, goggles or other eye and face protection shall not interfere with the seal of the facepiece to the face.

(i) Wearing of contact lenses in contaminated atmospheres is permitted.

d. Respiratory protection managers (RPM) at submarine squadrons or NSSCs shall attend Respiratory Protection Program Management (RPPM) course (CIN A-493-0072). Courses are available from the Navy Occupational Safety and Health and Environmental Training Center (NAVOSHENVTRACEN).

(1) Personnel assigned to issue respiratory protective equipment shall be trained on respirator selection, and care and maintenance prior to assignment and annually thereafter. The training should be given by the facility RPM.

(2) Submarine personnel assigned as the RPA shall be trained by the NSSC or squadron designated RPM. Training shall include local guidance and program standard operating procedures, respirator selection, care and maintenance, fit-testing procedures, and respirator user training. Training shall be conducted upon initial assignment and annually thereafter.

(3) See chapter A5 for training aids to assist in respiratory protection training. Department heads, division officers, leading petty officers, and the MDR shall be trained annually on the recognition of work requiring respirators, respiratory protection procedures, and the proper use of respirators.

e. Responsibilities

(1) Per paragraph B0614(b), **NSSC or squadron commanders** shall designate a RPM to provide support to all submarine units under their cognizance.

(2) **The RPM shall:**

(a) Ensure that up-to-date command guidance exists on respiratory protection. Such guidance will normally be issued in this chapter; however, information unique to the command may be written into a command directive.

(b) Develop and maintain a roster of personnel enrolled in the respiratory protection program.

(c) For respirators needed while underway (e.g., nuclear welders), provide guidance to submarine RPAs and supply officers on the selection of proper types and stock levels of respiratory protective equipment. Sufficient respirators, spare parts, and expendable supplies (e.g., cartridges and filters) shall be stocked to conduct all operations."

(d) Ensure respirator users and supervisors of those wearing respirators are trained on respiratory protection requirements. This training shall be repeated annually.

(e) Ensure appropriate fit testing is performed for all respirator users. Fit testing may be conducted by squadron/NSSC RPM, submarine RPA, supporting intermediate maintenance activity (IMA), or other sources. Fit testing results will be documented and contain the following minimum elements:

1. Name, rate/rank, division, department.
2. Date of current periodic military physical and/or preventive health assessment.
3. Date of fit-test and by whom.
4. Fit-test medium (material used (e.g., Bitrex, irritant smoke)) and type of cartridge(s) or filter used in the test.
5. Make (brand), model, and size of respirator(s) fitted.

(f) Provide the supporting submarine intermediate maintenance activity (IMA) or central respirator

issue/control point an electronic copy of respirator fit test results to contain as a minimum:

1. Name.
2. Last respirator training date.
3. Date medically qualified.
4. Respirator successfully fit tested (brand, model, size).
5. Name of fit tester/date/command.

(g) Coordinate with the supporting submarine IMA to determine what respirators (brand, model, and size) are available for issue.

(h) Train submarine RPAs initially upon assignment and annually thereafter. Training shall include local guidance and program standard operating procedures, respirator selection, care and maintenance, fit testing procedures, and respirator user training procedures.

(i) Provide submarine RPAs with a copy of the local guidance or standard operating procedures, roster of personnel in the respiratory protection program, standard submarine respiratory protection lesson plan for training, and sufficient supplies to conduct fit testing and training.

(j) Provide submarine RPAs with a letter verifying training by the RPM.

(k) Evaluate the overall program annually and evaluate compliance of each submarine unit at least once during each in port availability period to include a review of procedures, fit testing and training conducted by appointed RPAs. A checklist for program evaluation is provided in appendix B6-A.

(l) Ensure a baseline or periodic industrial hygiene survey (IH) has been conducted of all processes and areas where there is the risk of occupational exposure to air contaminants. The IH survey will provide recommendations on the

types of respiratory protection required for various processes, areas, and situations.

(m) Coordinate with the submarine IMA, squadrons and NSSC to establish a central respirator issue/control point for issuing, maintaining, and storing respirators.

(n) Ensure respirators are inspected, cleaned, disinfected, maintained, and stored per paragraph B0609.

(3) **Submarine commanding officers** shall appoint at least one RPA (for two-crew submarines, each crew shall have at least one RPA).

(4) **The RPA** shall:

(a) Assist the NSSC/squadron RPM in the management of the program for his submarine.

(b) Maintain a copy of the local guidance or standard operating procedures, roster of personnel in the respiratory protection program, standard submarine respiratory protection lesson plan for training, and sufficient supplies to conduct fit testing and training.

(c) Ensure respirator users and supervisors of those wearing respirators are trained on respiratory protection requirements. This training shall be repeated annually.

(d) Ensure appropriate fit-testing is performed for all respirator users. Recordkeeping for fit-testing shall include type of respirator, brand name and model, method of test, test results, test date, name of the instructor/tester, and name of the individual tested.

(e) Provide command guidance for work processes that may require use of respiratory protection, as identified in the industrial hygiene survey.

(f) Issue respirators to personnel requiring respiratory protection.

(5) Division officers shall:

(a) Ensure that personnel have a current fit test and training prior to donning a respirator.

(b) For respirators needed while in port, ensure personnel obtain required respirator from the supporting submarine IMA, NSSC, or squadron.

(c) Ensure non-disposable respirators are returned to supporting submarine IMA when work is completed and prior to getting underway.

(d) Provide respirators needed while underway (e.g., nuclear systems welders).

(6) The MDR shall:

(a) Confirm that personnel, who are issued respirators have no deployment limiting medical conditions, and have a current annual PHA per reference B6-3 (see paragraph B0613).

(b) Assist the RPM and/or RPA in identifying and evaluating hazards and selecting appropriate respirators, as recommended in the industrial hygiene survey.

(7) Supporting submarine IMAs shall:

(a) Upon request, schedule/provide initial or refresher fit-testing and training for the submarine respirator users while in port.

(b) Upon request establish a respirator central control point and provide only the respirators needed by submarines in port. Respirators will only be issued to personnel with respirator user cards described in paragraph B0614e(2)(f).

(c) Provide a standard submarine respiratory protection lesson plan to RPMs and submarine RPAs for use in training their crews.

(8) Personnel required to wear a respirator to perform in-port work shall:

(a) Wear the provided respirator when required and in a proper manner.

(b) Inspect the respirator before and after each use per paragraph B0609a.

(c) Perform a positive and negative respirator facepiece seal check prior to each use per paragraph B0607b.

(d) Report any malfunction of the respirator to their immediate supervisor and the RPA.

(e) Prevent damage or loss of respiratory protective equipment.

f. Procedures

(1) Personnel shall report to the RPA or RPM for fit-testing and training. Those personnel who do not have a current (within one year) record of fit-testing/training shall be fit-tested and trained by the RPA, RPM or submarine supporting IMA

(2) All personnel shall receive the following training prior to respirator issue from the respirator issuing facility:

(a) Respirator inspection procedures.

(b) Positive and negative facepiece seal checks.

(c) Respirator/cartridge service life.

(d) Warning signs of respirator failure.

Respirators/cartridges shall be issued for the duration of the job.

(3) Upon completion of work, disposable respirators shall be disposed of; non-disposable respirators shall be returned to the supplying activity.

g. Training. Department heads, division officers, leading petty officers, and the MDR shall be trained annually on the recognition of work requiring respirators, respiratory protection procedures, and the proper use of respirators.

CHAPTER B6

REFERENCES

- B6-1. 29 CFR 1910.134 Respiratory Protection
http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=12716
- B6-2. NAVSEA S9213-33-MMA-000/V, Radiological Controls for Ships
- B6-3. OPNAVINST 6120.3
- B6-4. OPNAVINST 5100.23G
- B6-5. NEHC Technical Manual, NEHC-TM6290.91-2, Industrial Hygiene Field Operations Manual, chapter 9, Respiratory Protection,
http://www-nehc.med.navy.mil/downloads/ih/ihfom/IHFOM_CH9.pdf
- B6-6. 42 CFR 84, Approval of Respiratory Protection Devices
- B6-7. Naval Ships Technical Manual (NSTM) 074, Volume 3, Gas Free Engineering
- B6-8. Compressed Gas Association, Inc., Commodity Specification for Air, Pamphlet G-7.1-2004 (NOTAL)
- B6-9. OPNAVINST 3150.27B
- B6-10. NEHC Technical Manual OM 6260, Occupational Medical Surveillance Procedures Manual and Medical Matrix
<http://www-nehc.med.navy.mil/occmed/Matrix.htm>.

OPNAVINST 5100.19E
30 May 2007

B6-11. NAVSEA S9510-AB-ATM-010(U), Nuclear Powered Submarine
Atmosphere Control Manual

Appendix B6-A

Respirator Program Checklist

Program Element	Yes	No	N/A
Is a respiratory protection manager (RPM) appointed in writing by the commanding officer? (paragraph B0602(a))			
Has the RPM completed the required training described in paragraphs B0602(b)(1) and B0612(b)?			
Has a baseline or periodic industrial hygiene survey been conducted of all processes and areas where there is the risk of occupational exposure to air contaminants? (paragraph B0602(b)(2))			
Does the industrial hygiene survey provide recommendations on the types of respiratory protection required for various processes, areas, and situations? (paragraph B0602(b)(2))			
Are there a sufficient supply of NIOSH or NIOSH approved respirators, spare parts, and expendable supplies (e.g., cartridges and filters) maintained to conduct routine and emergency operations? (paragraph B0602(b)(3))			
Are there a sufficient number of respirator models and sizes so that the respirator is acceptable to, and correctly fits, the users? (paragraph B0602(b)(3))			
Is a current roster of personnel enrolled in respiratory protection maintained and provided to the medical department representative (paragraph B0602(b)(4))?			
Is fit testing performed initially and annually and documented per paragraph B0608? (paragraphs B0602(b)(5) and B0603(h))			
Are central control points established for issuing and maintaining respiratory protection equipment? (paragraph B0602(b)(6))			
Are divisions that frequently use respirators and personnel who are assigned individual respirators allowed to maintain custody of their own respiratory protection equipment and are responsible for its proper care and storage? (paragraph B0602(b)(6))			

Program Element	Yes	No	N/A
Are respirators inspected, cleaned, disinfected, stored, maintained and repaired per paragraph B0609? (paragraph B0602(b)(7))			
Is the respirator program evaluated at least annually by the RPM using this checklist (paragraph B0602(b)(9)) and evaluated by the industrial hygiene office performing baseline and periodic industrial hygiene surveys? (paragraph B0603(1))			
Has the medical department representative (MDR) confirmed that personnel, who are issued respirators have no deployment limiting medical conditions, and have a current annual Preventive Health Assessment per OPNAVINST 6120.3 and paragraph B0613? (paragraph B0602(d)(1))			
Does the MDR assist the RPM in identifying and evaluating hazards and selecting appropriate respirators, as recommended in the industrial hygiene survey? (paragraph B0602(d)(2))?			
Do respirator issuers issue respirators only to personnel who are trained, medically certified per paragraph B0613, and successfully fit-tested for the respirator(s) requested? (paragraph B0602(e))			
Are respirator issuers trained initially and annually by the facility RPM on respirator selection, care and maintenance? (paragraph B0612(c))			
Do all hands inspect their respirator before and after each use; perform user seal checks, prevent damage to or loss of respirators; and report any malfunction of the respirator to their immediate supervisor? (paragraph B0602(f))			
Are there written standard operating procedures (SOPs) governing the selection, care, issue, and use of respirators, including worksite SOPs? (paragraph B0603(c))			
Are only NIOSH approved respirators selected and issued? (paragraph B0603(d))			
Are only hoses supplied by the respirator manufacturer as part of the complete supplied-air assemblage used? (paragraph B0606(c))			

Program Element	Yes	No	N/A
Are air-line couplings incompatible with outlet couplings for other gas systems to prevent inadvertent servicing with non-respirable gases or oxygen? (paragraph B0606(c))			
Are tight fitting respirators not allowed to be worn when conditions such as facial hair, facial scars, or prescription eyeglasses prevent a good respirator seal? (paragraph B0607(a)(4))			
Are particulate filters changed or filtering facepiece respirators discarded when breathing resistance is first noticed? (paragraph B0607(c)(1))			
Are emergency use respirators inspected after each use and at least monthly and are inspection records maintained for the life of the respirator (paragraph B0609(a))?			
Are only SCBA or combination airline/SCBA allowed for entry into IDLH atmospheres? (paragraph B0610(a)(2))			
During entry into IDLH atmospheres, is at least one trained standby person, with a suitable respirator per paragraph B0610a, present in the nearest uncontaminated area? If the standby person enters the IDLH atmosphere, is there a second standby person with a suitable respirator in the uncontaminated area? (paragraph B0610(b))			
During entry into IDLH atmospheres, is the standby person and those persons working in the IDLH atmosphere able to communicate continuously with each other, i.e., visually, by telephone or radio or signal line? (paragraph B0610(c))			
Are personnel entering into IDLH atmospheres also equipped with safety harnesses and lines that can be used to rescue them should they lose consciousness? (paragraph B0610(d))			
Is a hoist present for removing personnel from the IDLH atmosphere? (paragraph B0610(d))?			

Program Element	Yes	No	N/A
Is entry into tanks, voids, compartments and other confined spaces prohibited until tests of the atmosphere are completed by a qualified gas free engineer and entry by personnel is authorized by competent authority? (paragraph B0610(d))			
Are breathing air sources tested quarterly to ensure they meet Grade D air quality requirements of paragraph B0611? (paragraphs B0602(b) (8) and B0611(d))			
Is ship's low pressure air prohibited from use as breathing air unless specifically tested and certified to meet the purity standards in paragraph B0611(a). (paragraph B0611(b))?			
Are air intakes for portable pumps such as the AABA placed in an area free of contaminants? (paragraph B0611(c))			
Are fixed air compressor systems equipped with high-temperature cut-off switches, which shut down the compressor at a temperature below which the lubricating oil breaks down (i.e., thermal degradation point) and do these compressors meet quarterly requirements for Grade D breathing air? (paragraph B0611(e))			
New and/or upgraded fixed breathing air compressor systems equipped with high-temperature cut-off switches? (paragraph B0611(e))			
New and/or upgraded portable breathing air compressor systems equipped or operated with carbon monoxide monitor and alarm systems during SCBA air cylinder charging operations? (paragraph B0611(e))			
Are monitor and alarm systems on compressors used for supplying breathing air calibrated according to the manufacturer's instructions? (paragraph B0611(e))			
Are respirator wearers trained initially and annually per paragraph B0612?			

Appendix B6-B TYPES OF RESPIRATORS



Filtering Facepiece



Half-mask



Full face



Airline/SCBA



SCBA



EEBD

Appendix B6-C

Qualitative Respirator Fit Test Protocols

1. Fit Testing Procedures - General Requirements

The tester shall conduct fit testing using the following procedures. The requirements in this appendix apply to all OSHA- accepted fit test methods, both qualitative fit test (QLFT) and quantitative fit test (QNFT).

a. The test subject shall be allowed to pick the most acceptable respirator from a sufficient number of respirator models and sizes so that the respirator is acceptable to, and correctly fits, the user.

b. Prior to the selection process, the test subject shall be shown how to put on a respirator, how it should be positioned on the face, how to set strap tension and how to determine an acceptable fit. A mirror shall be available to assist the subject in evaluating the fit and positioning of the respirator. This instruction may not constitute the subject's formal training on respirator use, because it is only a review.

c. The test subject shall be informed that he/she is being asked to select the respirator that provides the most acceptable fit. Each respirator represents a different size and shape, and if fitted and used properly, will provide adequate protection.

d. The test subject shall be instructed to hold each chosen facepiece up to the face and eliminate those that obviously do not give an acceptable fit.

e. The more acceptable facepieces are noted in case the one selected proves unacceptable; the most comfortable mask is donned and worn at least five minutes to assess comfort. Assistance in assessing comfort can be given by discussing the points in the following item I.6. If the test subject is not familiar with using a particular respirator, the test subject shall be directed to don the mask several times and to adjust the straps each time to become adept at setting proper tension on the straps.

f. Assessment of comfort shall include a review of the following points with the test subject and allowing the test subject adequate time to determine the comfort of the respirator:

- (1) Position of the mask on the nose,
- (2) Room for eye protection,
- (3) Room to talk,
- (4) Position of mask on face and cheeks.

g. The following criteria shall be used to help determine the adequacy of the respirator fit:

- (1) Chin properly placed;
- (2) Adequate strap tension, not overly tightened;
- (3) Fit across nose bridge;
- (4) Respirator of proper size to span distance from nose to chin;
- (5) Tendency of respirator to slip;
- (6) Self-observation in mirror to evaluate fit and respirator position.

h. The test subject shall conduct a user seal check, either the negative and positive pressure seal checks described in paragraph B0607 or those recommended by the respirator manufacturer which provides equivalent protection to the procedures in paragraph B0607. Before conducting the negative and positive pressure checks, the subject shall be told to seat the mask on the face by moving the head from side-to-side and up and down slowly while taking in a few slow deep breaths. Another facepiece shall be selected and retested if the test subject fails the user seal check tests.

i. The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface, such as stubble beard growth, beard, mustache or sideburns which

cross the respirator sealing surface. Any type of apparel which interferes with a satisfactory fit shall be altered or removed.

j. If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician or other licensed health care professional, as appropriate, to determine whether the test subject can wear a respirator while performing her or his duties.

k. If the employee finds the fit of the respirator unacceptable, the test subject shall be given the opportunity to select a different respirator and to be retested.

l. Exercise regimen. Prior to the commencement of the fit test, the test subject shall be given a description of the fit test and the test subject's responsibilities during the test procedure. The description of the process shall include a description of the test exercises that the subject will be performing. The respirator to be tested shall be worn for at least five minutes before the start of the fit test.

m. The fit-test shall be performed while the test subject is wearing any applicable safety equipment that may be worn during actual respirator use which could interfere with respirator fit.

n. Test Exercises: The following test exercises are to be performed for all fit-testing methods prescribed in this appendix. The test subject shall perform exercises, in the test environment, in the following manner:

(1) Normal breathing. In a normal standing position, without talking, the subject shall breathe normally.

(2) Deep breathing. In a normal standing position, the subject shall breathe slowly and deeply, taking caution so as not to hyperventilate.

(3) Turning head side to side. Standing in place, the subject shall slowly turn his/her head from side to side between the extreme positions on each side. The head shall be held at each extreme momentarily so the subject can inhale at each side.

