CHAPTER 9
RESPIRATORY PROTECTION

1. GENERAL.
   a. Navy safety and occupational and health (SOH) standards place primary emphasis on engineering, administrative and work practice controls to control workplace inhalation hazard exposure. Respirators are worn in those instances where these controls are not feasible and/or are ineffective in reducing exposures below occupational exposure limits. Respiratory protection can also be provided as an interim measure while controls are being sought or installed.
   b. For the purposes of this chapter, the terms “exposure” and “overexposure” refer to concentrations of air contaminants in the breathing zone of the employee and outside of the respirator. That is, the exposure of the employee regardless of the use of a respirator.
   c. Surgical masks worn by medical care providers are not considered respirators. They are for medical/dental use only and worn to protect the patient - not the healthcare provider.
      (1) In some instances, such as pandemic influenza, patients may wear surgical masks as an infection control measure.
      (2) Note that there are filtering facepiece respirators that are both NIOSH approved and have FDA clearance for use as surgical masks.
         (a) FDA clearance for N95 surgical masks includes testing under ASTM F 1862-00a, Standard Test Method for Resistance of Surgical Mask to Penetration by Synthetic Blood to ensure splash protection during medical procedures.
         (b) Surgical N95 filtering facepiece respirators are designed to be worn for medical procedures, but since they are NIOSH approved, they can be worn to control industrial workplace exposures up to five times the occupational exposure limit (OEL).
   d. Details of the Occupational Safety and Health Administration (OSHA) and the Navy SOH industrial respiratory protection program policy are in reference 9-1, Chapter 15 of reference 9-2, and Chapter B6 of reference 9-3. If OSHA and Navy policy conflict, Navy respirator policy takes precedence. An example is Navy respirator user medical evaluation, which is more stringent than OSHA requirements. Issues not specifically addressed in Navy policy do not constitute conflicts with OSHA policy.
   e. The Navy SOH chemical, biological, radiological, nuclear, explosive (CBRNE) respirator program is in Chapter 26 of reference 9-2. Additional requirements of the CBRNE program are addressed under appropriate sections of this Chapter.
2. **WRITTEN STANDARD OPERATING PROCEDURES.**

   a. Each activity where respirators are used is required have a written respiratory protection program addressing all program elements. Developing a written program requires understanding the components of a successful program and considering unique workplace characteristics. The written program will include specific provisions and procedures for each element of the program, including respirator selection, use, fit testing, storage, maintenance, training, and medical evaluation of personnel required to wear respirators. Worksite standard operating procedures (SOPs) are required in all areas where respirators are used. Each worksite SOP is specific to the worksite hazards and explains which respirator(s) to wear and under what conditions it should be worn. For a detailed discussion, see [*Respirator SOP Guidance*](#). The document entitled [*Generic Respirator SOP*](#) may also be helpful. It includes a generic, fill-in-the-blank command instruction, and standard operating procedures for all elements of the respirator program. SOPs should include emergency and rescue guidance where appropriate. When possible, anticipate emergencies and develop a hazard assessment and a contingency plan prior to the actual event.

   b. In contrast to the detailed SOPs required for a complete respirator program, paragraph 1503.g. of reference 9-2 has relaxed shore-based program requirements for voluntary use respirators. Voluntary use respirators can only be issued when respirators are not required to control exposures and not otherwise required by the activity. Voluntary use respirators must be approved by NIOSH (National Institute for Occupational Safety and Health).

      (1) The Respiratory Protection Program Manager (RPPM) is allowed to issue filtering facepiece respirators for voluntary use against particulates to personnel who choose to wear them. Voluntary users must be trained annually on the limitations stated on the respirator approval label and the information contained in Appendix D of 29 CFR 1910.134 (reference 9-1), but do not require fit-testing and medical examination. The RPPM ensures that voluntary use filtering facepieces are not dirty or contaminated and do not interfere with working safely.