(4) Moving head up and down. Standing in place, the subject shall slowly move his/her head up and down. The subject shall be instructed to inhale in the up position (i.e., when looking toward the ceiling).

(5) Talking. The subject shall talk out loud slowly and loud enough so as to be heard clearly by the test conductor. The subject can read from a prepared text such as the Rainbow Passage, count backward from 100, or recite a memorized poem or song.

Rainbow Passage

When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow.

(6) Grimace. The test subject shall grimace by smiling or frowning. **(This applies only to QNFT testing; it is not performed for QLFT.)**

(7) Bending over. The test subject shall bend at the waist as if he/she were to touch his/her toes. Jogging in place shall be substituted for this exercise in those test environments such as shroud type QNFT or QLFT units that do not permit bending over at the waist.

(8) Normal breathing. Same as exercise (1).

(9) Each test exercise shall be performed for one minute except for the grimace exercise which shall be performed for 15 seconds. The test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become unacceptable, another model of respirator shall be tried. The respirator shall not be adjusted once the fit test exercises begin. Any adjustment voids the test, and the fit test must be repeated.

2. Isoamyl Acetate (IAA) Fit Test

Note: This protocol is not appropriate to use for the fit testing of particulate respirators. If used to fit test particulate respirators, the respirator must be equipped with an organic vapor filter.

Odor Threshold Screening

Odor threshold screening, performed without wearing a respirator, is intended to determine if the individual tested can detect the odor of isoamyl acetate at low levels.

- a. Three 1 liter glass jars with metal lids are required.
- b. Odor-free water (e.g., distilled or spring water) at approximately 25 degrees C (77 degrees F) shall be used for the solutions.
- c. The isoamyl acetate (IAA) (also known as isopentyl acetate) stock solution is prepared by adding 1 ml of pure IAA to 800 ml of odor-free water in a one liter jar, closing the lid and shaking for 30 seconds. A new solution shall be prepared at least weekly.
- d. The screening test shall be conducted in a room separate from the room used for actual fit testing. The two rooms shall be well-ventilated to prevent the odor of IAA from becoming evident in the general room air where testing takes place.
- e. The odor test solution is prepared in a second jar by placing 0.4 ml of the stock solution into 500 ml of odor-free water using a clean dropper or pipette. The solution shall be shaken for 30 seconds and allowed to stand for two to three minutes so that the IAA concentration above the liquid may reach equilibrium. This solution shall be used for only one day.
- f. A test blank shall be prepared in a third jar by adding 500 cc of odor-free water.
- g. The odor test and test blank jar lids shall be labeled (e.g., 1 and 2) for jar identification. Labels shall be placed on the lids so that they can be peeled off periodically and switched to maintain the integrity of the test.

h. The following instruction shall be typed on a card and placed on the table in front of the two test jars (i.e., 1 and 2):

"The purpose of this test is to determine if you can smell banana oil at a low concentration. The two bottles in front of you contain water. One of these bottles also contains a small amount of banana oil. Be sure the covers are on tight, then shake each bottle for two seconds. Unscrew the lid of each bottle, one at a time, and sniff at the mouth of the bottle. Indicate to the test conductor which bottle contains banana oil."

i. The mixtures used in the IAA odor detection test shall be prepared in an area separate from where the test is performed, in order to prevent olfactory fatigue in the subject.

j. If the test subject is unable to correctly identify the jar containing the odor test solution, the IAA qualitative fit test shall not be performed.

k. If the test subject correctly identifies the jar containing the odor test solution, the test subject may proceed to respirator selection and fit testing.

3. IAA Fit-Test

a. The fit-test chamber shall be a clear 55-gallon drum liner suspended inverted over a two-foot diameter frame so that the top of the chamber is about six inches above the test subject's head. If no drum liner is available, a similar chamber shall be constructed using plastic sheeting. The inside top center of the chamber shall have a small hook attached.

b. Each respirator used for the fitting and fit testing shall be equipped with organic vapor cartridges or offer protection against organic vapors.

c. After selecting, donning, and properly adjusting a respirator, the test subject shall wear it to the fit testing room. This room shall be separate from the room used for odor threshold screening and respirator selection, and shall be well ventilated, as by an exhaust fan or lab hood, to prevent general room contamination.

d. A copy of the test exercises and any prepared text from which the subject is to read shall be taped to the inside of the test chamber.

e. Upon entering the test chamber, the test subject shall be given a 6-inch by 5-inch piece of paper towel, or other porous, absorbent, single-ply material, folded in half and wetted with 0.75 ml of pure IAA. The test subject shall hang the wet towel on the hook at the top of the chamber. An IAA test swab or ampoule may be substituted for the IAA wetted paper towel provided it has been demonstrated that the alternative IAA source will generate an IAA test atmosphere with a concentration equivalent to that generated by the paper towel method.

f. Allow two minutes for the IAA test concentration to stabilize before starting the fit test exercises. This would be an appropriate time to talk with the test subject; to explain the fit test, the importance of his/her cooperation, and the purpose for the test exercises; or to demonstrate the exercises in paragraph I.14.

g. If at any time during the test, the subject detects the banana-like odor of IAA, the test is failed. The subject shall quickly exit from the test chamber and leave the test area to avoid olfactory fatigue.

h. If the test is failed, the subject shall return to the selection room and remove the respirator. The test subject shall repeat the odor sensitivity test (paragraph II.(a)), select and put on another respirator, return to the test area and again begin the fit test procedure described in paragraphs II.b.(1) through (7) above. The process continues until a respirator that fits well has been found. Should the odor sensitivity test be failed, the subject shall wait at least five minutes before retesting. Odor sensitivity will usually have returned by this time.

i. If the subject passes the test, the efficiency of the test procedure shall be demonstrated by having the subject break the respirator face seal and take a breath before exiting the chamber.

j. When the test subject leaves the chamber, the subject shall remove the saturated towel and return it to the person

conducting the test, so that there is no significant IAA concentration buildup in the chamber during subsequent tests. The used towels shall be kept in a self-sealing plastic bag to keep the test area from being contaminated.

4. Saccharin Solution Aerosol Protocol. The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.

a. Taste threshold screening. The saccharin taste threshold screening, performed without wearing a respirator, is intended to determine whether the individual being tested can detect the taste of saccharin.

(1) During threshold screening as well as during fit testing, subjects shall wear an enclosure about the head and shoulders that is approximately 12 inches in diameter by 14 inches tall with at least the front portion clear and that allows free movements of the head when a respirator is worn. An enclosure substantially similar to the 3M hood assembly, parts # FT 14 and # FT 15 combined, is adequate.

(2) The test enclosure shall have a 3/4 inch (1.9 cm) hole in front of the test subject's nose and mouth area to accommodate the nebulizer nozzle.

(3) The test subject shall don the test enclosure. Throughout the threshold screening test, the test subject shall breathe through his/her slightly open mouth with tongue extended. The subject is instructed to report when he/she detects a sweet taste.

Note:

If the test subject eats or drinks something sweet before the screening test, he/she may be unable to taste the weak saccharin solution.

(4) Using a DeVilbiss Model 40 inhalation medication nebulizer or equivalent, the test conductor shall spray the threshold check solution into the enclosure. The nozzle is directed away from the nose and mouth of the person. This nebulizer shall be clearly marked to distinguish it from the fit test solution nebulizer.

(5) The threshold check solution is prepared by dissolving 0.83 gram of sodium saccharin USP in 100 ml of warm water. It can be prepared by putting one ml of the fit test solution (see paragraph III(b) (5) below) in 100 ml of distilled water.

(6) To produce the aerosol, the nebulizer bulb is firmly squeezed so that it collapses completely, then released and allowed to fully expand.

(7) Ten squeezes are repeated rapidly and then the test subject is asked whether the saccharin can be tasted. If the test subject reports tasting the sweet taste during the 10 squeezes, the screening test is completed. The taste threshold is noted as 10 regardless of the number of squeezes actually completed.

(8) If the first response is negative, 10 more squeezes are repeated rapidly and the test subject is again asked whether the saccharin is tasted. If the test subject reports tasting the sweet taste during the second 10 squeezes, the screening test is completed. The taste threshold is noted as 20 regardless of the number of squeezes actually completed.

(9) If the second response is negative, 10 more squeezes are repeated rapidly and the test subject is again asked whether the saccharin is tasted. If the test subject reports tasting the sweet taste during the third set of 10 squeezes, the screening test is completed. The taste threshold is noted as 30 regardless of the number of squeezes actually completed.

(10) The test conductor will take note of the number of squeezes required to solicit a taste response.

(11) If the saccharin is not tasted after 30 squeezes (step 10), the test subject is unable to taste saccharin and may not perform the saccharin fit test.

(12) If a taste response is elicited, the test subject shall be asked to take note of the taste for reference in the fit test.

(13) Correct use of the nebulizer means that approximately one ml of liquid is used at a time in the nebulizer body.

(14) The nebulizer shall be thoroughly rinsed in water, shaken dry, and refilled at least each morning and afternoon or at least every four hours.

b. Saccharin solution aerosol fit test procedure

(1) The test subject may not eat, drink (except plain water), smoke, or chew gum for 15 minutes before the test.

(2) The fit test uses the same enclosure described in IIIb.1 above.

(3) The test subject shall don the enclosure while wearing the respirator selected in paragraph I of this appendix. The respirator shall be properly adjusted and equipped with a particulate filter(s).

(4) A second DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent is used to spray the fit test solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the screening test solution nebulizer.

(5) The fit test solution is prepared by adding 83 grams of sodium saccharin to 100 ml of warm water.

(6) As before, the test subject shall breathe through the slightly open mouth with tongue extended, and report if he/she tastes the sweet taste of saccharin.

(7) The nebulizer is inserted into the hole in the front of the enclosure and an initial concentration of saccharin fit test solution is sprayed into the enclosure using the same number of squeezes (either 10, 20 or 30 squeezes) based on the number of squeezes required to elicit a taste response as noted during the screening test. A minimum of 10 squeezes is required.

(8) After generating the aerosol, the test subject shall be instructed to perform the exercises in paragraph I.14. of this appendix.

(9) Every 30 seconds the aerosol concentration shall be replenished using one half the original number of squeezes used initially (e.g., 5, 10 or 15).

(10) The test subject shall indicate to the test conductor if at any time during the fit-test the taste of saccharin is detected. If the test subject does not report tasting the saccharin, the test is passed.

(11) If the taste of saccharin is detected, the fit is deemed unsatisfactory and the test is failed. A different respirator shall be tried and the entire test procedure is repeated (taste threshold screening and fit testing).

(12) Since the nebulizer has a tendency to clog during use, the test operator must make periodic checks of the nebulizer to ensure that it is not clogged. If clogging is found at the end of the test session, the test is invalid.

5. Bitrex TM (Denatonium Benzoate) Solution Aerosol Qualitative Fit Test (QLFT) Protocol. The Bitrex TM (Denatonium benzoate) solution aerosol QLFT protocol uses the published saccharin test protocol because that protocol is widely accepted. Bitrex is routinely used as a taste aversion agent in household liquids which children should not be drinking and is endorsed by the American Medical Association, the National Safety Council, and the American Association of Poison Control Centers. The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.

a. **Taste Threshold Screening.** The Bitrex taste threshold screening, performed without wearing a respirator, is intended to determine whether the individual being tested can detect the taste of Bitrex.

(1) During threshold screening as well as during fit-testing, subjects shall wear an enclosure about the head and shoulders that is approximately 12 inches (30.5 cm) in diameter by 14 inches (35.6 cm) tall. The front portion of the enclosure shall be clear from the respirator and allow free movement of the head when a respirator is worn. An enclosure substantially similar to the 3M hood assembly, parts # FT 14 and # FT 15 combined, is adequate.

(2) The test enclosure shall have a 3/4 inch (1.9 cm) hole in front of the test subject's nose and mouth area to accommodate the nebulizer nozzle.

(3) The test subject shall don the test enclosure. Throughout the threshold screening test, the test subject shall breathe through his or her slightly open mouth with tongue extended. The subject is instructed to report when he/she detects a bitter taste.

(4) Using a DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent, the test conductor shall spray the Threshold Check Solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the fit test solution nebulizer.

(5) The threshold check solution is prepared by adding 13.5 milligrams of Bitrex to 100 ml of 5% salt (NaCl) solution in distilled water.

(6) To produce the aerosol, the nebulizer bulb is firmly squeezed so that the bulb collapses completely, and is then released and allowed to fully expand.

(7) An initial 10 squeezes are repeated rapidly and then the test subject is asked whether the Bitrex can be tasted. If the test subject reports tasting the bitter taste during the 10 squeezes, the screening test is completed. The taste threshold is noted as 10 regardless of the number of squeezes actually completed.

(8) If the first response is negative, 10 more squeezes are repeated rapidly and the test subject is again asked whether the Bitrex is tasted. If the test subject reports tasting the bitter taste during the second 10 squeezes, the screening test is completed. The taste threshold is noted as 20 regardless of the number of squeezes actually completed.

(9) If the second response is negative, 10 more squeezes are repeated rapidly and the test subject is again asked whether the Bitrex is tasted. If the test subject reports tasting the bitter taste during the third set of 10 squeezes, the screening test is completed. The taste threshold is noted as 30 regardless of the number of squeezes actually completed.

(10) The test conductor will take note of the number of squeezes required to solicit a taste response.

(11) If the Bitrex is not tasted after 30 squeezes (step 10), the test subject is unable to taste Bitrex and may not perform the Bitrex fit test.

(12) If a taste response is elicited, the test subject shall be asked to take note of the taste for reference in the fit test.

(13) Correct use of the nebulizer means that approximately one ml of liquid is used at a time in the nebulizer body.

(14) The nebulizer shall be thoroughly rinsed in water, shaken to dry, and refilled at least each morning and afternoon or at least every four hours.

b. Bitrex Solution Aerosol Fit Test Procedure.

(1) The test subject may not eat, drink (except plain water), smoke, or chew gum for 15 minutes before the test.

(2) The fit test uses the same enclosure as that described in paragraph IV.a.(1) above.

(3) The test subject shall don the enclosure while wearing the respirator selected according to paragraph I of this appendix. The respirator shall be properly adjusted and equipped with any type particulate filter(s).

(4) A second DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent is used to spray the fit test solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the screening test solution nebulizer.

(5) The fit-test solution is prepared by adding 337.5 mg of Bitrex to 200 ml of a 5% salt (NaCl) solution in warm water.

(6) As before, the test subject shall breathe through his or her slightly open mouth with tongue extended, and be instructed to report if he/she tastes the bitter taste of Bitrex.

(7) The nebulizer is inserted into the hole in the front of the enclosure and an initial concentration of the fit test solution is sprayed into the enclosure using the same number of

squeezes (either 10, 20 or 30 squeezes) based on the number of squeezes required to elicit a taste response as noted during the screening test.

(8) After generating the aerosol, the test subject shall be instructed to perform the exercises in paragraph I.14. of this appendix.

(9) Every 30 seconds the aerosol concentration shall be replenished using one half the number of squeezes used initially (e.g., 5, 10 or 15).

(10) The test subject shall indicate to the test conductor if at any time during the fit test the taste of Bitrex is detected. If the test subject does not report tasting the Bitrex, the test is passed.

(11) If the taste of Bitrex is detected, the fit is deemed unsatisfactory and the test is failed. A different respirator shall be tried and the entire test procedure is repeated (taste threshold screening and fit testing).

6. Irritant Smoke (Stannic Chloride) Protocol. This qualitative fit-test uses a person's response to the irritating chemicals released in the smoke produced by a stannic chloride ventilation smoke tube to detect leakage into the respirator.

a. General Requirements and Precautions

(1) The respirator to be tested shall be equipped with high efficiency particulate air (HEPA) or P100 series filter(s).

(2) Only stannic chloride smoke tubes shall be used for this protocol.

(3) No form of test enclosure or hood for the test subject shall be used.

(4) The smoke can be irritating to the eyes, lungs, and nasal passages. The test conductor shall take precautions to minimize the test subject's exposure to irritant smoke. Sensitivity varies, and certain individuals may respond to a greater degree to irritant smoke. Care shall be taken when performing the sensitivity screening checks that determine

whether the test subject can detect irritant smoke to use only the minimum amount of smoke necessary to elicit a response from the test subject.

(5) The fit test shall be performed in an area with adequate ventilation to prevent exposure of the person conducting the fit test or the build-up of irritant smoke in the general atmosphere.

b. Sensitivity Screening Check. The person to be tested must demonstrate his or her ability to detect a weak concentration of the irritant smoke.

(1) The test operator shall break both ends of a ventilation smoke tube containing stannic chloride, and attach one end of the smoke tube to a low flow air pump set to deliver 200 milliliters per minute, or an aspirator squeeze bulb. The test operator shall cover the other end of the smoke tube with a short piece of tubing to prevent potential injury from the jagged end of the smoke tube.

(2) The test operator shall advise the test subject that the smoke can be irritating to the eyes, lungs, and nasal passages and instruct the subject to keep his/her eyes closed while the test is performed.

(3) The test subject shall be allowed to smell a weak concentration of the irritant smoke before the respirator is donned to become familiar with its irritating properties and to determine if he/she can detect the irritating properties of the smoke. The test operator shall carefully direct a small amount of the irritant smoke in the test subject's direction to determine that he/she can detect it.

c. Irritant Smoke Fit Test Procedure

(1) The person being fit tested shall don the respirator without assistance, and perform the required user seal check(s).

(2) The test subject shall be instructed to keep his/her eyes closed.

(3) The test operator shall direct the stream of irritant smoke from the smoke tube toward the face seal area of the test

subject, using the low flow pump or the squeeze bulb. The test operator shall begin at least 12 inches from the facepiece and move the smoke stream around the whole perimeter of the mask. The operator shall gradually make two more passes around the perimeter of the mask, moving to within six inches of the respirator.

(4) If the person being tested has not had an involuntary response and/or detected the irritant smoke, proceed with the test exercises.

(5) The exercises identified in paragraph I.14. of this appendix shall be performed by the test subject while the respirator seal is being continually challenged by the smoke, directed around the perimeter of the respirator at a distance of six inches.

(6) If the person being fit tested reports detecting the irritant smoke at any time, the test is failed. The person being retested must repeat the entire sensitivity check and fit test procedure.