      (2) When the contaminant of concern to the employee is a gas or vapor, NIOSH approved elastomeric respirators equipped with appropriate chemical cartridges may be issued for voluntary respirator use. However, in this circumstance, all elements of the respirator program must be implemented, including medical evaluation and fit testing. Hooded respirators are also permitted for voluntary use, and their use also requires complying with all elements of the respiratory protection program.
3. **RESPIRATOR CLASSIFICATION.**

a. Only NIOSH approved or NIOSH/Mine Safety and Health Administration (MSHA) approved respirators may be worn. The respirator assigned protection factor (APF), which is the level of protection provided by a class of respirators, is listed in Appendix 9-A. APFs only apply when respirators are used within the context of a comprehensive respirator program. The types (or classes) of respirators are briefly described in the following list. For detailed information on respirator classification, see *Respirator Classification*.

(1) Atmosphere-supplying respirators – Respirators that provide Grade D breathing air to the wearer.

   (a) Self-contained breathing apparatus (SCBA) – Respirators that provide breathing air that is carried by the wearer.

      1. Closed-circuit – SCBA in which the breathing air is recirculated and that requires tight-fitting facepiece.

         a. Demand – Closed-circuit SCBA that is under negative pressure during inhalation.

         b. Pressure demand – Closed-circuit SCBA that is normally under positive pressure.

      2. Open-circuit – SCBA in which the breath is exhaled to the atmosphere and that are equipped with a full-facepiece or tight-fitting hood sealing around the neck.

         a. Demand – Open-circuit SCBA that is under negative pressure during inhalation.

         b. Pressure demand – Open-circuit SCBA that is normally under positive pressure.

   (b) Supplied air respirators (SAR) – Respirators that provide breathing air through a hose, usually connected to an air supply (e.g., air compressor).

      1. Type B supplied-air (hose mask) respirator – No longer used – Negative pressure SAR in which air is drawn into lungs by lung power and requires tight-fitting facepieces.

      2. Type A supplied-air (hose mask with blower) respirator - No longer used – Negative pressure SAR, similar to hose mask, but breathing is assisted by a hand-cranked or mechanical blower.

      3. Type C supplied-air (airline) respirator – An airline respirator which delivers Grade D air from a source (e.g., air compressor) though an air hose.

         a. Continuous flow – Airline respirator that is normally under positive pressure and equipped with a hood or helmet, loose-fitting facepiece, tight-fitting facepiece, or tight-fitting hood sealing around the neck.

         b. Demand – Airline respirator that is normally under negative pressure during inhalation and requires a tight-fitting facepiece.
c. Pressure demand – Airline respirator that is normally under positive pressure and requires a tight-fitting facepiece.

(c) Multi-functional atmosphere supplying respirator (a combination of SAR and SCBA).

(2) Air-purifying respirators (APR) – Respirators that purify ambient air by drawing it through an air-purifying element to remove aerosols, vapors, gases, particulates or a combination of these contaminants.

(a) Non-powered APR – Half mask or full face APR in which the wearer’s breathing draws air through the air-purifying element.
   1. Gas and vapor removing
   2. Particulate removing
   3. Combination of gas/vapor removing and particulate removing

(b) Powered air-purifying respirators (PAPRs) – PAPRs use a blower to draw ambient air through the air-purifying element. PAPRs are normally under positive pressure and equipped with a hood or helmet, loose-fitting facepiece, tight-fitting facepiece, or tight-fitting hood sealing around the neck.
   1. Gas and vapor removing
   2. Particulate removing
   3. Combination of gas/vapor removing and particulate removing

(c) Multi-functional (combination of an APR and PAPR) – A PAPR that is also approved to operate in negative pressure mode in case the motor fails or for clandestine operations.
   1. Gas- and vapor-removing
   2. Particulate-removing
   3. Combination of gas/vapor removing and particulate removing

(3) Combined atmosphere-supplying and air-purifying respirator - Respirators that can be used in either an atmosphere-supplying or air-purifying mode.
4. **RESPIRATOR SELECTION GUIDELINES.**

a. Use only respirators approved by NIOSH or NIOSH/MSHA. See *Hazard Assessment for Respirator Selection* for detailed information on inhalation hazard assessment and respirator selection. In general, the first step in respirator selection is to perform a hazard assessment including hazard identification and quantification (e.g., concentration), worker activity, humidity, temperature, and other environmental conditions. Determine if there is an OSHA substance specific standard (e.g., lead, asbestos) for the contaminant(s), which may require specific respirators to perform the operation. Then select the proper type(s) of respirator(s) based on respirator capabilities/limitations and workplace respiratory and environmental hazards.

b. The required respiratory protection for immediately dangerous to life or health (IDLH)\(^1\) conditions caused by the presence of toxic materials or a reduced percentage of oxygen is a full face, pressure demand, self contained breathing apparatus (SCBA) or a combination of a full face, pressure demand, supplied-air respirator with auxiliary self-contained air supply. These respirators must provide a minimum flow rate of 100 lpm. SCBAs that operate in the demand mode cannot be used for entering IDLH atmospheres because the pressure inside the SCBA is negative during inhalation, which may draw contaminated air into the facepiece. An atmosphere is considered to be IDLH when:

1. the identity or concentration of a contaminant is unknown (e.g., interior structural firefighting\(^2\)) or the atmosphere is known or suspected to have concentrations above the IDLH level for that contaminant, or;

2. the oxygen concentration is below 19.5% oxygen at sea level, which is equivalent to an atmospheric oxygen partial pressure (PO\(_2\)) <148 mmHg, or;

3. the oxygen concentration is unknown or contains less than the normal 20.9 percent oxygen unless the source of the oxygen reduction is understood and controlled.

c. For non-IDLH atmospheres, determine employee potential airborne contaminant exposure and verify that it is less than the maximum use concentration (MUC) when applying the respirator assigned protection factor (see Appendix 9-A).

1. The MUC is the maximum atmospheric concentration of a hazardous substance from which an employee can be expected to be protected by a class of respirators and is determined by the lesser of either the calculated MUC (MUC = APF x OEL) or a MUC established by respirator manufacturers (see reference 9-4). However, if the IDLH concentration is lower than the MUC, then the IDLH concentration takes precedence over the calculated MUC.

2. Determine the hazard ratio by dividing the exposure concentration of the contaminants, as determined by acceptable industrial hygiene methods, by the applicable occupational exposure limit (OEL).

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\(^1\) Per ANSI Z88.2, IDLH is any atmosphere that poses an immediate hazard to life or poses immediate irreversible debilitating effects on health.

(3) Identify the location of the hazardous area and location of breathable air when selecting a respirator. This will permit planning for workers to escape if an emergency occurs, for the entry of workers to perform maintenance duties, and for rescue operations. Consider the distance to a breathing air station, the number of obstacles within the work area, and other safety hazards.

(4) After performing the hazard assessment, choose a specific respirator with an APF (see Appendix 9-A) that is greater than the hazard ratio. If air-purifying respirators are being used, the appropriate filters, cartridges, or canisters can then be selected. For detailed information on types of respirators and filters, consult the article on Respirator Classification.

5. CARTRIDGE AND CANISTER CHANGE SCHEDULES.
   a. Chemical cartridge air-purifying respirators are appropriate for protection against gases and vapors, including isocyanates and other substances without good warning properties up to their maximum use concentration if a cartridge change schedule is developed and implemented. Alternatively, atmosphere supplying respirators or air-purifying respirators equipped with approved end-of-service-life indicators (ESLI) can be used.

   b. Reference 9-1 requires establishing a change schedule for chemical canisters and cartridges based on objective information that will ensure that they are changed before the end of their service life. This data, along with the logic for relying on this change schedule, will be described in the written respirator program for each operation. Ideally, the basis for cartridge change schedules should be based on the results of cartridge/canister breakthrough studies that are conducted under worst-case conditions of contaminant concentration, humidity, temperature, and air flow rate through the filter element. Such information may be based on reliable use recommendations from the activity’s respirator and/or chemical suppliers.

   c. Methods for testing cartridge service life and determining change schedules include laboratory testing, field testing, respirator carbon tubes, and mathematical modeling service life software. See Chemical Cartridge Change Schedules for more information on respirator cartridge change schedules.

   (1) Most chemical cartridge respirator manufacturers offer free respirator cartridge service life software to estimate respirator cartridge change schedules. The software requires characterization of workplace chemical concentrations and workplace environmental data. Each manufacturer’s software is specific for their cartridges.