(7) Each test subject passing the irritant smoke test without evidence of a response (involuntary cough, irritation) shall be given a second sensitivity screening check, with the smoke from the same smoke tube used during the fit test, once the respirator has been removed, to determine whether he/she still reacts to the smoke. Failure to evoke a response shall void the fit test.

(8) If a response is produced during this second sensitivity check, then the fit test is passed.

CHAPTER B7

ELECTRICAL SAFETY

B0701. DISCUSSION

This chapter provides guidance to assist in the identification of electrical hazards, and to prevent mishaps that could cause injuries and extensive damage to shipboard equipment and may compromise the ship's mission capabilities. Reference B7-1, chapter 300 is the primary reference for detailed technical guidance on electrical hazards and the potential for electric shock. Work involving electric tools, equipment and systems is inherently dangerous. Always use the principles of operational risk management (ORM) when dealing with electricity. Details of ORM are found in reference B7-2.

B0702. RESPONSIBILITIES

a. The commanding officer shall authorize all work on energized equipment per reference B7-1.

b. The safety officer shall ensure electrical/electronic indoctrination training is provided for all newly reporting personnel per paragraph B0708. Coordinate with the electrical officer/electronics material officer to provide this training.

c. The electrical safety officer/electronic maintenance officer shall:

(1) Establish an electrical tool issue room per paragraph B0707.

(2) Ensure that applicable maintenance and repair are conducted per reference B7-3.

(3) Ensure that the on board cardiopulmonary resuscitation (CPR) instructor is certified per paragraph B0708.

(4) Ensure that all electrical tools/equipment received on board are authorized for shipboard use. Reference B7-1 contains guidance on determining suitability for shipboard use.

(5) Complete training per paragraph B0708d.

d. The supply officer shall ensure that all electrical tools/equipment received on board are turned over to the electrical safety office (electrical division for submarines) for a safety inspection prior to issue.

e. Division officers shall:

(1) Ensure that assigned personnel are trained per paragraph B0708.

(2) Ensure that all portable electrical equipment is visually inspected prior to use, and is electrically safety checked according to applicable planned maintenance system (PMS). Reference B7-1 (paragraph 300-2.7) contains detailed technical guidance on portable electric equipment.

(3) Ensure that all personal electrical/electronic equipment is authorized for shipboard use. Reference B7-1 contains guidance on determining suitability for shipboard use. The electrical safety checks for personal electrical/electronic equipment are not required.

(4) Ensure that required personnel receive CPR training per paragraph B0708.

(5) Ensure that items open purchased or received from Navy supply are authorized for shipboard use and electrically safety checked prior to use. Reference B7-1 contains guidance on determining suitability for shipboard use.

(6) Ensure that all personnel experiencing electrical shock report to medical.

f. All hands shall:

(1) Request permission from their division officer prior to bringing personal electrical/electronic equipment aboard. This requirement does not apply to battery-operated

equipment incapable of being plugged into ships' electrical service.

(2) Report any condition, equipment or material that is believed to be unsafe.

(3) Report any electrical shock to their division officer.

(4) Not make any alterations or additions to the ship's electrical system (e.g., adding an electrical receptacle in a berth to use a CD player).

B0703. ELECTRICAL SAFETY ELEMENTS

- a. Working on de-energized equipment. (paragraph B0704)
- b. Working on energized equipment. (paragraph B0705)
- c. Personal protective equipment(PPE). (paragraph B0706)
- d. Portable electrical tool issue. (paragraph B0707)
- e. General precautions for portable electrical equipment. (chapters C9 and D5)
- f. Training. (paragraph B0708)
- g. Safety standards implementation. (chapters C9 and D5 list the electrical safety standards)

B0704. WORKING ON DE-ENERGIZED EQUIPMENT

Completely de-energizing equipment will ensure safety from electrical hazards. Opening the power supply circuit breaker or switch and/or removing the fuses should de-energize electrical equipment. Some equipment has more than one source of power that requires opening multiple breakers or switches and/or removing multiple fuses. Tag-out the circuit breaker switches and fuses. Check the equipment with a voltmeter to ensure that it is completely de-energized before maintenance begins.

- a. For technical requirements concerning work on de-energized equipment, see reference B7-1, paragraph 300-2.4.
- b. For tag-out procedures, see reference B7-3.

B0705. WORKING ON ENERGIZED EQUIPMENT

a. Approval Procedures. As stated in reference B7-1, paragraph 300-2.5.1, do not disassemble or maintain energized electrical equipment without approval of such action by the commanding officer, or in his/her absence, the command duty officer (CDO). Exceptions to this policy are those cases where approved instructions issued by higher authority (equipment technical manuals, planned maintenance system (PMS), or an established troubleshooting procedure) permit opening or inspecting equipment in the course of performing maintenance, routine testing, taking measurements, or making adjustments that require equipment to be energized. Commanding officer permission is not required when checking equipment or circuits to verify de-energization.

b. Energized Circuit Working Procedures. Reference B7-1, paragraph 300-2.5.2 contains technical procedures for working on energized equipment.

- c. Damaged or deranged equipment shall be considered energized.

B0706. PERSONAL PROTECTIVE EQUIPMENT (PPE)

a. Use only gloves marked with a colored label indicating the usage limitations. Reference B7-1, table 300-2-1 contains further information on stock numbers, maximum safe voltage usage, and label colors.

b. Stow rubber insulating gloves in the box in which they came. Perform PMS on the gloves prior to stowage. Stow other rubber electrical safety protection equipment in a clean, dry, oil-free location. Take care not to fold the gloves, as folding will frequently result in cracks that will greatly reduce insulating capability of the material. Do not use electrical safety gloves for cleaning or chemical handling. For further information on glove damage causes, inspection, and maintenance refer to reference B7-1, paragraph 300-2.5.3.

B0707. PORTABLE ELECTRICAL TOOL ISSUE (Not applicable to submarines)

- a. Surface ships shall establish a centralized portable electrical tool issue room for issue of portable electrical tools. Larger ships may have more than one tool issue room.
- b. Personnel assigned to issue portable electric tools shall perform visual inspections and quarterly safety testing of equipment per reference B7-1 (paragraph 300-2.7.5) prior to issue to personnel. Reference B7-1 (paragraph 300-2.7) contains additional technical guidance on portable electric equipment.
- c. Prior to issue of portable electric tools, the personnel assigned to issue tools shall brief the tool users on general precautions for portable electrical equipment per B0708, as well as issue any required personal protective equipment.
- d. Certain divisions or work-centers (those that contain electrical/ electronic ratings) may retain selected electrical tools or equipment in their permanent custody. These divisions will perform safety checks on their equipment at the required frequency. These divisions shall not issue portable electrical tools to other divisions or work-centers.
- e. Housekeeping items such as vacuum cleaners and floor buffers need not be retained in the electrical tool issue room.
- f. Unsafe electrical tools should be clearly marked out-of-commission "OOC", be rendered incapable of being energized, and be kept in locked storage separate from the other tools. The only exceptions should be for those tools in which immediate repair is to be accomplished.

B0708. TRAINING

- a. All personnel, when reporting aboard, shall receive indoctrination on basic electrical safety, including the requirements regarding use of personal protective equipment. Reference B7-1 may be used as a source of training material. The training shall also include recognizing symptoms of electrical shock, electrical shock trauma, and emergency first aid responder techniques.

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b. Each ship shall have a certified American Red Cross/American Heart Association, or equivalent CPR instructor on board. At least 50% of all electrical/electronics associated ratings shall be certified in basic life support.

c. Personnel who man the portable electrical tool issue room shall complete the "Electrical Tool Issue Room," Watchstation 302 in the Safety Programs Afloat Personal Qualifications Standard (PQS), NAVEDTRA 43460-4A.

d. The electrical safety officer shall complete Watchstation 304 of the safety programs afloat PQS within 16 weeks of assignment.

CHAPTER B7

REFERENCES

- B7-1. Naval Ships' Technical Manual (NSTM) chapters 300, 302, 310, 313, 320, 330 and 400
- B7-2. OPNAVINST 3500.39B
- B7-3. NAVSEA S0400-AD-URM-010/TUM Rev. 01, "Tag-out User's Manual" (NOTAL)

CHAPTER B8

GAS FREE ENGINEERING

B0801. DISCUSSION

a. No routine hazard, with the exception of ordnance, is as dangerous as the presence of potentially lethal atmospheres in ship's spaces. In many instances, potentially harmful gases or vapors are present in such a low concentration (parts per million (ppm)) that no adverse conditions are created. By design a ship has many confined spaces (especially tanks and voids) in which a multitude of both toxic and non-toxic gas or vapor creating substances and operations are used in the normal operation of the ship. Hazardous atmospheres may be created that can explode or cause asphyxiation. Compounding the problem is that many gases or vapors are not detected by the human ability of smell, and personnel attempting to save a fallen shipmate may themselves be overcome and killed by undetected vapors. It is for these reasons that every confined space shall be considered hazardous and entry into or work in or on such spaces is prohibited until the space has been gas free tested by qualified gas free engineering personnel. This is known as gas free engineering (GFE).

b. Consult reference B8-1 for further details concerning specific procedures and related safety precautions during shipboard gas free evolutions. Reference B8-1 contains a program checklist which shall be used for annual program evaluation.

c. For maintenance periods pier-side, references B8-2 and B8-3 contain additional procedures and related safety precautions for conducting gas free operations.

B0802. PRECAUTIONS

a. All hands shall:

(1) Notify work-center supervisor prior to entering any unventilated, non-occupied space designated to store hazardous or toxic materials or any sealed space, verify that such a space was gas free tested and certified safe for entry and/or work by the appropriate gas free engineering personnel

prior to entry, and comply with the requirements of the gas free engineering certificates posted outside the space.

(2) Notify the work-center supervisor before any new space is used to store hazardous or toxic material or of any spill of hazardous or toxic material.

(3) When working in any confined space, always work with an observer or an attendant monitoring the work from outside the space. Maintain communication with personnel outside the space. The type and frequency of communication shall be specified by the GFE based on the nature of the space, the operation, and the degree of hazard.

b. Work-center supervisor shall notify chain of command and gas free engineer (GFE) to obtain approval:

(1) Prior to entering any unventilated, non-occupied space designated to store hazardous or toxic materials or any sealed space and

(2) Before any new space is used to store hazardous or toxic material or of any spill of hazardous or toxic material.

c. If a person is seen unconscious in any space, no one is to enter that space without appropriate respiratory protective equipment and a backup assistant.

B0803. GAS FREE ENGINEERING SUBSECTIONS

The following subsections apply to gas free engineering:

a. Confined space entry procedures, including testing. (reference B8-1, paragraphs 074-19.4 through 19.15)

b. Personal protective equipment. (reference B8-1, paragraphs 074-19.7 through 19.9)

c. Ventilation requirements. (reference B8-1, section 074-21)

d. Emergency and rescue procedures. (reference B8-1, section 074-25)

e. Instrumentation, including calibration and maintenance.
(reference B8-1, appendices K and L)

f. Training of ship's force and gas free engineering
personnel. (reference B8-1, paragraph 074-18.7 through 18.9)

CHAPTER B8

REFERENCES

B8-1. Naval Ships' Technical Manual, NAVSEA S9086-CH-STM-030/CH-074 V3, "Gas Free Engineering"

B8-2. NAVSEA S6470-AA-SAF-010, Gas free Engineering Manual (NOTAL)

B8-3. COMFLTFORCOMINST 4790.3, REV A, CH-4, Joint Fleet Maintenance Manual (JFMM), Volume 4, chapter 25

CHAPTER B9

RADIATION SAFETY

B0901. DISCUSSION

a. This chapter outlines Navy safety and occupational health policies and procedures designed for levels of command which comprise the naval afloat establishment to minimize personnel exposure to radiation from sources other than nuclear power systems and nuclear weapons that have their own radiation protection and control programs. This chapter also excludes those individuals, who as patients must undergo diagnostic or therapeutic procedures involving use of ionizing radiation.

b. Per paragraph A0103b, the Director, Naval Nuclear Propulsion Program (CNO (NOON)) is responsible for the control of radiation and radioactivity associated with naval nuclear propulsion plants. As such, the requirements of this chapter do not apply to the naval nuclear propulsion program. Issues concerning radiation and radioactivity associated with naval nuclear propulsion plants should be addressed via the chain of command.

c. Radiation is commonly divided into two categories: ionizing and non-ionizing. Ionizing radiation has sufficient energy to strip electrons from atoms in the media through which it passes. Less energetic radiation that is incapable of electron stripping is termed non-ionizing radiation.

d. Ionizing radiation can be in the form of energetic particles (such as neutrons, betas, alphas, protons) or in the form of electromagnetic radiation (EMR). Ionizing radiation in the form of EMR, sometimes referred to as a photon, is conventionally referenced by its energy, with about 40 electron volts (eV) being the smallest amount of energy necessary to liberate an electron from an atom (i.e., ionize an atom). The production of ionizing radiation can occur in a variety of ways. For example, from the spontaneous decay of natural or man-made radioactive materials or from devices that directly produces EMR such as X-ray machines, or indirectly, such as from particle accelerators.

e. Some devices containing radioactive material, such as radioactive calibration source materials, may require a naval radioactive material permit (NRMP) to possess and use them. NRMPs are issued to Navy and Marine Corps commands by the Naval Radiation Safety Committee (NRSC), per references B9-1, B9-2, and B9-3. The NRSC is chaired by the Director, Environmental Readiness Division, Office of the Chief of Naval Operations (N45). Under the master materials license issued by the Nuclear Regulatory Commission (NRC) to the Naval Radiation Safety Committee, a NRMP is equivalent to a NRC license.

f. Non-ionizing radiation is energy that propagates through space in the form of electromagnetic waves but possesses insufficient energy to ionize the material through which it passes. Non-ionizing radiation comprises the lower energy portion of the EMR spectrum as shown in figure B9-1.

Figure B9-1: A Summary of the Electromagnetic Spectrum and Relationships of Wavelength (λ), Frequency (ν), and Energy (E).

			$\lambda \nu = C$				$E = h \nu$		Approximate Description	
			Wavelength		Frequency		Energy			
			λ		ν		E			
ELECTROMAGNETIC RADIATION	NON-IONIZING	RF	∞	km	0	Hz	Direct Current	eV	Voltage = Current x Resistance	
			10,000	km	30	Hz	1.2E-13	eV	Radiowaves	Radar (3 MHz - 300 GHz)
			100	mm	3	GHz	1.2E-05	eV		
			100	mm	3	GHz	1.2E-05	eV	Microwaves	
			0.1	mm	3000	GHz	1.2E-02	eV		
		LASER	10,000	nm	3.0.E+04	GHz	0.1	eV	Infra-Red	
			700	nm	4.3E+05	GHz	1.8	eV	Visible	
			400	nm	7.5E+05	GHz	3.1	eV		
			180	nm	1.7E+06	GHz	6.9	eV	Ultra-violet	
	IONIZING	31	nm	9.6E+06	GHz	40	eV	Lowest Ionization Energy		
		0.06	nm	4.8E+09	GHz	20	keV	Mammography X-rays		
		2.5E-02	nm	1.2E+10	GHz	50	keV	Dental/Medical X-rays		
		4.1E-03	nm	7.2E+10	GHz	300	keV			
		1.9E-03	nm	1.6E+11	GHz	662	keV	Cs-137 Gamma Ray		
		9.9E-04	nm	3.0E+11	GHz	1.25	MeV	Co-60 Gamma Ray		
		1.2E-04	nm	2.4E+12	GHz	10	MeV	Cosmic Rays		

Note: "C" is the speed of light in a vacuum equal to 3×10^8 meters per second. "h" is Planck's constant equal to 3.34×10^{-34} Joule seconds.

g. As shown in Figure B9-1, non-ionizing radiation can be further divided into two sub-categories: radio frequency radiation (RFR) and laser radiation.

h. RFR is conventionally referenced by its frequency and includes frequencies from approximately 0 hertz (Hz) to 3000 gigahertz (GHz). Communication transmitters, radars, and radio frequency heat sealers emit RFR.

Note:

A Hz equals 1 cycle per second.

i. Laser radiation is conventionally referenced by its wavelength and includes wavelengths from approximately 10^4 nm (Infra-red) to 180 nm (Ultra-Violet). This includes the visible wavelengths between approximately 700 nm (red) to 400 nm (violet), with all the other colors in between these wavelengths (note the order - red, orange, yellow, green, blue, indigo, violet - pneumatic "ROY G. BIV").

Note:

nm is the abbreviation for nanometers. 1 nm equals $1 \times (10)^{-9}$ meters.

j. For all EMR (ionizing and non-ionizing), wavelength (λ) and frequency (ν) are related such that their product is equal to the speed of light in a vacuum (c), where c equals 3×10^8 meters per second.

$$\lambda \nu = c$$

k. For all EMR (ionizing and non-ionizing), the energy is equal to product of Planck's constant (h) and the frequency (ν), where h equals 3.34×10^{-34} Joule seconds.

$$E = h \nu$$

l. Potentially hazardous sources of ionizing and non-ionizing radiation exist aboard Navy ships. Examples of ionizing radiation sources include radioactive materials and x-

ray generating equipment. Examples of non-ionizing radiation sources include communication transmitters, radar systems, radio frequency heat sealers, and lasers.

m. The mechanism for potential harmful biological effects from personnel exposure to ionizing radiation involves the possibility of directly ionizing cellular DNA (deoxyribonucleic acid) or other cellular materials (such as cytoplasm) that result in the production of reactive oxidizing agents that can potentially affect cell function. There are four possible outcomes if this occurs; the cell can repair itself (majority of the time), the cell can be damaged and unable to reproduce, the cell can be damaged and reproduces corrupt daughter cells, or the cell dies. The occupational ionizing radiation control levels imposed by the Navy are typically 10 times lower than the Federal limits and keep worker exposures as low as reasonably achievable (ALARA). While any exposure, no matter how small, involves some risk, the risk is small compared with normal hazards of life. For further information and a perspective about the risks associated with occupational exposure to ionizing radiation see appendix M of reference B9-4.

n. The mechanism for potential harmful biological effects for radio frequency (RF) non-ionizing radiation depends on the frequency and magnitude of exposure. Predominant mechanisms for potential harmful biological effects as a function of frequency are; (0 to 1 Hz) magnetohydrodynamic effects (forces on flowing blood and other body fluids potentially stressing circulatory systems), (1 Hz to 5 MHz) electrostimulation (potentially causing involuntary muscle contraction thereby potentially causing falls), (100 kHz to 300 GHz) tissue heating (with potential thermal damage; for deep tissues between 100 kHz and 3 GHz and surface heating (skin) between 3 GHz and 300 GHz). The Navy adopts radio frequency (RF) radiation controlled maximum permissible exposure (MPE) limits that are consistent with non-governmental consensus-based standards (reference B9-5 for 0 kHz to 3 kHz and reference B9-6 for 3 kHz to 300 GHz).