   (2) OSHA provides the Advisor Genius service life software in which breakthrough times can be calculated for any manufacturers’ cartridges if pertinent information is known about the manufacturers’ sorbent material such as: (1) weight of sorbent in the cartridge in grams; (2) bulk density of the packed sorbent bed in g/cm³; (3) carbon micropore volume in cm³/g; and (4) diameter of the cartridge bed in centimeters.
(3) NIOSH *MultiVapor Version 2.2.3* is similar to the OSHA *Advisor Genius* but has been updated to include corrections for humidity and can be used to estimate breakthrough time(s) of one organic vapor or a mixture of vapors through organic vapor air-purifying respirator cartridges at any humidity. It requires: (1) parameters of the cartridge and the carbon it contains; (2) physical characteristics of the vapor(s) present; and (3) environmental and use conditions.

(4) The NMCPHC article *Chemical Cartridge Change Schedules* includes the mole fraction method for establishing and implementing respirator cartridge change schedules for mixtures of chemicals. It incorporates those factors which are problematic to mathematical modeling (i.e., humidity, temperature, atmospheric pressure, breathing rate, and varying concentrations of multiple contaminants). The article also contains a list of websites for respirator manufacturers’ cartridge service life calculator software and contains a spreadsheet for calculating change schedules for mixtures of chemicals. The article further explains how estimated change schedules can be verified in the field by collecting an air sample behind the cartridge with a *mask sampling adaptor* while the respirator is being worn.

(a) It is important to note that collecting air samples inside the respirator does not verify the cartridge change schedule. Collecting air samples inside the respirator in conjunction with collecting personal breathing zone samples is a workplace protection factor (WPF) study.

(b) WPF studies provide useful information on how well the respirator is performing. However, only air sampling collected behind the cartridge and inside a mask sampling adapter while the respirator is being worn verifies the change schedule.

(5) OSHA has developed “rules of thumb” which can be used to estimate service life of respirator cartridges. OSHA explains that this rule for establishing change schedules can only be used in conjunction with empirical data.

(a) The logic behind establishing Navy change schedules for *CBRN respirators* is a good example of combining rules of thumb for cartridge/canister service life with empirical data to set change schedules. The MSA CBRN approved *Millennium respirator (TC-14G-0270)* has been the Navy’s preferred make and model CBRN air-purifying respirator because of its similarity to the Navy’s military gas masks (*MCU-2A/P*). Although the Millennium has been the Navy’s first choice, equivalent CBRN gas masks are also authorized for purchase if they are specified as the respirator component of NFPA CBRN certified protective ensembles purchased for Navy first responders. Points of contact for assistance in ordering CBRN respirators that are required components of NFPA certified ensembles are on the *NAVSEA CBR-Defense* website under the Programs/Shore PPE tab.

1. CBRN Respirator Cartridge Change Schedules. Section 2606.c.(7) of *OPNAVINST 5100.23G* states that in the absence of industrial hygiene air sampling data:

   a. Respirator cartridges used by security guards shall be changed after every 8-hour shift.
b. Cartridges used by personnel assigned to secondary decontamination stations at medical treatment facilities and by security guards stationed at the decontamination corridor shall be changed every 2.5 hours.

2. The logic behind establishing these change schedules is that all NIOSH CBRN approved gas masks have CAP 1 approval, in which their service life must last for at least 15 minutes against the representative test agents at concentrations exceeding IDLH concentrations. Since air-purifying respirators are not allowed to be worn in IDLH atmospheres, CBRN canister service life will be considerably longer than 15 minutes in atmospheres less than IDLH.

a. OSHA has a rule of thumb related to increased cartridge/canister service life resulting from decreased concentration. This rule of thumb states, “Reducing workplace concentration by a factor of 10 will, in general, increase service live by a factor of five.”

b. For example: NIOSH CBRN certification testing empirically determines that CBRN approved canisters last at least 15 minutes at 2,600 ppm cyclohexane.

(1) NIOSH research determined that cyclohexane is the best representative test agent to use as approval criteria for testing CBRN canisters against the CBRN family of organic vapors.

(2) Organic chemicals with relatively low vapor pressures are effectively removed by physical adsorption in the pores of the activated carbon. There are 61 organic chemicals in the organic vapor family (including the nerve agent Sarin (GB) and the blister agent Distilled Sulfur Mustard (HD)), all of which have vapor pressures lower than cyclohexane.

c. Using the OSHA rule of thumb, CAP 1 canisters should last 75 minutes at 260 ppm, 375 minutes at 26 ppm, and 1,875 minutes at 2.6 ppm. Reference 5 determined that overall, multiple application of this rule of thumb provides accurate estimates of service life 94.9% of the time when compared to the NIOSH organic vapor certification testing criteria for CBRN respirator canisters evaluated by the NIOSH MultiVapor service life software at 260 ppm, 26 ppm, and 2.6 ppm cyclohexane. In addition to evaluating cyclohexane, the representative test agent for the CBRN organic vapor family, reference 5 also evaluated 59 other organic vapors in the CBRN organic vapor family at each concentration motioned above with the same overall increase in canister service life.
d. OSHA also has a rule of thumb for humidity, which states “Humidity above 65% can reduce service life by 50%.” However, this rule of thumb probably does not apply to CBRN canisters since NIOSH CBRN certification testing is performed at both 25 ± 5 percent relative humidity and 80 ± 5 percent relative humidity. Reference 5 determined that this OSHA Rule of Thumb was applicable 96.0% of the time when compared to estimated service life with the three concentrations at 25% relative humidity and applicable 93.8% of the time under the same conditions except at 80% relative humidity.

e. Another OSHA rule of thumb is “Every 10 ºC (50 ºF) increase can reduce service life up to 10%,” which may need to be considered in very hot environments. NIOSH CBRN certification testing is performed at 77 ± 5° F.

f. To receive NIOSH CBRN certification, the complete respirator assemblage (including canister) must also have a minimum service life of at least eight hours against initial concentrations of 210 mg/m³ GB vapor challenge and 50 mg/ HD vapor and must have at least a two hour service life against 0.860 milliliters liquid HD.

(1) The USACHPPM Summary of Chemical Agent Air Exposure Values of 8/03/04 indicates that the IDLH concentrations of HD and GB are 2 and 0.1 mg/m³, respectfully.

(2) Doing the math for the OSHA rule of thumb “Reducing workplace concentration by a factor of 10 will, in general, increase service live by a factor of five,” for Sarin and mustard vapor shows that the service life for protection against these chemical warfare agents below the IDLH concentration greatly exceeds 8 hours. However, being conservative, canisters are changed after eight hours, two hours if liquid agent is present.

(b) The logic used for setting Navy change schedules for CBRN air-purifying respirators illustrates how to correctly use the OSHA rules of thumb for cartridge/canister service life, which is to correlate these rules with sound empirical data. However, if air sampling data is available, more detailed information on respirator cartridge change schedules, including a method for validating estimated change schedules, is provided in Chemical Cartridge Change Schedules.

6. BREATHING AIR FOR ATMOSPHERE SUPPLYING RESPIRATORS.

a. Grade D breathing air. All compressed breathing air must meet the quality specification for grade D breathing air as described in reference 9-6. For a detailed discussion on breathing air, see the article entitled Compressed Breathing Air.
b. Breathing air is sampled and analyzed quarterly for all shore-based and shipboard breathing air compressors (both oil-lubricated and non-oil-lubricated).

(1) Collect and analyze breathing air using the procedures specified in reference 9-6.

(2) The *Compressed Breathing Air* article provides a list of commercially available breathing air test kits that meet the CGA 7.1 analytical requirements. This article also contains a generic SOP for analyzing breathing air. Ensure that the minimum specifications for Grade D breathing air listed in Table 9-1 are met.

| Table 9-1 |
| CGA G-7.1-2011 |
| **GRADE D COMPRESSED AIR PURITY REQUIREMENTS** |
| Characteristic | CGA G-7.1-2011 Requirements |
| Oxygen content (v/v) | 19.5% - 23.5% |
| Oil (Condensed) | ≤ 5 mg/m³ |
| Carbon monoxide | ≤ 10 ppm |
| Carbon dioxide | ≤ 1,000 ppm |
| Water content | Dew point ≤ -50°F (67 ppm v/v). Note 6 states that for SCBA use in extreme cold a dew point not to exceed -65°F (24 ppm v/v) or the dew point must be 10˚ F lower than the coldest temperature where the respirator is worn. |
| Odor | No pronounced odor |

c. According to paragraph 1506 of reference 9-2, newly purchased compressors have to be equipped with continuous carbon monoxide (CO) monitor and alarm systems. Existing compressors must have continuous CO monitor and alarm systems installed when they are upgraded during major maintenance.