Note:

Reference B9-7 is under revision to reflect the current MPE limits listed in references B9-5 and B9-6.) The RF exposure limits for controlled environments represent scientifically derived values to limit absorption of RF

energy in the body, and to restrict the magnitude of RF currents induced in the body. This means that the amount of energy absorbed is insufficient to produce or cause adverse effects on health, even under repeated or long-term exposure conditions. The Navy also establishes maximum levels to prevent hazards from electromagnetic radiation to fuels (HERF) and hazards from electromagnetic radiation to ordnance (HERO).

o. The mechanism for potential harmful biological effects for laser (non-ionizing radiation) is excessive energy deposition to parts of the eyes or to the skin leading to tissue damage. For laser exposures that are within the MPE limits, no adverse biological effects are expected to occur even under repeated or long-term exposure conditions. The Navy adopts laser MPE limits that are consistent with non-governmental consensus-based standards (see references B9-8 and B9-9). Laser incidents are rare due to rigorous Navy laser safety and training programs.

B0902. RESPONSIBILITIES

a. Ionizing Radiation:

(1) The Commanding Officer shall:

(a) Appoint a radiation safety officer (RSO) for industrial uses of radiation, when required, and ensure that they are properly trained per reference B9-1.

(b) As applicable, ensure compliance with the requirements of references B9-10, B9-11, B9-12, B9-13, B9-1, B9-2, and naval radioactive material permits (NRMPs) specifically issued to the command, and the applicable NRMPs (issued to another command) when possessing the devices noted in paragraph B0903a.(2).

(2) The Radiation Safety Officer shall:

(a) Establish, implement, and maintain an effective radiation safety program per reference B9-1 and NRMPs specifically issued to the command.

(b) Ensure that the appropriate communication processes are established to provide direct access to the highest levels of the chain of command to provide program status reports, notification of major evolutions, non-conformance issues, or any concern that may impact safety, readiness, or mission objectives.

b. Non-Ionizing Radiation (RF):

(1) **The Commanding Officer shall:**

(a) Request a radiation hazard (RADHAZ) survey when:

1. Emitter systems have been added, relocated, or upgraded as a result of scheduled ship alteration (SHIPALT) or alteration (ALT) installation since the last RADHAZ survey.

2. Watch stations or work areas are moved or established in the proximity of emitter systems.

3. Gasoline storage or transfer stations are relocated in the proximity of emitter systems.

4. Personnel are injured as a result of exposure to RF radiation and the command requires assistance in re-evaluating the current RADHAZ survey.

5. The current RADHAZ survey was conducted prior to 1995.

(b) Submit a confirmation letter to COMNAVSEASYSCOM (Code SEA 05K2B), stating that the recommended control measures provided in the hazards of electromagnetic radiation to personnel (HERP) survey report have been implemented to obtain a NAVSEASYSCOM letter of certification, per reference B9-14.

(c) Ensure personnel are trained to be familiar with potential RF exposure hazards and appropriate protective measures.

(2) **Division Officers (responsible for work-centers and areas with identified radiation hazards) shall:**

(a) Ensure RF radiation hazard areas are posted with

the appropriate warning signs and deck markings in accordance with appendix B9-A.

(b) Ensure that awareness and hazard recognition training is given for all personnel assigned to work or stand duty in RADHAZ areas to prevent exceeding MPE limits.

(c) Investigate, document, and report all suspected RF incidents or mishaps involving suspected RF overexposures to personnel exposure in accordance with the governing references listed in paragraph B0903.

c. Non-Ionizing Radiation (Lasers):

(1) **The Commanding Officer shall:**

(a) For the use of any class of military exempt lasers or the use of commercial class 3b or commercial class 4 lasers, establish a laser safety program per references B9-15 and B9-16 and designate a laser system safety officer (LSSO) to manage the program.

(b) Ensure the LSSO is properly trained and qualified per references B915 and B9-16.

(c) Ensure other personnel are trained to be familiar with potential laser exposure hazards and appropriate protective measures.

(2) **Division Officers (responsible for work-centers and areas with identified radiation hazards) shall:**

(a) Ensure that the LSSO has posted laser hazard areas with the appropriate warning signs in accordance with appendix B9-A.

(b) Investigate, document, and report all suspected Laser incidents or mishaps involving suspected Laser overexposures to personnel exposure in accordance with the governing references listed in paragraph B0903.

(3) **Laser System Safety Officer (LSSO) shall:**

(a) Establish, implement, and maintain an effective

laser safety program per reference B9-15 and B9-16.

(b) Ensure that the appropriate communication processes are established to provide direct access to the highest levels of the chain of command to provide program status reports, non-conformance issues, or any concern that may impact safety, readiness, or mission objectives.

(c) The LSSO is responsible for labeling lasers and posting laser hazard areas.

B0903. GUIDANCE

a. Ionizing Radiation

(1) **Industrial Radiography.** Sources of ionizing radiation are used onboard tenders, in shipyards, and at intermediate maintenance activities for non-destructive testing (NDT) of materials. A NRMP specifically issued to the command is required to possess and use radiographic devices containing radioactive material. X-ray machines are used on carriers, large amphibious assault ships, and at naval air stations for NDT procedures conducted on aircraft. Each command performing industrial radiography must have a formal radiation safety program instruction. The ship's radiological safety officer (RSO) is responsible for all aspects of the program described in the governing instructions.

(2) Radioactive Material Under a NRMP Issued to Another Command

(a) Devices used to detect chemical warfare agents, explosives, and radioactive material (RADIACs) may contain small amounts of radioactive material. These devices are regulated by NRMPs (issued to other commands) that allow ships to use and possess them under specific conditions including inventory requirements, leak testing, and other control procedures. Each command possessing one of these devices must have a copy of the applicable NRMP that describes in greater detail the conditions for possession. To get a copy of the applicable NRMP, contact NAVSEADET RASO.

(b) Depleted uranium is used as penetrators in some munitions. Ships are authorized to possess these munitions

under a NRMP issued to NSWC Crane. Each command possessing depleted uranium munitions must comply with the procedures outlined in the NRMP. Contact NAVSEADET RASO to obtain a copy of the NRMP.

(c) The laser target designator used on the FA-14 and FA-18 aircraft and the in-flight blade inflation system (IBIS) used on some helicopters contain radioactive material under NRMPs issued to Naval Air Systems Command. Squadrons possessing these devices must comply with the procedures outlined in the NRMP. Contact NAVSEADET RASO to obtain a copy of the NRMP.

(3) Other Radioactive Material

(a) Luminous markers, clocks, smoke detectors, compasses, depth gauges, and electron tubes may contain small quantities of radioactive material. The evaluation of such items shall consist of a simple inspection for physical damage. Reports of damaged devices should be made to NAVSEADET RASO.

(b) Some aircraft and missile construction material contains magnesium-thorium alloys. Altering this material through cutting or grinding by ship crewmembers is prohibited. Only commands specifically authorized by a NRMP may alter these materials per reference B9-1. Thorium containing welding rods are exempt from radioactive material permitting.

Note:

The small quantities, low specific activity, and physical form of radioactive materials used aboard ships usually make them non-hazardous. However, breakage and spread of even small quantities of some radioactive materials can lead to internal contamination (by ingestion, inhalation or wound contamination) in excess of allowable limits. Therefore, report all incidents of suspected or actual contamination through the cognizant medical department representative (MDR) per reference B9-10 and notify NAVSEADET RASO of any such incidents.

(4) **Medical Radiography.** Medical x-ray units (fixed or mobile) ashore and on hospital ships are evaluated annually.

All other fixed x-ray units afloat require 24-month evaluation. Deployed units may delay unit evaluation until returning to homeport if meeting the 24-month window would interfere with operational obligations. Dental fixed and portable x-ray units require 36-month evaluation. All radiation protection surveys shall be conducted by a qualified Navy medical radiological surveyor in accordance with the Navy Radiological Systems Performance Evaluation Manual (Reference B9-12). The medical officer shall request the survey from the nearest medical activity with a RHO or contact the Navy Environmental Health Center (NAVENVIRHLTHCEN), Radiation Health Team.

(5) Governing Instructions

(a) Industrial: NAVSEA S0420-AA-RAD-010 (reference B9-1)

(b) Medical/Dental:

1. NAVMED P-5055 (reference B9-10)

2. BUMEDINST 6470.22 (reference B9-11)

(6) Points of Contact

(a) Industrial: NAVSEADET Radiological Affairs Support Office (RASO), P.O. Drawer 260, Naval Weapons Station, Yorktown, VA 23691-0260; Commercial: (757) 887-4692 DSN: 953-4692 FAX: (757) 887-3235

(b) Medical/Dental: Radiation Health Team, Navy Environmental Health Center (NAVENVIRHLTHCEN), 620 John Paul Jones Circle, Suite 1100, Portsmouth, VA 23708-2103 DSN: 377-0766. Commercial: (757) 953-0766. Fax: (757) 953-0685.

b. Non-Ionizing Radiation Radiofrequency (RF) and Microwaves (MW)

(1) Radar, communication equipment (transmitters), and radiofrequency (RF) heat sealers

(a) These devices may emit hazardous levels of RF radiation. In addition to causing biological changes,

RF/microwave radiation can induce electrical currents/voltages that may cause shocks and burns, premature activation of electro-explosive devices (EEDs) in ordnance, and arcs, which may ignite flammable materials. Information on the hazards of RF (electromagnetic) radiation to personnel, fuels, and ordnance is available in reference B9-17. Hazards of electromagnetic radiation to fuels (HERF) and for ordnance (HERO) can be found in volume II of reference B9-17. The hazards of electromagnetic radiation to personnel (HERP) can be found in Volume I of reference B9-17. However, volume I of reference B9-17 will be amended to reflect the current RF MPE limits listed in reference B9-5 for 0 kHz to 3 kHz and reference B9-6 for 3 kHz to 300 GHz. (Note: reference B9-7 is also under revision to reflect the current MPE limits listed in references B9-5 and B9-6). Refer to appendix B9-A for a discussion of controlled and uncontrolled MPE limits.

(b) Commander, Naval Sea Systems Command (COMNAVSEASYS COM) is the lead agent for coordinating electromagnetic safety programs for naval ships. Commander, Space and Naval Warfare Systems Command (COMSPAWARSYSCOM) is the lead agent for coordinating electromagnetic safety programs for shore facilities.

(c) Commands shall determine RF levels for all areas in which personnel could receive exposures in excess of the exposure limits. Commands must use proper RF measurement techniques and application of the RF exposure limits to avoid imposing unnecessary restrictions on operations or establishing overly restrictive protective boundaries.

(d) A comprehensive RF hazard evaluation for major platforms, such as warships or communication stations, where multiple RF emitters exist in close proximity to each other, requires considerable technical familiarity with electromagnetic fields. Such surveys may involve determination of boundary locations for protective fences or enclosures, or specifying operational conditions or restrictions necessary for protection of personnel, (see points of contacts (POCs) below for activities that perform these evaluations, which are primarily an engineering-type survey).

(e) Following a survey and implementation of the recommended control measure provided in the HERP survey report

of B9-14, submit a confirmation letter to COMNAVSEASYSCOM (Code SEA 05K2B) requesting a NAVSEASYSCOM letter of certification (POC information below).

(f) Activities shall provide RF safety training to personnel who routinely work directly with RF equipment or whose work environments contain RF equipment that routinely emits RF levels in excess of the exposure limits for controlled environments. Activities shall conduct training before assignment to such work areas, and shall focus on awareness of the potential hazards of RF fields, established procedures and restrictions to control RF exposures, and personnel responsibility to limit their own exposures. Activities may incorporate RF safety training in periodic safety training programs to satisfy command-training objectives.

(g) The Navy does not authorize RF-shielded protective clothing for routine use as a means of protecting personnel. This does not preclude use of other protective equipment, such as electrically insulated gloves and shoes for protection against electrical shock or RF burn, or for insulation from the ground plane.

(h) Electric and magnetic fields exist around power lines, electrical devices and appliances. The intensity of these fields decreases rapidly with distance. While questions have been raised about the possibility of health effects from exposure to electric and magnetic fields at levels that are commonly encountered in homes and most work places, findings issued by various scientific review panels have not confirmed that such fields pose a risk to health.

(i) Since the body is a conductor, time varying magnetic fields, or body movement in a static magnetic field, induce electric fields and current flow inside the body. For commonly encountered fields near high voltage transmission lines, power distribution systems, office equipment, and household appliances, the magnitude of these induced currents will typically be below levels which are perceptible. Existing guidelines given in reference B9-5 have been established to limit induced current densities in body tissues. This rationale has been used to set a biological endpoint since no other definable risk criterion has been identified for establishing a health standard for electric and magnetic fields.

(2) Governing Instructions

(a) MPE Limits - see references B9-5 (0 kHz to 3 kHz) and B9-6 (3 kHz to 300 GHz).

(b) Training and reporting requirements - see reference B9-7.

(c) HERP, HERF, HERO operational guidance - see reference B9-17.

(d) Electromagnetic environmental effects - see reference B9-18.

(e) Medical management of non-ionizing casualties - see reference B9-19.

(f) Institute of Electrical and Electronics Engineers (IEEE) C95 Series of Standards, Guides, and Recommendations - see references B9-5, B9-6, B9-20 thru B9-23.

(3) Points of Contact

(a) For Technical Assistance and Reporting Authority.

Naval Sea Systems Command (SEA 62), Commander, Naval Sea Systems Command Headquarters, Washington, D.C., 20362, commercial: 202-781-3140.

(b) For measurement surveys and technical assistance for shipboard RF emitting systems. Systems Electromagnetic Effects Branch (Code J-52), Naval Surface Warfare Center Dahlgren Division, 17320 Dahlgren Road, Dahlgren, VA 22448-5100, DSN 249-8594, commercial 540-653-3487, or 401-832-5552, fax 540-653-7494.

(c) For RF bio-effects and medical research issues, or assistance in evaluating personnel overexposure incidents.

Naval Health Research Center-Detachment Directed Energy Bioeffects Laboratory, Brooks City Base, 8315 Navy Road, Brooks City Base TX 78235-5365, DSN 240-4699/6532, commercial 210-536-4699/6532, fax: 210-536-6439.

(d) For RF health hazards, personnel exposures and exposure incidents from industrial and medical RF emitting sources. Navy Environmental Health Center (NEHC), 620 John Paul Jones Circle, Suite 1100, Portsmouth, VA 23708-2103 DSN: 377-0766. Commercial: (757) 953-0766. FAX: (757) 953-0685.

(e) For guidance on RF exposure limits and health issues. Non-Ionizing Radiation Health Branch, Bureau of Medicine and Surgery (Code M342), 2300 E Street NW, Washington DC 20372-5300, DSN 762-3448/3444, commercial 202-762-3448/3444, fax 202-762-0931.

(f) For site certification and measurement surveys for shore-based RF emitting systems. Space and Naval Warfare Systems Center (SPAWARSYSCEN) Charleston (Attn: Code 323), P.O. Box 190022, North Charleston, SC 29419-9022, DSN 588-4228, or commercial 843-218-4228. For shore facilities within PACNAVFACENGCOM geographical region, contact Space and Naval Warfare Systems Activity Pacific (SPAWARSYSACT PAC) (Attn: Code 2915), 675 Lehua Avenue, Pearl City, HI 96782-3356, DSN 315-474-7330, commercial 808-474-7330, fax: 808-474-5511.

c. Non-Ionizing Radiation. Lasers (class IIIb, class IV, and Military Exempt Lasers Only).

(1) Laser range finders, laser guided munitions, communications equipment, fiber optics, scoring systems, landing systems and training aids.

(a) The Navy has adopted a system for categorizing the hazards of lasers, which provides a practical means for determining safety requirements appropriate for different types of lasers. These categories range from a class I laser that is safe to view under all conditions, to the class IV laser which can cause eye damage under most viewing conditions. Appendix B9-A provides information on laser classification, types of laser warning signs and labels.

(b) For most lasers used in medical, laboratory, research and industrial applications, the use of the classification system precludes the necessity for performing any laser measurements or calculations. Reference B9-24 requires manufacturers to classify and label their laser systems. Laser measurements or laser safety calculations will usually be

required only for lasers operating on outdoor ranges or in open areas when it is necessary to define a laser nominal hazard zone (NHZ).

(c) Lasers or laser systems designated for combat, combat training or classified in the interest of national security may be exempted from compliance with some or all of the provisions of reference B9-24. To obtain military exemption status, the contractor must have written authorization from the military contracting activity, and the laser product must be certified to conform with requirements in reference B9-15, B9-25, and have been approved by the Navy Laser Safety Review Board (LSRB).

(d) Military laser systems are reviewed by the LSRB during their development to ensure that adequate safety criteria have been incorporated. LSRB review is required at appropriate stages of development and prior to introduction of prototype or production units into the fleet for testing or initial use. An important function of the Navy laser safety program is a determination of the nominal ocular hazard distance (NOHD) or safe viewing range, for each operational laser system used in the Navy. LSRB review also applies to class IIIb and class IV commercial lasers and laser systems that are not intended solely for laboratory or medical use. Reference B9-15 contains general guidance for materials necessary and procedures followed by the LSRB review.

(e) Commands shall maintain a current inventory of all military exempt lasers, class IIIb lasers, and class IV lasers for submission to the administrative lead agent (ALA) (BUMED Code M342) as requested. Commands wishing to dispose of lasers shall obtain approval from BUMED following guidance in references B9-15 and B9-25.

(f) Commands operating class IIIb or class IV commercial or military exempt lasers shall establish a laser safety program and designate a laser system safety officer (LSSO) per reference B9-15. The laser safety program shall include an inventory of all commercial class IIIb, class IV and all classes of military exempt lasers that are assigned to the command lasers for submission to the administrative lead agent as requested.

NOTE:

Some commercially available laser pointers are categorized as class IIIa lasers with output levels that are not considered safe for all viewing conditions. A formal laser safety program is not required for class IIIa laser pointers; however, the user needs to recognize that care must be exercised to control its accessibility (kept out of the hands of children or others who are unaware of the hazardous nature of lasers), and to avoid directing the pointer at those in the audience. Class II laser pointers do not pose a hazard during normal viewing, and their use is not restricted.

(g) Laser MPE limits are published in reference B9-8. For laser exposures that are within the MPE limit, no adverse biological effects are expected to occur even under repeated or long-term exposure conditions. Only trained and technically qualified personnel shall apply these exposure limits in determining laser safe viewing conditions, since an improperly conducted laser hazard evaluation may pose serious risks to a person's eyes.

(h) Laser exposure limits are set to protect tissue from damage and are not the equivalent of comfortable viewing levels. Operators of lasers need to be aware of secondary laser safety concerns. For example, intrabeam viewing of visible wavelength lasers, even at or below the permitted safe level, will still be perceived as an intense light source capable of producing disabling glare or visual after-images. These temporary visual effects can interfere with performing critical tasks such as operating vehicles or aircraft. Similarly, intrabeam viewing of lasers at or below the permitted exposure limits can still damage or "saturate" night vision viewing devices because of the high amplification of incident light levels provided by the devices. Wearing of laser protective eyewear can also lead to other safety concerns, such as the potential for blocking or filtering out the color of some warning or alarm indicator lights.

(i) Commands shall provide laser system safety officer (LSSO) laser safety training through the completion of a course approved by ALA (BUMED-M342) and the Lead Navy Technical Laboratory at the Naval Surface Warfare Center, Dahlgren Division. There are four categories of LSSOs, administrative

laser safety officer (ALSO), technical laser safety officer (TLSO), laser safety specialist (LSS), and range laser safety specialist (RLSS). Re-testing at the LSSO's highest certification level is required to maintain certification for all categories of LSSO every 4 years. If the LSSO fails the re-certification examination, the LSSO will have to be re-certified by attending the appropriate course. Commanding officers should determine which category of LSSO is appropriate for their command considering their mission, types of lasers being used, and size of the laser safety program. Laser safety-training requirements at medical treatment facilities for the medical LSSO and designated medical personnel are contained in reference B9-16.

(j) Laser range safety officers, laser maintenance personnel and industrial laser supervisors shall complete a formal command laser safety training course as outlined in reference B9-15. Commands shall provide formal classroom training on the potential hazards associated with accidental exposure to laser radiation to all personnel in areas operating class IIIB (and class IIIa with danger logo) or class IV lasers. In particular, the vulnerability of the eyes to being damaged by lasers shall be emphasized. Commands shall conduct annual refresher training per reference B9-15. For employee training, the following laser safety training videotapes are available from the Norfolk Regional Electronic Media Center: Laser Hazards and Control, 804245DN, Hazards and Control of Military Lasers, 804246DN, and Laser Safety in Medical Treatment Facilities, 803198DN.

(k) Specific laser safety-training requirements at medical treatment facilities for the medical LSSO and designated medical personnel are contained in reference B9-16.

(l) Broadband optical sources such as germicidal lamps, phototherapy, sun lamps, backlights, arc lights, projector lamps, high intensity discharge lamps and infrared arrays are also used in many medical and industrial applications. These types of light sources may require controls to prevent possible acute effects such as skin burns, photokeratitis, cataracts or retinal burns. Exposure guidance can be found in the American Council of Government Industrial Hygienists - Threshold Limit Values and Biological Exposure Indices (www.acgih.org/). Obtain assistance in the evaluation of broadband optical sources, where personnel

are considered to be at ocular risk, from an industrial hygienist or radiation health officer.

(2) Governing Instructions

(a) Policy and guidance in the identification and control of laser radiation hazards - see reference B9-15.

(b) Laser safety for medical facilities - see reference B9-16.

(c) Military exempt lasers - see reference B9-25.

(d) Laser safety on ranges and in other outdoor areas - see reference B9-26.

(e) Food and Drug Administration (FDA) performance standards for light emitting products - see reference B9-27.

(f) American National Standards Institute (ANSI) Z136 series of standards, guides, and recommendations - see references B9-8, B9-9, and B9-27 thru B9-31.

(g) Medical management of non-ionizing casualties - see reference B9-19.

(3) Points of Contact

(a) **For medical and industrial laser operations.**
Bureau of Medicine and Surgery (BUMED) (Code M342), 2300 E Street NW, Washington, DC 20372-5300, DSN: 762-3448. Commercial: 202-762-3448. Fax: 202-762-0931.

(b) **For all laser operations; other than medical, military exemption of lasers, and certification surveys of laser firing ranges.** (Funding for services shall be provided by the requesting command). Laser System Evaluation and Range Surveys: Naval Surface Warfare Center Dahlgren Division, G-72, 17320 Dahlgren RD Dahlgren, VA 22448, DSN: 249-1060/1149/2442, Commercial 540-653-1060/1149/2442, Fax: 540-653-8824
<http://www.navylasersafety.com/>

(c) **Laser Range Surveys.** Naval Surface Warfare Center Corona Division (Code SE-41), 2300 Fifth St, Norco, CA 92860 mailing address P.O. Box 5000 Corona, CA 92878-5000, DSN: 933-4090, Commercial: 909-273-4090 or Fax: 909-273-5089.

(d) **For laser bio-effects and medical research issues, or assistance in evaluating laser-induced injuries.** Naval Health Research Center-Detachment Energy Bioeffects Laboratory, Brooks City Base 8315 Navy Road, Brooks AFB, TX 78235-5365, DSN: 240-4699/6552, Commercial: (210) 536-4699/6552, Fax: (210) 536-6439.

(e) **For guidance on laser exposure limits and health issues.** Non-Ionizing Radiation Health Branch, Bureau of Medicine and Surgery (Code M342), 2300 E Street NW, Washington DC 20372-5300, DSN: 762-3448/3444, Commercial: 202-762-3448/3444, Fax: 202-762-0931.

B0904. RADIATION HAZARD AREAS

a. Ionizing Radiation. Ionizing radiation hazard signs are required at access points to radioactive material storage areas and where the radiation levels could exceed the exposure limit for the general public. The type and wording of each sign is dependent upon the type of radiation area. Reference B9-11, provides specific guidance for posting ionizing radiation hazard areas. Medical X-ray units will be posted per reference B9-13 and B9-4.

b. Radiofrequency Radiation (RFR) Hazard Areas. RFR hazard warning signs are required at all access points to areas where the RFR levels may exceed the MPE. Obtain NAVSEA-approved warning signs and labels through the standard stock system (see appendix B9-A). When military operational considerations prevent the posting of such signs, a waiver must be obtained from cognizant safety and occupational health professionals depending upon the RFR source. Where the RFR levels may exceed 10 times the MPE limit, additional warning devices and controls such as flashing lights, audible signals, barriers, and interlocks may be required, depending on the potential risk for exposure. These areas will be noted in the ship's RADHAZ and baseline industrial hygiene survey reports.

(1) **Radar and Communications.** The ship's RADHAZ report provides detailed posting and deck marking information for radar

and communications RFR hazard areas. These are also described in appendix B9-A.

(2) **Heat Sealers and Other RFR Sources.** The baseline industrial hygiene survey will provide posting requirements for other RFR hazard areas.

c. Lasers (Class IIb, Class IV, and all Military Exempt Lasers). The LSSO is responsible for labeling lasers and posting laser hazard areas. See appendix B9-A.

B0905. MEDICAL SURVEILLANCE

The baseline industrial hygiene survey identifies those work-centers that require medical surveillance for exposure to radiation.

a. Ionizing Radiation. Medical surveillance of personnel exposed to ionizing radiation shall follow reference B9-13.

b. RF Radiation

(1) Workers who have implanted medical devices such as pacemakers or defibrillators or use certain medical devices such as apnea monitors or electrically powered wheelchairs should be aware of the potential for interference from various emitters of RF energy. This condition is called radiofrequency interference (RFI) or electromagnetic interference (EMI). The consequences of these potential failures range from inconvenience to serious injuries and death.

(2) It is impossible to state that there will be no observable effects for all devices. This is because electronic devices can be extremely sensitive to EMI and there are no regulatory standards by the Food and Drug Administration (FDA) or the Federal Communications Commission (FCC) forcing manufacturers to harden their products against EMI. Therefore the Navy cannot make any guarantees that all medical or consumer electronic devices won't experience EMI, even at RF levels well below the MPE limits for biological effects.

(3) Therefore, it is each worker's responsibility to discuss with their physician the EMI risks associated with each medical device that they may be using and determine if they are

able to work within the RF environment of their command. It is also the worker's responsibility to inform their chain of command of any medical devices they may be using and to discuss any safety concerns they may have with those devices.

c. Lasers

(1) Enrollment in a laser radiation medical surveillance program is limited to those personnel who are clearly at risk from exposure to laser radiation. The nature of such risks is associated with accidental injuries resulting from excessive exposure to laser levels and not as a result of chronic exposures. The command LSSO determines which personnel should be enrolled in the surveillance program using the following guidance:

(a) Laser workers requiring medical surveillance are those individuals who routinely work with class IIb or class IV lasers under conditions where there is a likely potential for accidental exposures to excessive levels. These workers require a pre-placement and termination laser eye examination per reference B9-15.

(b) The following personnel generally require medical surveillance: (1) Research and development (R&D) and laboratory personnel who routinely work with unenclosed class III and class IV laser beams. (2) Maintenance personnel who routinely repair or align class III or class IV laser systems. (3) Operators (personnel behind the laser) and down-range personnel who routinely work with class III or class IV engineering laser transits, geodimeters and alignment laser devices. (4) Operators who routinely work with class IIb and class IV industrial lasers where access to an unenclosed beam path is possible.

(c) Other laser workers or personnel where the potential for accidental exposure is deemed very unlikely generally do not require medical surveillance. For example: (1) Personnel who work with class I or class II lasers, or with laser systems containing class III or class IV lasers when there is little or no potential for exposure to the open laser beam. (2) Visitors or other personnel involved infrequently in laser testing, demonstrations or training when the LSSO has ensured such personnel will be protected from exposure to levels of laser radiation greater than the MPE limit. (3) Supervisory,

clerical and custodial personnel working in laser areas where laser safety procedures preclude their exposure to levels of laser radiation above the MPE limit. (4) Operators of fielded military laser systems when operations are conducted on established laser ranges, or as part of training operations where prescribed laser safety procedures are enforced. (5) Personnel involved in "force-on-force" laser training exercises where appropriate protection is established, either in the form of administrative controls or procedures, or where laser protective eyewear is provided.

B0906. RADIATION INCIDENTS

a. Ionizing Radiation. In the event of a radiation incident involving ionizing radiation, notify NAVSEADDET RASO for incidents associated with industrial operations and NAVENVIRHLTHCEN for medical and dental incidents.

b. Radiofrequency Radiation

(1) Commands shall investigate and document all suspected RF incidents or mishaps involving personnel exposure to excessive RF levels, in accordance with reference B9-7 and B9-15 such as:

(a) Personnel injury has been sustained or physical symptoms are experienced by the individual(s) that are believed to be associated with RF exposure.

(b) Personnel exposure has been determined to have exceeded the appropriate MPE limit in terms of power density by a factor of five or more. (For exposure determinations, provisions for time averaging and spatial averaging can be used in conjunction with transmitter duty factors and antenna rotation or scanning rates to establish maximum likely exposure levels).

(c) Inadvertent exposure occurred to members of the general public or to other non-involved personnel as a result of naval operations that have exceeded the appropriate MPE limit.

(d) Exposure circumstances or the severity of the incident or mishap are such that inquires from news media are

anticipated, or are deemed to be of interest to the chain of command.

(2) Investigation of incidents involving alleged or actual RFR exposures that are five times the MPE or greater shall include, as a minimum:

- (a) A listing of all involved personnel.
- (b) Measurements of RFR exposure levels.
- (c) Results of appropriate medical examinations.
- (d) A detailed description of the circumstances surrounding the incident.
- (e) Recommendations for more detailed medical follow-up (if necessary).
- (f) Recommendations to prevent future recurrence of the incident.

(3) The command exercising operational control of the RF source has the primary lead for conducting the RF exposure investigation and for ensuring the appropriate report is filed.

(4) Commands shall refer personnel reporting physical symptoms, or suspected of having been exposed to levels in excess of five times the MPE limit, for a medical evaluation or follow-up. Since medical evaluations following RF exposures have been infrequently required and physical signs of injury are usually not manifested, medical personnel should be advised to refer to reference B9-19, for information on RF biological effects.

(5) Commands shall make initial notification for the occurrence of an RF incident by telephone, fax, message or e-mail to the appropriate technical assistance point listed in this chapter with copy to the Bureau of Medicine and Surgery (Code M342). Discussions following this initial notification can determine whether a more extensive investigation will be necessary and whether a site visit should be scheduled to assist in making RF measurements or an exposure evaluation. Central to the command's investigation will be a determination of the

degree of RF exposure incurred since such incidents often involve emotional or health concerns which cannot be easily addressed when measurement data is not available. Performing RF measurement assessments are often beyond the technical capabilities of the local command or the nearby medical facility.

(6) If exposure incident results in a service member receiving medical treatment, loses workdays, or is placed on light or limited duty, a mishap report must be submitted in accordance with reference B9-32.

(7) In cases where it is necessary to reconstruct events or reestablish equipment configuration for conducting an RF exposure assessment, the accuracy of the recreation is crucial to the validity of the subsequent RF measurements. The command's investigating officer should apply particular attention to obtaining written statements from those involved giving detailed descriptions of the sequence of events, exposure times and equipment set-ups, as well as obtaining appropriate charts, diagrams or photographs indicating the locations of exposed personnel.

(8) The command shall submit a final report on the RF incident to the Commander, Naval Safety Center and to the Bureau of Medicine and Surgery (Code M342), with copies to appropriate headquarters and systems commands. The command will also include in the report to BUMED pertinent medical records and identification data for personnel who were exposed. BUMED is tasked with maintaining a permanent repository for RF exposure incidents.

c. Laser Radiation

(1) If eye damage from laser exposure is suspected or observed, and in all cases of exposure to levels in excess of five times the laser exposure limits of this chapter, the cognizant activity shall ensure the individual receives a medical examination by an ophthalmologist as soon as possible. While laser injuries associated with military operations have been rare, limited experience indicates that the extent of eye damage from an accidental laser exposure may not be readily or initially apparent to either the individual or to local medical personnel. Since early medical intervention may lessen the severity of the damage or subsequent retinal scarring from the

laser injury, efforts should be made to have the individual promptly seen by an ophthalmologist or at the ophthalmology department of a hospital on a walk-in emergency basis.

(2) Commands shall investigate and document all suspected laser incidents or mishaps involving personnel exposure to excessive laser energy. The command exercising operational control of the laser has the primary lead for conducting the laser exposure investigation and for ensuring the appropriate report is filed.

(3) Commands are required to report exposure incidents and investigate exposure levels for the following situations: (1) Personnel injury has been sustained or physical symptoms are experienced by the individual(s), which are believed to be associated with laser exposure. (2) Inadvertent exposure occurred to members of the general public or to other non-involved personnel as a result of naval operations, which have exceeded the MPE limit. (3) Exposure circumstances or the severity of the incident or mishap are such that inquiries from news media are anticipated, or are deemed to be of interest to the chain-of-command.

(4) Commands shall refer personnel reporting physical symptoms or suspected of having been exposed to levels in excess of the MPE limit for a medical evaluation or follow-up.

(5) Commands shall make initial notification for the occurrence of a laser incident by telephone, fax, message or e-mail to the appropriate technical assistance point listed in this appendix with copy to the Bureau of Medicine and Surgery (Code M342). Discussions following this initial notification can determine whether a more extensive investigation will be necessary and whether a site visit should be scheduled to assist in making laser measurements or an exposure evaluation. Central to the command's investigation will be a determination of the degree of laser exposure incurred since such incidents often involve emotional concerns or health worries, which cannot be easily addressed when measurement data is not available. Performing laser measurement assessments are often beyond the technical capabilities of the local command or the nearby medical facility.

(6) In cases where it is necessary to reconstruct events or reestablish equipment configuration for conducting a laser exposure assessment, the accuracy of the recreation is crucial to the validity of the subsequent measurements. The command's investigating officer should apply particular attention to obtaining written statements from those involved giving detailed descriptions of the sequence of events, exposure times and equipment set-ups, as well as obtaining appropriate charts, diagrams or photographs indicating the locations of exposed personnel.

(7) The command shall submit a final report on the laser incident to the Commander, Naval Safety Center, and to the Bureau of Medicine and Surgery (Code M342), with copies to appropriate headquarters and systems commands within 30 days of the incident.

(8) Investigation of incidents involving alleged or actual laser exposure shall include as a minimum the following:

- (a) List of personnel involved.
- (b) Estimation of exposure(s) as related to the applicable MPE.
- (c) Details of immediate and subsequent medical findings.
- (d) Narrative account/summary of exposure incident—to include wavelength, mode of operation(s) and energy/power output.
- (e) Details regarding safety procedures and equipment used.
- (f) The command shall also include in the report to BUMED pertinent medical records, retinal photographs and identification data for personnel who were exposed.

(9) If exposure incident results in a service member receiving medical treatment, loses workdays, or is placed on light or limited duty, a mishap report must be submitted in accordance with reference B9-32.

CHAPTER B9

REFERENCES

- B9-1. NAVSEA S0420-AA-RAD-010, Radiological Affairs Support Program (RASP) Manual (NOTAL)
- B9-2. OPNAVINST 6470.2A
- B9-3. OPNAVINST 6470.3
- B9-4. NAVSEA 389-0288, Radiological Controls for Shipyards (NOTAL)
- B9-5. ANSI C95.6, IEEE Standard for Safety Levels with Respect to Human Exposure to Electromagnetic Fields, 0 to 3 kHz (NOTAL)
- B9-6. ANSI C95.1, IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz (NOTAL)
- B9-7. DoD Instruction 6055.11, Protection of DoD Personnel from Exposure to Radiofrequency Radiation
- B9-8. ANSI Z136.1, The American National Standard for the Safe Use of Lasers (NOTAL)
- B9-9. ANSI Z136.3, The American National Standard for the Safe Use of Lasers in Health Care Facilities
- B9-10. NAVMED P-5055, Radiation Health Protection Manual
- B9-11. BUMEDINST 6470.22, Navy Radiological Systems Performance Evaluation Program
- B9-12. Navy Environmental Health Center Technical Manual NEHC - TM 6470.03-1, Navy Radiological Systems Performance Evaluation Manual

- B9-13. BUMEDINST 6470.10B, Initial Management of Irradiated or Radioactively Contaminated Personnel
- B9-14. DoD 6055.5-M, Occupational Health Surveillance Manual
- B9-15. OPNAVINST 5100.27A/MCO 5104.1B
- B9-16. BUMEDINST 6470.19A, Laser Safety for Medical Facilities
- B9-17. NAVSEA OP 3565/NAVAIR 16-1-529/NAVELEX 0967-LP-624-6010, Electromagnetic Radiation Hazards (Hazards to Personnel, Fuel, and other Flammable Material)
- B9-18. MIL-STD-464A, Electromagnetic Environmental Effects Requirements for Systems
- B9-19. BUMEDINST 6470.23, Medical Management of Non-Ionizing Radiation Casualties
- B9-20. ANSI C95.2, IEEE Standard for Radio-Frequency Energy and Current Flow Symbols (NOTAL)
- B9-21. ANSI C95.3, IEEE Recommended Practice for Measurements and Computations of Radio Frequency Electromagnetic Fields with Respect to Human Exposure to such Fields, 100 kHz t 300 GHz (NOTAL)
- B9-22. ANSI C95.4, IEEE Recommended Practice for Determining Safe Distances from Radio Frequency Transmitting Antennas when Using Electric Blasting Caps (NOTAL)
- B9-23. ANSI C95.7, IEEE Recommended Practice for Radio Frequency Safety Programs (NOTAL)
- B9-24.21 CFR Part 1040, FDA Performance Standards for Light Emitting Products
- B9-25. SECNAVINST 5100.14C
- B9-26. MIL-HDBK-828A, Laser Safety on Ranges and in Other Outdoors Areas

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B9-27. ANSI Z136.7, The American National Standard for Laser Eye Protection and Protective Devices (NOTAL)

B9-28. ANSI Z136.2, The American National Standard for the Safe Use of Optical Fiber Communication Systems Utilizing Laser Diode And LED Sources (NOTAL)

B9-29. ANSI Z136.4, The American National Standard for Laser Safety Measurements and Instrumentation (NOTAL)

B9-30. ANSI Z136.5, The American National Standard for the Safe Use of Lasers in Educational Institutions

B9-31. ANSI Z136.6, The American National Standard for the Safe Use of Lasers Outdoors (NOTAL)

B9-32. NAVSEA S9040-AA-GTP-010/SSCR, Shipboard Systems Certification Requirements for Surface Ship Industrial Periods (Non-Nuclear) (NOTAL)

Appendix B9-A

CHAPTER B9 RADIATION INSTRUCTIONS, STANDARDS, REGULATIONS, MANUALS, AND HANDBOOKS

A. THOSE CONTAINING IONIZING RADIATION GUIDENCE:

NAVMED P-5055, Radiation Health Protection Manual

This manual provides the radiation health requirements applicable to Navy and Marine Corps radiation protection programs. A radiation protection program may be defined as the sum of all methods, plans, and procedures used to protect the health and environment of personnel from exposure to sources of ionizing radiation. It includes the radiation health program and radiological controls program.

These regulations are intended for observance during peacetime by all Navy and Marine Corps activities possessing or using sources of ionizing radiation which may affect the health of personnel. These standards do not apply to the exposure of an individual to ionizing radiation when used for the diagnosis or treatment of medical or dental conditions of that individual. Personnel not employed by the Department of the Navy shall comply in all respects with these regulations when engaged in a Navy sponsored program or operation. It is recognized that these regulations may not be applicable to procedures initiated after an attack in which nuclear weapons are used; however, the provisions of these regulations, insofar as they are feasible, shall remain in effect after such an attack.

BUMEDINST 6470.22, Navy Radiological Systems Performance Evaluation Program

This instruction provides guidance on the radiological safety management of all diagnostic imaging systems in Navy Medicine that use ionizing radiation. This instruction applies to all naval facilities and commands, ashore or afloat, and Navy Medical Department sponsored operations having medical and dental radiological systems. For implementation procedures this instruction references

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the Navy Environmental Health Center Technical Manual (NEHC) TM 6470.03-1, "Navy Radiological Systems Performance Evaluation Manual."

Navy Environmental Health Center Technical Manual NEHC -TM 6470.03-1, Navy Radiological Systems Performance Evaluation Manual

This manual provides the surveyor with standard procedures for acceptance testing and periodic testing of medical diagnostic medical equipment that employs ionizing radiation for ships and shore stations. This manual establishes periodicity of surveys, parameters to be measured, training and qualification of surveyors, and reporting requirements. This manual does not address therapeutic medical equipment that employs ionizing radiation.

BUMEDINST 6470.10B, Initial Management of Irradiated or Radioactively Contaminated Personnel

To provide direction to the Medical Department, civilian medical personnel of the naval services, and Navy and Marine Corps commands for the initial exposure assessment, management, and treatment of individuals who are irradiated or externally or internally radioactively contaminated.

This instruction applies to all naval facilities or commands and Navy-sponsored operations in which there exists a known potential for radioactive contamination or excessive ionizing radiation exposure and to all medical treatment facilities (MTFs), fixed and non-fixed. This instruction applies to the period from actual exposure, contamination, or injury to the time when the individual is either returned to full-duty or, if a seriously injured individual is on a course of recovery at an MTF with definitive care capability. Although applicable to personnel irradiation or contamination following a nuclear weapon detonation in a time of war, the procedures outlined in this instruction are intended for use in occupational or accidental exposure environments.

NAVSEA 389-0288, Radiological Controls for Shipyards

This manual presents the limits and protection measures applicable to ionizing radiation and radioactivity associated with constructing, servicing, and decommissioning U.S. naval nuclear propulsion plants; it does not cover control of radiation from nuclear weapons, medical uses, or other employment of radiation. The procedures and limits in this manual are applicable to shipyards, Fleet Maintenance Activities (FMAs), and naval reactors prototype sites.

NAVSEA TW120-AA-PRO-010, Nuclear Weapons Radiological Controls Program

This manual establishes the requirements for the Navy's nuclear weapons radiological controls program. This program is concerned with radiation exposure received during stowage, maintenance or handling of nuclear weapons and is not involved with radiation exposure from weapon detonation, fallout, naval nuclear propulsion plants, industrial or medical sources. The requirements of this manual apply to each ship, station or facility that stows, maintains, or handles nuclear weapons.

NAVSEA S9213-33-MMA-000/(V), Radiological Controls for Ships

This manual provides the radiological safety standards, procedures, and requirements for nuclear powered ships and in-hull propulsion plant operations and routine maintenance at naval reactor prototypes.

NAVSEA S0420-AA-RAD-010, Radiological Affairs Support Program (RASP) Manual

The RASP applies to all sources of ionizing radiation with the Navy and Marine Corps except nuclear propulsion, nuclear weapons, and medical-dental sources. Ships and shore stations shall comply with the standards and procedures of this manual and maintain effective radiation protection programs for any operation involving RASP ionizing radiation sources.

DoD Instruction 6055.8, Occupational Radiation Protection Program

DoD Instruction 6055.8 implements the United States Environmental Protection Agency "Radiation Protection Guidance to Federal Agencies for Occupational Exposure" of January 1987.

Applies to the Office of the Secretary of Defense (OSD), the military departments (including the Reserve components), the Joint Staff, the Unified and Specified Commands, the Defense Agencies, the DoD Field Activities, and the Army and Air Force Exchange Service (hereafter referred to collectively as "DoD Components"). Applies during peacetime to all DoD civilian and military personnel who are exposed to ionizing radiation worldwide, except personnel who, as patients, undergo diagnostic or therapeutic radiological procedures in medical or dental treatment facilities.

OPNAVINST 6470.2A, Occupational Radiation Protection Program

OPNAVINST 6470.2 formalizes the uniform occupational radiation protection program for the Department of the Navy, required by DoD Instruction 6055.8, to preserve and maintain the health of personnel while performing duties involving occupational exposure to sources of ionizing radiation.

OPNAVINST 6470.3, Navy Radiation Safety Committee

This instruction establishes the Navy radiation safety committee as a means for controlling the use of radioactive material within the Navy and Marine Corps.

This instruction applies to all Navy and Marine Corps activities engaged in the use of Nuclear Regulatory Commission (NRC) regulated byproduct material, special nuclear material, source material, and naturally occurring or accelerator-produced radioactive material. It does not apply to radioactive materials transferred from the Department of Energy (DOE) to the Department of Defense (DoD) in accordance with section 91B of the Atomic Energy Act of 1954. Nor does it apply to radioactive materials

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produced as a consequence of the construction, operation, servicing or maintenance of naval nuclear propulsion plants.

B: THOSE CONTAINING BOTH RF AND LASER RADIATION GUIDENCE UNDER ONE DOCUMENT:

OPNAVINST 5100.23G, Navy Safety and Occupational Health (SOH) Program Manual, chapter 22, Non-Ionizing Radiation, and appendix 22 A and B.

This chapter implements SOH procedures for non-ionizing (RF and Laser) radiation protection requirements, exposure standards and safety guidelines for all levels of command (OPNAVINST 5100.19D is the implementing document for forces afloat). Provisions of this chapter do not apply to exposures administered to patients undergoing medical diagnostic or therapeutic procedures.

BUMEDINST 6470.23, Medical Management of Non-Ionizing Radiation Casualties

The purpose of this instruction is to issue MPE limits, medical surveillance requirements, and casualty management procedures for personnel exposed to non-ionizing (RF and Laser) electromagnetic radiation. It applies to all Departments of the Navy activities using sources of non-ionizing radiation that may affect the safety or health of personnel. Personnel not employed by the Department of the Navy must comply in all respects with this instruction when engaged in a Navy-sponsored program or operation, or when visiting Navy ships, aircraft, or stations. This instruction does not apply to the exposure of individuals to non-ionizing radiation when used for the diagnosis or treatment of medical or dental conditions of those individuals.

C: THOSE CONTAINING ONLY LASER RADIATION GUIDANCE:

OPNAVINST 5100.27A/MCO 5104.1B, Navy Laser Hazards Control Program

The purpose of this instruction is to prescribe Navy and Marine Corps policy and guidance in the identification and control of laser radiation hazards. The scope and provisions of this directive are mandatory for all Navy and Marine Corps activities. They apply to the design, use, and disposal of all equipment and systems capable of producing laser radiation including laser fiber optics, with the exception of medical and industrial lasers.

BUMEDINST 6470.19A, Laser Safety for Medical Facilities

This instruction provides laser safety guidance for medical facilities. It applies to all medical treatment and laboratory activities using lasers or laser systems. This instruction does not apply to the use of lasers or laser systems for military, industrial, or non-medical research applications.

SECNAVINST 5100.14C, Military Exempt Lasers

The purpose of this instruction is to implement DoD Instruction 6055.11, provide policy, and assign responsibilities per SECNAVINST 5100.10G for individual Navy laser products that are exempt from portions of the radiation safety performance standards of code of federal regulations, title 21. Actions required by this instruction apply to all Navy and Marine Corps activities that procure, fabricate, possess, use, store or dispose of laser products that are designed for combat, combat training or classified in the interest of national security. Laser products used in research, development, test or evaluation and which are components of systems intended for combat, combat training or classified are included. All other laser products must comply fully with code of federal regulations, title 21 and are not within the scope of this instruction.

MIL-HDBK-828A, Laser Safety on Ranges and in Other Outdoors Areas

The purpose of this handbook is to provide uniform guidance in evaluations for the safe use of military lasers and laser systems on DoD military reservations or military-controlled areas worldwide. It is intended to supplement each military service's established range procedures. It applies to all DoD ranges or operation test facilities where lasers are used and all DoD laser operations conducted on non- DoD controlled ranges or test facilities and all laser systems that have been evaluated by the health and safety specialists of each Service.

21 CFR Part 1040, FDA Performance Standards for Light Emitting Products

Classifies laser products and defines design features, labeling, and test requirements. Access on line at:
<http://www.navylasersafety.com/>

ANSI Z136.1, The American National Standard for the Safe Use of Lasers

This is the fundamental commercial user standard that has been approved and adopted by the DON. This standard is meant for users, not manufacturers (commercial designers/manufacturers of lasers use FDA's 21 code of federal regulations (CFR) chapter I, subpart J, Part 1040). The ANSI standard provides guidance by defining control measures for each of the four laser classifications. It is applicable to lasers with wavelengths from 180 nm to 1 mm, and provides information on laser hazard evaluation.

ANSI Z136.2, The American National Standard for the Safe Use of Optical Fiber Communication Systems Utilizing Laser Diode And LED Sources

ANSI Z136.3, The American National Standard for the Safe Use of Lasers in Health Care Facilities

ANSI Z136.4, The American National Standard for Laser Safety Measurements and Instrumentation

ANSI Z136.5, The American National Standard for the Safe Use of Lasers in Educational Institutions

ANSI Z136.6, The American National Standard for the Safe Use of Lasers Outdoors

ANSI Z136.7, The American National Standard for Laser Eye Protection and Protective Devices

D: THOSE CONTAINING ONLY RF RADIATION GUIDANCE:

DoD Instruction 6055.11, Protection of DoD Personnel from Exposure to Radiofrequency Radiation

This instruction provides MPE limits to RF EMF. This instruction also covers training requirements and over exposure reporting procedures. This instruction applies to all DoD civilian and military personnel who may be exposed to RF EMF, except for patients undergoing diagnostic or therapeutic procedures in medical and dental treatment facilities. This instruction applies during peace time and to the maximum extent possible during wartime, to limit personnel exposure to RF EMF.

NAVSEA OP 3565/NAVAIR 16-1-529/NAVELEX 0967-LP-624-6010, Electromagnetic Radiation Hazards (Hazards to Personnel, Fuel, and other Flammable Material)

The purpose of this volume is to prescribe operating procedures and precautions to prevent injury to personnel and ignition of volatile vapors from exposure to environmental electromagnetic radiation (EMR) to assist commanding officers in carrying out their responsibilities for EMR safety. The sources of this EMR include communications transmitters, radars, electronic countermeasures transmitters, and lasers. This manual also provides technical data and information concerning non-ionizing radio frequency (RF), hazards to personnel, fuel, and other flammable material, as well as laser hazards to personnel. The procedures and precautions prescribed herein apply in every instance within the naval establishment where a person or a flammable vapor mixture is exposed to RF fields of potentially hazardous intensity.

Operational commanders may waive compliance with any provision when essential under emergency conditions. When noncompliance with restrictions contained herein is essential, emergency procedures are suggested and background information is provided in order to explain and minimize the risks involved.

MIL-STD-464A, Electromagnetic Environmental Effects Requirements for Systems

This standard established electromagnetic environmental effects (E3) interface requirement and verification criteria for airborne, sea, space, and ground systems, including associated ordnance. This standard contains two sections, the main body and an appendix. The main body of the standard specifies a baseline set of requirements. The appendix portion provides rationale, guidance, and lessons learned for each requirement to enable the procuring activity to tailor the baseline requirement for a particular application.

ANSI C95.1, IEEE Standard for Safety Levels with Respect to Human Exposure to Radiofrequency Electromagnetic Fields, 3 kHz to 300 GHz

ANSI C95.2, IEEE Standard for Radiofrequency Energy and Current Flow Symbols

ANSI C95.3, IEEE Recommended Practice for Measurements and Computations of Radiofrequency Electromagnetic Fields with Respect to Human Exposure to such Fields, 100 kHz to 300 GHz

ANSI C95.4, IEEE Recommended Practice for Determining Safe Distances from Radiofrequency Transmitting Antennas when Using Electric Blasting Caps

ANSI C95.6, IEEE Standard for Safety Levels with Respect to Human Exposure to Electromagnetic Fields, 0 to 3 kHz

ANSI C95.7, IEEE Recommended Practice for Radiofrequency Safety Programs

OPNAVINST 5100.19E
30 May 2007

E: OTHER RELATED DOCUMENTS:

OPNAVINST 5102.1D/MCO P5102.1B, Navy and Marine Corps Mishap and Safety Investigation, Reporting, and Recordkeeping Manual

This instruction provides procedures for investigating and reporting material (property) damage, personnel injury/death, Navy civilian occupational injuries and illnesses, motor vehicle, explosive, and diving mishaps.

NAVSEA S9040-AA-GTP-010/SSCR, Shipboard Systems Certification Requirements for Surface Ship Industrial Periods (Non-Nuclear)
DoD 6055.5-M, Occupational Health Surveillance Manual

CHAPTER B10

LEAD CONTROL

B1001. DISCUSSION

a. The purpose of this chapter is to prevent lead intoxication and related injuries during the use, handling, removal and melting of materials containing lead.

b. In this chapter, "lead" means metallic lead, all inorganic lead compounds, and organic lead soaps. Lead's low melting point, high molecular weight, high density and malleability make it useful structural material. When added to resins, grease, or rubber, lead compounds act as antioxidants. Common uses for lead and lead compounds include ballast, radiation shielding, paint filler and hardener, rubber and pipe joints, high voltage cable shielding, small arms ammunition, batteries and weights. While not an absolute indicator, red, forest green, chrome yellow and "school bus" yellow color paints typically contain lead compounds. Lead may also be found in polyurethane and water-based paints.

c. Significant lead exposures can occur during: lead and babbitt melting and casting; ballast handling; spraying, sanding, grinding, burning, and abrasive blasting of lead-containing materials and lead-containing paint; brazing with torches; high voltage cable repair; abrasive blasting with smelting slag; lead-acid battery reclaiming; machining lead; disassembly of gasoline engine components (which have used leaded gasoline); and handling of contaminated personal clothing.

d. Lead is a recognized health hazard. Lead may adversely affect the peripheral and central nervous systems, as well as the red blood cells, kidneys, reproductive and endocrine systems.

e. In recognition of the serious health hazards associated with lead and the numerous sources of potential lead exposure, the Navy has established strict controls to limit both occupational and environmental exposures. Standards and controls discussed in this chapter shall be applicable to all Navy personnel.

B1002. PERMISSIBLE EXPOSURE LIMIT AND ACTION LEVEL TRIGGERING REQUIREMENTS

a. Permissible Exposure Limit (PEL). The PEL for an eight-hour time-weighted average (TWA) exposure to airborne lead is 50 micrograms per cubic meter (ug/m^3) of air.

b. Action Level (AL). The AL for an eight-hour TWA exposure to airborne lead is 30 ug/m^3 (without regard to respirator use).

c. Biological monitoring and medical surveillance shall be initiated when an employee's exposure exceeds the AL for more than 30 days per year.

d. Engineering and administrative controls shall be initiated when an individual's exposure exceeds the PEL for more than 30 days per year. When a person's exposure is greater than the AL, but less than the PEL, engineering controls shall be initiated to reduce the workplace environmental level to a maximum of 200 ug/m^3 . Thereafter, any combination of engineering and administrative controls may be used to maintain exposure at or below the PEL.

B1003. LEAD CONTROL RESPONSIBILITIES

a. Commanding officers shall not authorize paint removal for cosmetic reasons or due to excessive paint thickness. They may only authorize paint removal to protect the ship from corrosion, when incidental to hot work, and when bare metal is required for an inspection.

b. The safety officer shall:

(1) When applicable, as determined by the baseline industrial hygiene survey, establish effective shipboard lead control practices that include as a minimum those elements in paragraph B1004.

(2) Verify that the ship has the proper clothing and equipment aboard to protect personnel during shipboard lead work.

(3) Notify the commanding officer when sufficient funds are unavailable to obtain mandatory protective clothing

and equipment to protect ship's force personnel during shipboard lead work.

(4) If specified in the baseline industrial hygiene survey, ensure a written compliance plan to comply with lead control requirements is available. The supporting industrial hygiene officer/industrial hygienist shall prepare this plan.

(5) Implement lead hazard training for all personnel identified in the baseline industrial hygiene survey as potentially exposed to lead at or above the AL.

(6) Request industrial hygiene assistance for the evaluation of new potential lead hazards.

c. Division officers shall:

(1) Ensure that personnel required to perform work involving lead exposure are provided with proper clothing and equipment and trained in its use.

(2) Ensure that personnel who work with lead or who work in areas where the potential exists for lead exposure at or above the AL are properly trained.

(3) Identify to the medical department representative (MDR), personnel who work with lead or who work in areas where the potential exists for lead exposure at or above the AL.

d. The Medical department representative (MDR) shall:

(1) Assist the safety officer with conducting lead hazard training upon request.

(2) Schedule personnel for blood lead analysis and physical examinations at shore medical activities as required for medical surveillance.

e. All hands shall:

(1) Obtain and properly use protective equipment and use safe work practices as trained when working with lead.

(2) Report for medical surveillance tests and examinations, when scheduled.

B1004. LEAD CONTROL ELEMENTS

The following elements, as a minimum, are necessary to carry out effective lead control:

- a. Industrial hygiene survey (paragraph B1005);
- b. Control of lead in the workplace environment (paragraph B1006);
- c. Waste disposal procedures (paragraph B1007);
- d. Medical surveillance (paragraph B1008);
- e. Written compliance plan (paragraph B1009);
- f. Worker and supervisor training (paragraph B1010).

B1005. INDUSTRIAL HYGIENE SURVEY

a. An industrial hygienist shall evaluate all workplaces in which lead is used. This evaluation shall be accomplished during the baseline and periodic industrial hygiene surveys specified per chapter A3. Where a potential for exposure from inhalation of airborne lead particulate or personnel contamination is found, the industrial hygienist shall establish an exposure monitoring plan to characterize personnel exposures. When personnel lead exposures warrant, the industrial hygiene survey shall identify the need for the command to have a written lead hazard compliance plan and provide the specific content for the plan.

b. Within five working days after the receipt of exposure monitoring results, the command shall notify affected personnel in writing of results that represent their exposure. Whenever the results indicate that the individual was exposed above the PEL, without regard to respirator use, the written statement shall include that fact and a description of the corrective action(s) taken to reduce the individual's exposure.

c. If the safety officer or any supervisor has a question regarding the potential lead hazards and appropriate controls involving an operation which includes or potentially includes lead, the safety officer shall request industrial hygiene officer assistance from a tender, staff or local medical treatment facility or Navy Environmental and Preventive Medicine Unit (NAVENPVNTMEDU).

B1006. CONTROL OF LEAD IN THE WORKPLACE ENVIRONMENT

There are seven basic principles to be used when working with lead or materials that contain lead:

a. General Workplace Control Practices

(1) Use non-lead paint.

(2) Keep mechanical grinding and sanding to the absolute minimum with primary reliance on impact tools and authorized chemical strippers for paint removal. Mechanical tools equipped with high efficiency particulate air (HEPA) filtered exhaust for removal and reclamation of lead dust are preferred.

(3) When feasible, minimize the heating of lead and leaded materials by using thermostatically-controlled heating (below 600 degrees Fahrenheit) or removing the lead-containing surface coatings or contaminants prior to heating.

(4) Establish procedures to maintain work surfaces as free of lead dust as is practical. Clean up lead dust with a HEPA filtered vacuum cleaner. Wet sweeping, wet brushing and wiping down with wet rags may be effective in removing lead dust. Rags used for wiping down shall be disposed of as lead waste.

(5) Lead-containing waste, scrap, debris, containers, equipment and clothing consigned for disposal shall be collected, sealed, and labeled in impermeable containers. Transportation shall be conducted in a manner that does not release airborne dust or pollute surrounding waterways. Dispose of lead waste per the procedures of chapter B3.

(6) To minimize exposure potential, isolate hot work on lead and abrasive lead removal operations from other operations.

b. Ventilation

(1) If deemed necessary by the cognizant industrial hygienist, provide fixed local exhaust ventilation connected to high efficiency particulate air filters at the point of particulate generation.

(2) Do not exhaust emissions to another workspace.

c. Personal Protective Clothing and Related Control Facilities

(1) Personnel engaged in the handling of lead or in situations where the concentration of airborne particulate lead is likely to exceed the PEL, or where the possibility of skin or eye irritation exists shall remove uniform clothing and wear protective clothing. Consult the command's industrial hygiene officer, industrial hygiene survey, or contact the local BUMED industrial hygienist for specific clothing requirements. Clothing shall be waterproof when wet lead is handled.

(2) Personnel shall remove protective clothing before leaving the work area.

(3) Provide change rooms as close as practical to the lead work area(s) for personnel who work where the airborne lead exposure is above the PEL (without regard to the use of respirators). When possible, locate shower facilities between the "clean" and "dirty" change rooms. Consult the command's industrial hygiene officer, industrial hygiene survey, or contact the local BUMED industrial hygienist for specific decontamination facility requirements.

(4) Launder lead-contaminated clothing to prevent release of lead dust in excess of the AL. Transport lead-contaminated clothing in a sealed container with the standard "caution label" affixed (see paragraph B1006(e)). Notify persons who clean or launder protective clothing or equipment in writing of the potentially harmful effects of exposure to lead

and monitor these persons for exposure to lead as required by paragraph B1005.

d. Respiratory Protection

(1) Respirators are required where the concentration of airborne, particulate lead is likely to exceed the PEL.

(2) Consult the command's respiratory protection program manager (RPPM), industrial hygiene survey, or contact the local BUMED industrial hygienist for specific respirator requirements.

e. Warning Signs and Caution Labels

(1) **Warning signs** shall be provided and displayed at each location where airborne lead concentrations may exceed the PEL. Signs shall state, as a minimum, the following:

**WARNING
LEAD WORK AREA
POISON
NO SMOKING, EATING OR DRINKING**

(2) **Caution labels** shall be affixed to containers of lead-contaminated clothing and equipment, raw materials, waste, debris, or other products containing lead. These caution labels shall state:

**CAUTION

CLOTHING CONTAMINATED WITH LEAD
DO NOT REMOVE DUST BY BLOWING OR SHAKING
DISPOSE OF LEAD CONTAMINATED WASH WATER ACCORDING TO
APPLICABLE LOCAL, STATE OR FEDERAL REGULATIONS**

f. Housekeeping

(1) Where lead containing materials are routinely melted, ground or cut, maintain all surfaces as free as practical of lead accumulation. Clean surfaces at least once per shift to prevent accumulation of lead dust.

(2) All cleaning shall use methods such as vacuuming with HEPA filtered vacuum cleaners or washing down where feasible, observing water pollution regulations as they pertain to lead-contaminated wastewater. Only use wet sweeping, shoveling or brushing shall when other methods have been tried and found to be ineffective or infeasible.

(3) Do not use compressed air to clean work surfaces.

(4) When wash down procedures are used to clean surfaces or wetting is used to control dust, treat floor surfaces with a non-skid agent and drain the floor so that excess water is collected in a holding tank for disposal per chapter B3.

g. Personal Hygiene

(1) Prohibit eating, drinking, smoking, chewing of tobacco products or gum, the application of makeup, and storage of food and tobacco products in lead work areas.

(2) Personnel working with lead shall wash their hands and faces prior to eating, drinking, smoking or applying cosmetics.

B1007. WASTE DISPOSAL PROCEDURES

a. Lead-containing waste materials are classified as hazardous material and must be handled per chapter B3. Bag hazardous lead waste in heavy-duty plastic bags or other impermeable containers. Label bags with caution labels described in paragraph B1006e(2).

b. Label containers such as bags and trash cans "**LEAD WASTE ONLY.**" Care must be exercised in order to prevent bags and other containers from rupturing when being moved.

B1008. MEDICAL SURVEILLANCE

a. Medical surveillance consists of: pre-placement medical evaluation, blood lead monitoring, and follow-up medical evaluation based on the results of blood lead analysis, worker complaint, and physician opinion. The lead medical surveillance examination and forms can be found in the medical matrix of

reference B10-1 as examination #161. Personnel are included in this program when industrial hygiene surveillance indicates that they perform work or are likely to be in the vicinity of an operation which generates airborne lead concentrations at or above the AL more than 30 days per year. Inclusion in this program is based on measured airborne concentrations without regard to respirator use, and therefore does not indicate that an individual is overexposed to lead.

b. Within five days of receipt of blood lead monitoring results, the command shall notify affected personnel in writing of his/her blood lead if their blood lead level is at or above 30 ug/100gm. Notification should include the criteria for removal from lead work and, if appropriate, notification that the person is being temporarily removed from lead exposure per reference B10-2. If an individual is pregnant, she should be counseled on the possible adverse affects to the pregnancy or fetus. A decision regarding any action to be taken will be made by the physician on a case-by-case basis.

c. All records of examinations, possible lead-related conditions, related laboratory results and all forms and correspondence related to the person's medical history shall become a permanent part of the health record and be retained for the period of naval service plus 20 years, or 40 years after the date of the last entry, whichever is longer.

B1009. WRITTEN COMPLIANCE PLAN

The supporting industrial hygiene officer or industrial hygienist shall prepare a written compliance plan for processes that produce exposures in excess of the PEL as specified in reference B10-2. The ship only needs a lead compliance plan if lead processes are identified during the baseline industrial hygiene survey. These plans shall include the following items, at a minimum:

a. A description of each operation in which lead is emitted; (e.g., machinery used, material processed, controls in place, crew size, employee job responsibilities, operating procedures and maintenance practices);

b. A description of the specific means that will be employed to achieve compliance, including engineering plans and

studies used to determine methods selected for controlling exposure to lead;

c. A report of the technology considered in meeting the permissible exposure limit;

d. Air monitoring data that documents the source of lead emission;

e. A detailed schedule for implementation of the program, including documentation such as copies of purchase orders for equipment, construction contracts, etc.;

f. A work practice program which includes items required under paragraphs (g), (h) and (i) of reference B10-2;

g. An administrative control schedule required by paragraph (e)(6) of reference B10-2, if applicable; and

h. Other relevant information.

The supporting industrial hygiene officer/industrial hygienist shall review written plans and update as necessary at least every six months to reflect the current status.

B1010. TRAINING

a. All personnel who are potentially exposed to lead at or above the AL, and their supervisors shall receive initial training prior to such assignment and at least annually thereafter. This training shall, at a minimum, include the following:

(1) The specific nature of operations during which exposure is possible;

(2) The purpose, proper selection, fit testing, use and limitations of respirators;

(3) The adverse health effects of lead with particular attention to the reproductive effects upon both males and females, including the possible adverse effects on pregnancy and the fetus;

(4) The purpose and description of the medical surveillance program, including the use of chelating agents;

(5) The engineering controls and work practices to be applied and used in the work, including personal protective equipment and personal hygiene measures;

(6) The contents of any compliance plan in effect; and

(7) The command shall procure sufficient copies of reference B10-1 from the Department of Labor and make them available to personnel required to receive training. They should be provided with appendix B (employee standard summary) of reference B10-2 and, upon request, any other handout-type materials used in or related to the training.

b. All painted surfaces that cannot be identified as lead-free through laboratory analysis must be handled as containing lead. Division officers shall train personnel assigned to remove paint per the safety precaution for paint removal in chapters C18 and D12.

CHAPTER B10

REFERENCES

B10-1. NEHC TM OM-6260, Medical Surveillance Procedures Manual and Medical Matrix

B10-2. 29 Code of Federal Regulations (CFR) 1910.1025, Lead

CHAPTER B11

TAG-OUT

B1101. DISCUSSION

a. A tag-out procedure is necessary because of the complexity of modern ships and the cost, delays, and hazards to personnel which could result from improper operation of equipment or the inadvertent release of stored energy. In order to prevent injury to personnel and damage to equipment, the tag-out program is mandatory for all-shipboard equipment, components, and systems. The program is designed to notify personnel that tagged out equipment or systems are not in a normal operating condition. The tag-out procedure consists of a series of tags or adhesive labels that are applied to instruments, gauges, or meters to indicate that they are inoperative, restricted use, or out of calibration. Each tag contains information necessary to avoid a possible mishap. Standard tag-out procedures are to be used for shipboard work performed by any activity. Tag-out procedures shall be enforced at all times. The use of tags or labels is not a substitute for other safety measures such as chaining or locking valves, removing fuses, or racking out circuit breakers. If any system, portion of a system, component, equipment, or instrument has more than one type of tag or sticker, the **DANGER (RED)** tag, when present, shall take precedence over all other tags or stickers.

b. Reference B11-1 is the primary technical reference for all tag-out procedures conducted by ship's crew.

c. A tag-out program checklist is provided in appendix B11-A

CHAPTER B11

REFERENCES

B11-1. NAVSEA S0400-AD-URM-010/TUM, Tag-Out User's Manual (NOTAL)

Appendix B11-A

TAG-OUT PROGRAM CHECKLIST

Indicate by an X, the answer to each of the questions below. If a question is not applicable to the command, indicate by NA in the YES block. Explain or describe the condition warranting any NO answer on the space provided at the end of the checklist or on additional sheets, if necessary.

The location of the reference for any question is provided at the end of the question.

	YES	NO
PROGRAM RESPONSIBILITIES		
1. Do department heads ensure that personnel assigned to their respective areas understand and comply with reference (B11-1, 1.3.1.a)?		
2. Do supervisory watchstanders review associated tag-out logs during watch relief and shift turnover? (B11-1, 1.3.1.c)		
3. Is the authorizing officer responsible for the administration of their cognizant tag-out log? (B11-1, 1.3.2.a)		
4. Is the authorizing officer for the engineering tag-out log the watch/duty officer for the propulsion plant? (B11-1, 1.3.2.c)		
TAG-OUT ESTABLISHMENT		
5. Has the type commander specified the number of logs to be maintained by ship class and where the log shall be maintained? (B-11, 1.5.1.a)		

6.	Are sufficient tags used to completely isolate equipment or prevent operation of equipment from all stations that could exercise control? (B-11-1,1.5.2.b(1))		
7.	Before authorization does the authorizing officer check the tag coverage for adequacy, and check the tags and TORS for completeness and accuracy? (B-11-1, 1.6.3.c)		
8.	Are tag-outs carefully planned in an effort to minimize unnecessary record sheets and tags to maintain better control of the tag-out process? (B11-1, 1.5.2.b(3))		
9.	Does a second qualified person independently determine the adequacy and accuracy of the TORS and tags? (B-11-1, 1.6.2)		
10.	Does a second person independently ensure that the correct component is tagged, and check (verify) proper component positioning and tag attachment? (B11-1, 1.6.5)		
11.	Is the authorizing officer final authority for the final authority for commencement of work? (B11-1, 1.6.6.b)		
12.	Does the log contain the following sections: B-11,1.5.1.c)?		
	a. A copy of the equipment tag-out bill and amplifying instructions?		
	b. DANGER/CAUTION Tag-out index and record of audits?		
	c. Effective DANGER/CAUTION Tag-out record sheets?		
	d. Instrument log?		
	e. Cleared DANGER/CAUTION tag-out record sheets?		
13.	Are danger and caution tags removed immediately when the situation requiring the tag-out has been corrected and the clearing of tags has been authorized? (B-11-1, 1.8.1)		

14. Does the authorizing officer specify in block 19 of the TORS the desired position or condition of the tagged item after the tag has been removed? (B11-1, 1.8.3)		
TAG-OUT AUDIT		
15. Does the department head ensure that audits are performed every two weeks, and for ships in overhaul, conversion, or restricted availability, conduct audits of the propulsion plant tag-out log(s) weekly? (B11-1, 1.7.4.a(1))		
16. Does ships force check all outstanding tags on each TORS for correct posting by visually comparing the information on the tag, on the TORS, and on the component for the tag audit? (B11-1, 1.7.4.b(1))		
17. Are the results for the tag audits recorded on the back of the TORS under the last tag listed or on an audit record sheet? (record the date completed, the discrepancies noted, and the signature of the person doing the audit) (B11-1, 1.7.4.b(3))		
18. Are all outstanding TORS audited against the tag-out index sheet? (B11-1, 1.7.4.c.(1))		
19. Are the results of the TORS audit entered on the index sheet, or an audit record sheet? (record the date completed, the discrepancies noted, and the signature of the person conducting the audit (B11-1, 1.7.4.c(2))		
20. Does the authorizing officer report the results of the audit to the applicable department head? (B-11-1, 1.7.4.a(2))		
21. Do special instructions on the back of the CAUTION tags checked state specific conditions under which the tagged object may be operated? (B11-1, 1.5.2.d)		

22. Do out of calibration labels checked indicate a correction factor to be applied to the instrument? (B11-1,1.10.1.a.(1))		
TRAINING		
23. Do all newly reported personnel receive indoctrination training on the tag-out program? (B11-1, 1.4.a)		
24. Do personnel assigned to prepare tag-outs, review tag-outs, position equipment, post (attach) tags, check posted tags, clear (remove) tags, or perform tag audits, qualified on the tag-out users manual? (B11-1,1.4)		
25. Is the authorizing officer responsible for ensuring that ship's force personnel assigned to make a tag-out are qualified to perform the duties under this manual? (B-11-1,1.4)		
26. Are Tag-out users manual training topics included in the ship's continuing training program? (B-11,1.4.b)		
27. Does ship's force qualify in the tag-out users manual prior to the completion of 3M 301 personnel qualification standard, and if required, completion of departmental qualifications? (B-11,1.4.d)		

CHAPTER B12

PERSONAL PROTECTIVE EQUIPMENT

B1201. DISCUSSION

This chapter provides procedures for provision and use of personal protective equipment (PPE). Chapters B1, B3, B4, B5, B6, B8, B9 and B10 contain more detailed instructions for use and maintenance of certain specialized equipment. See reference B12-1 for additional information on PPE. Appendix B12-A contains stock number information for ordering PPE. Check naval supply system for most current stock and ordering information.

PPE establishes a "last line of defense" against exposure to workplace hazards, and in some cases, may be the only means of protection. Any personal protective equipment breakdown, failure, or misuse immediately exposes the wearer to the hazard. For this reason, proper equipment selection and maintenance, personnel training (including equipment limitations), and enforcement of protective equipment maintenance, configuration, and use are key elements to an effective personal protective effort.

NOTE:

Preparation for any availability should include careful assessment of PPE needs over the entire period to ensure an adequate supply.

B1202. RESPONSIBILITIES

a. The commanding officer shall ensure that there is sufficient PPE aboard to meet the needs of his/her command. He/she shall ensure that adequate funding is provided to obtain or replace missing or worn out personal protective equipment.

b. The safety officer shall ensure that the use of PPE is monitored for required work or in required spaces, as well as being worn in a proper and effective manner. PPE selection should be based on the workplace evaluation and recommendations contained in the applicable sections of the baseline or periodic industrial hygiene survey, naval ship's technical manual (NSTM),

hazardous materials user's guide (HMUG) and maintenance requirement card (MRC). Appendix B12-B contains a checklist that can be used for program assessment and evaluation.

c. Division officers shall budget for, procure, and stock personal protective clothing and equipment and provide it to personnel as needed. Division officers shall ensure that the supply officer is aware of required changes to the allowance of PPE so that coordinated shipboard/shore-based allowance list (COSAL), allowance parts list (APL) or authorized equipment list (AEL) can be changed accordingly. Once equipment is acquired, division officers shall ensure that it is properly maintained. Additionally, division officers shall ensure that assigned personnel are adequately trained on the type and proper use of PPE required at their work stations and shall enforce the proper use and wearing of protective equipment.

d. All hands shall ensure that they wear or use the required PPE to perform assigned work in a proper manner. If the required equipment is not available to do the assigned work, or if instruction is needed on how to wear or use the equipment, the affected person shall notify his/her supervisor immediately. MDR shall assist in obtaining and providing medically fitted PPE.

B1203. PROTECTIVE EQUIPMENT

a. Head Protection. Helmets or hard hats protect crew members from the impact of falling and flying objects, from impact with low overheads, and on a limited basis, from electric shock and burn.

(1) Metal hard hats are not authorized for shipboard use.

(2) Stow helmets or hard hats in a manner so that cracks will not develop in hat material. Do not stow heavy materials atop composite material hard hats.

(3) Do not wear hard hats if cracked, if the hat material has a hole other than one caused by the manufacturer, if missing the suspension harness, or if painted. Such hard hats will be turned in and replaced.

(4) Do not drill any holes in hard hats or modify them in any way. Such action will greatly reduce the protective

capability of the headwear. Affixing decals on protective headwear is permitted.

(5) Protective headwear for cold weather (watch caps, stocking caps, ball caps, etc.) may be worn with the hard hat if it does not interfere with correct fit.

b. Foot Protection. Shipboard environments such as flight decks, hangar decks, machine shops, pipe shops, heavy supply parts stowage areas, replenishment areas, and rigging sponsons expose personnel in some degree to foot hazards.

(1) Leather shoes are required for all personnel aboard ship for normal daily wear. CORFAM® (or equivalent) shoes made of synthetic material may only be worn when immediately departing or returning to the ship or when specifically authorized by the commanding officer for ceremonial or other special occasions. Do not wear CORFAM® (or equivalent), plastic, synthetic or vinyl shoes in fire rooms, main machinery spaces or in hot work areas.

(2) Standard stock safety shoes, with built-in steel box toe protection and non-slip soles, are intended primarily to provide protection from falling and rolling objects. Enlisted personnel are issued safety shoes at recruit training commands. Officers shall be provided standard stock safety shoes when required by their work. Safety shoes should be periodically examined for worn soles and heels that would reduce the non-skid features of the shoe. Safety shoes shall be replaced when the upper leather is worn or develops cracks exposing the toe protection or the foot. When safety shoes exhibit wear such that safety protection is no longer afforded the command shall provide standard stock safety shoes as organizational clothing (similar to coveralls or foul weather gear).

(3) Special safety shoes:

(a) Semi-conductive safety shoes are used to dissipate static electricity.

(b) Safety shoes with special electrical hazard soles are used to guard against shock hazards when performing electrical work and shall be provided to EMs, ETs, and personnel working around high voltage.

(c) Safety shoes or boots with rubber or synthetic material are used for protection against acids, caustics and other liquid chemical hazards. They may or may not have toe protection.

(d) Molders boots (slip on), with toe protection, should be provided to welders to provide easy removal in case hot slag or metal drops in or on the boot.

(4) Protective shoes shall be stowed in a dry atmosphere. Where practical, they shall be stowed upright, allowing the insides to dry out.

c. Hand Protection. Hand hazards include handling sharp objects, working with chemicals or electrical equipment and hot work. The following guidance is provided:

(1) When handling sharp materials, such as sheet metal, wear leather gloves. Also wear leather gloves over electrical grade rubber gloves whenever the rubber gloves could be subjected to cutting by sharp or abrasive objects.

(2) Whenever it is necessary to work with portable electric tools or equipment in damp locations or when it is necessary to work on live electrical circuits or equipment, wear electrical grade insulating rubber gloves.

(3) Wear only gloves approved to handle acids, corrosives, solvents, and other industrial chemicals when required. The safety officer or hazardous material coordinator shall assist supervisors in the selection of gloves to protect against chemical hazards. Surgical, clear plastic, latex, or food-handler type gloves are not approved for use with hazardous materials.

(4) When it is necessary to handle hot items or perform hot work, even if tongs or other gripping/clamping tools are available, wear non-asbestos, insulated gloves.

(5) Wear Kevlar® or boning gloves when handling knives in food service situations.

(6) Do not wear gloves when operating machinery with rotating or moving parts or line handling when the gloves could be caught in the bite.

(7) Deck personnel shall be provided with leather gloves to protect against hand injury when handling sharp objects including wire rope or banding material.

(8) Stow rubber electrical insulating gloves in the box in which they came. Perform the appropriate planned maintenance on the gloves prior to stowage. Stow other rubber electrical safety protection equipment in a clean, dry, oil-free location. Care should be taken not to fold such equipment as folding will frequently result in cracks that will greatly reduce the insulating capability of the material.

(9) Do not use electrical insulating gloves for non-electrical work such as; general cleaning with cleansers, work involving solvents, work involving alkali material, or work involving acids. Cleaning products, acids and alkalis will degrade the insulating properties of the gloves making them unsafe for electrical work.

d. Safety Clothing. Special clothing may consist of fire resistant coveralls, disposable coveralls, impervious chemical spill coveralls, welding leathers, and chemical aprons. These items may be specified as required by annual safety zone inspections, baseline industrial hygiene surveys, or standard work practices. Special clothing is required for personnel involved in emergency asbestos removals (see chapter B1). When operating/working in fossil fueled machinery spaces fire retardant coveralls shall be worn (see chapter C1). Synthetic clothing, such as certified Navy twill (CNT), may only be worn when immediately departing or returning to the ship or when specifically authorized by the commanding officer for ceremonial or other special occasions. Stow leather protection equipment in a clean, dry atmosphere. Hang up welding leathers.

e. Personal Fall Protection Equipment. When climbing, working aloft or over the side, wear a full-body safety harness with safety lanyard at all times. Additionally, use the following actions to provide maximum protection:

(1) Use wire rope lanyard when doing hot work.

(2) Perform MRC 6231/001-12 R-1, or perform the appropriate planned maintenance on the safety harness and safety lanyards before each use. Inspect safety harnesses, D-rings, and safety lines before each use.

(3) Ships shall train personnel who work aloft or over the side in the proper use of personal fall protection equipment.

(4) Do not use safety lanyards for any other purpose than personal fall protection. In particular, do not use them for hoisting heavy objects.

(5) Hang lanyards and full body harnesses used for personal fall protection equipment in a cool, dry atmosphere. Do not pile equipment one upon the other, as such action may prevent proper drying and result in rotting and weakening of lanyards. Rinse nylon lanyards and full body harnesses that have been exposed to salt water with fresh water before allowing equipment to air dry prior to storage.

f. Personal Flotation Devices. Whenever personnel, other than aircrew members and flight deck personnel, are required to wear life preservers in open sea operations, the life preservers must be the inherently buoyant or the MK-1. Those jacket-type life preservers are used by personnel in exposed battle stations, when working over the side, topside in heavy weather, during replenishment at sea, in small boats and other evolutions when personnel can be carried over the side. MK-1 life preservers should not be worn by personnel performing hot work or other actions that may cause damage to the bladder. Thoroughly dry life preservers prior to stowage. Following drying, stow them in designated clean and dry locations.

CHAPTER B12

REFERENCES

B12-1. Naval Ships Technical Manual (NSTM) 077

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Appendix B12-A

PERSONAL PROTECTIVE EQUIPMENT STOCK NUMBER INFORMATION*

ITEM	NSN*
1. Head Protection:	
Hard Hat	8415-01-025-9958
Helmet, battle	8470-01-455-3325
Helmet, Flight Deck Crew	
Cloth	8415-00-861-3527
Helmet, liner	8470-01-455-3338
Helmet, shell	8470-01-455-3331
Pad, Back Assembly	8415-00-178-6830
Pad, Front Assembly	8415-00-178-6831
Shell Assembly,	
Front	8415-00-178-7013
Shell Assembly,	
Back	8415-00-178-6855
2. Safety Shoes:	
Steel Tip	8430-00-596-5396 through 6052
	8430-01-032-2900 through 2909
	8430-01-079-1252, MIL-S-21894
Steel Tip Boots	8430-00-624-2151 (series)
Molder's	8430-00-926-9966 (series)
Electrical	8430-00-611-8314 (series)
Rubber	8430-00-624-2151 (series)
3. Gloves:	
Leather	8415-01-092-3910
Butyl	8415-00-753-6551 through 6554
Industrial (corro-	
sive handling)	8415-00-266-8673, 8675, 8677, 8679
Industrial (organic	
solvent handling)	8415-00-823-7456, 7457
Kelvar® work gloves	41110-01-397-7346, 7348, 7349
Neoprene	8415-00-753-6551 through 6553
PVC	8415-00-916-2817, 2818
Rubber (chemical	
handling)	8415-00-753-6651 through 6654
Rubber latex	8415-01-012-9294
Protective Fuel	
and Oxidizer	8415-00-577-4091 (series)
Resistant (Resin	
Modified Butyl)	
Chipper, Gauntlet	
Left	8415-00-559-1339 (series)
Chipper, Gauntlet	
Right	(series)
Cotton, Work	8415-00-268-8330
Cloth, leather palm	8415-00-268-8350

ITEM	NSN*
	Leather, Welder, Gauntlet 8415-00-269-0432 (series) Leather, heavy 8415-00-268-7871 (series) Leather, Gauntlet, Linesman 8415-00-274-2432 (series) Cotton Knit, Fire Retardant 8415-00-024-9505 Heat Protective Mitten 8415-01-092-0039 Rubber, Electrical Insulating 8415-01-158-9445 through 9449
4. Safety Clothing:	Butyl apron 8415-00-281-7813 through 7815 Plastic apron 8415-00-715-0450 Rubber apron 8415-00-082-6108 Boot covers, butyl 8430-00-262-5295 through 5297 Boot covers, disposable 8430-00-591-1359 Coveralls, toxicological 8415-00-099-6962, 6968, 6970 Coverall, white cloth 8405-00-082-5536 through 5539 Coveralls, cotton (fire retardant) 8405-01-286-XXXX (series) Coveralls, Nomex (fire retardant) 4210-01-514-XXXX (series) Coveralls, anti-exposure 8415-01-531-XXXX (series) Coveralls, Catapult Crewman 8415-00-753-6346 (series) Coveralls, Cotton Sateen (Maintenance) 8405-00-131-6507 (series) Coveralls, Microwave Radiation Protection 8415-00-006-7770 (series) Coveralls, Arc Protection 8415-00-081-6481 (series) Footwear, Disposal Covers (used for OTTO II handling and with microwave protection coveralls) 0430-00-591-1359 (series) Coveralls, Explosive Handling 8415-00-280-2455 (series) Coveralls, Rocket Fuel Handlers Impermeable Full Protection 8415-00-725-3627 (series) Hood, Rocket Fuel Handlers, Impermeable 8415-00-753-6210

ITEM	NSN*
	Clothing, leather (for welders)
	Sleeves 8415-00-164-0513
	Jacket 8415-00-268-8262 (series)
	Apron 8415-00-250-2531
	Jacket, cold weather 8415-01-495-XXXX (series)
5. Personal	Safety Harness Complete
Fall	Assembly (work/safety
Protection	lanyard) 4240-00-402-4514
Equipment:	Safety Harness 4240-00-022-2522
	Safety Lanyard, ½"
	Nylon Rope NEW NSN TBD
	Safety Lanyard 1"
	Strap Nylon NEW NSN TBD
	Climber Safety Sleeve 4240-01-042-9688
6. Personal	Life Preserver,
Flotation	Vest, Foam Pack
Devices:	(Inherently Buoyant) 4220-00-200-0538 (KAPOK)
	MIL-L-18045 TYPE I is being replaced with:
	Life Preserver, Vest
	(Inherently Buoyant)
	(Stearns I600-ORG-NLT) 4220-01-485-1138
	Life Preserver
	MK1 Auto Inflatable
	Complete 4220-01-487-XXXX (series)
	Surface ships use AEL's 2-330014161 through 2-330014166
	Submarines use the green color MK-1 only AEL 2-330013101

*Also see Naval Ships Technical Manual, chapter 077, for additional information on personal protective equipment. _____

** National Stock Numbers (NSN) are subject to change. Recheck Numbers prior to ordering.

Appendix B12-B

PERSONAL PROTECTIVE CLOTHING AND EQUIPMENT CHECKLIST

Indicate by an X, the answer to each of the questions below. If a question is not applicable to the command, indicate by NA in the YES block. Explain or describe the condition warranting any NO answer on the space provided at the end of the checklist or on additional sheets, if necessary.

The location of the NAVOSH Manual reference for any question is provided at the end of the question.

	YES	NO
RESPONSIBILITIES		
1. Is there sufficient personal protective equipment (PPE) aboard the command? (B1202a)		
2. Is adequate funding provided to obtain or replace missing or worn out personal protective equipment? (B1202a)		
3. Does the safety officer, in conjunction with the master-at-arms force, monitor work stations to ensure that personal protective equipment is used for required work or in required spaces as well as being worn in a proper manner? (B1202b)		
4. Do division officers inform the supply officer of changes to the allowance of PPE so that COSALs, APLs, or AELs can be changed? (B1202c)		
5. Do division officers stock sufficient PPE to support the division's needs and issue it to personnel when required? (B1202c)		
6. Do division officers ensure that personal protective equipment is properly maintained? (B1202c)		
7. Does the MDR assist in obtaining/providing medically fitted PPE? (B1202d)		

PROTECTIVE EQUIPMENT			
8.	Does the command ensure that metal hard hats are not used? (B1203a)		
9.	Do all personnel above the damage control deck during condition 1 wear battle helmets?		
10.	Do all enlisted hands possess standard stock safety shoes (issued at Recruit Training)? (B1203b)		
11.	Are poromeric (i.e., CORFAM®) shoes prohibited except for departing or returning to the ship or when specifically authorized by the commanding officer for ceremonial purposes? (B1203b)		
12.	Are deck personnel provided with leather gloves to protect against hand injury when handling sharp objects, wire rope, or banding material? (B1203c(1))		
13.	When working with caustic or toxic materials, are personnel provided with gloves suitable for handling the material? (B1203c(3))		
14.	Are insulated gloves (non-asbestos) available for personnel doing hot work? (B1203c(4))		
15.	Is synthetic clothing such as certified Navy twill, prohibited in ship's fire rooms, main machinery spaces, and hot work areas? (B1203d)		
16.	Are fire retardant coveralls provided to engineering personnel who stand watch or work in fire rooms or main machinery spaces? (C1302a(6))		
17.	Are personnel working aloft or over the side provided with a safety harness and safety lanyard? (B1203e)		
18.	Are wire rope lanyards used instead of nylon when doing hot work either aloft or over the side? (B1203e(1))		

19.	Are safety harnesses, D-rings, and safety lanyards inspected in accordance with planned maintenance prior to each use? (B1203e(2))		
20.	Are safety lanyards prohibited from being used for any other purpose than personal fall protection? (B1203e(4))		
21.	Do personnel, other than air crew members and flight deck personnel who are required to wear life preservers in open sea operations, wear the life preservers? (B1203f)		
22.	Do personnel wear MK-1 life preservers when in exposed battle stations, when working over the side, topside during heavy weather, in small boats and during towing and other evolutions when personnel can be carried over the side? (B1203f)		
STORAGE, MAINTENANCE AND INSPECTION OF PERSONAL PROTECTIVE EQUIPMENT			
23.	Do divisions properly stow personal protective equipment? (B1202c)		
24.	Check the PMS records for the personal protective equipment. Are maintenance and inspections being accomplished at the proper intervals? (B1202c)		
25.	Are the hard hats being used by crew members free from cracks, holes, paint, or unauthorized modifications? (B1202a)		
TRAINING			
26.	Do personnel, who are required to wear or use PPE in work, receive training prior to use and annually thereafter? (B1202c)		

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CHAPTER B13
RESERVED (ERGONOMICS)

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CHAPTER B14
RESERVED (FALL PROTECTION)