(1) Calibrate CO monitor and alarm systems on compressors used for supplying breathing air according to the manufacturer's instructions.

(2) According to B0611 of reference 9-3, “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.”

d. OSHA states in paragraph (i)(5) of reference 9-1 that the employer shall ensure that compressors used to supply breathing air to respirators are constructed and situated so as to prevent entry of contaminated air into the air supply system. Therefore, locate air intakes in fresh outdoor atmospheres, such as above roof level and away from ventilation exhausts.
e. Ambient Air Breathing Apparatuses (AABAs) are exempt from the quarterly breathing air testing requirement. AABA are defined as portable electrically- or pneumatically-powered, oil-less air pumps, which supply breathing air to low pressure continuous flow respirators. Although AABAs do not generate oil mist, oil vapor, or carbon monoxide, they also do not produce Grade D breathing air. The ambient air that is drawn through the inlet particulate filter is delivered to the respirator(s) without significant change to the air quality. Therefore, air inlets must be placed in contaminant-free environments.

7. **MEDICAL EVALUATION.**

a. Per paragraph 1508 of reference 9-2, personnel at shore-based commands must be found medically able to wear respirators prior to fit testing.

(1) According to section 1508 of OPNAVINST 5100.23G, civilians will be medically evaluated according to the *Medical Surveillance Procedures Manual/Medical Matrix*. Medical evaluation is age dependent, according to the following schedule:

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Evaluation Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>(under 35)</td>
<td>5 yrs</td>
</tr>
<tr>
<td>(35-45)</td>
<td>2 yrs</td>
</tr>
<tr>
<td>(over 45)</td>
<td>1 yr</td>
</tr>
</tbody>
</table>

(a) Appendix 15-A of reference 9-2 is filled out by the respirator wearer’s supervisor to provide the cognizant BUMED occupational medicine provider with information needed to understand the type of respirator to be worn and the environment in which it will be worn.

(b) Appendix 15-A is also used by the healthcare professional to furnish their medical evaluation of the individual’s physical ability to perform their duties while wearing that respirator and indicate when the respirator wearer shall return for their next medical evaluation. The healthcare professional provides completed and signed copies of Appendix 15-A to the RPPM and to the respirator wearer.

(c) Note that we expect Appendix 15-A to be replaced with the electronic Respirator Use Questionnaire, OPNAV Form 5100/35 in OPNAVINST 5100.23H. The form is available on the Naval Safety Center's Medical Surveillance Toolbox webpage.

(2) Per sections 1508 and 2602 of OPNAVINST 5100.23G, military personnel who have been confirmed as “Fit for Full Duty” and who have a current annual Periodic Health Assessment (PHA), are deemed medically qualified to wear all types of respirators. The phrase “Fit for Full Duty” is interpreted as having no deployment-limiting conditions. This is consistent with a “fully or partially medically ready status” of the Individual Medical Readiness (IMR) classification described in BUMED Notice 6110, Tracking and Reporting Individual Medical Readiness Data.

(3) PHA screening, IMR, and deployment readiness tracking for activity military personnel is accomplished and verified by the IMR point of contact for the command or at the local MTF. Questionable cases will be referred to the MTF for a Respirator User Certification exam (Medical Matrix Program 716).

b. Shipboard military respirator medical evaluations are addressed in Paragraph B0602.d(1) of OPNAVINST 5100.19E, which states that the medical department representative (MDR) shall, “Confirm that personnel, who are issued respirators have no deployment
limiting medical conditions, and have a current annual Preventive Health Assessment per reference B6-3 [OPNAVINST 6120.3] (see paragraph B0613).”

(1) Note that OPNAVINST 6120.3 was canceled by SECNAVINST 6120.3 CH-1. However, these instructions address only the PHA. They do not discuss medical qualification for respirators. OPNAVINST 5100.19E and OPNAVINST 5100.23G establish the policy that physically fit for duty military personnel are medically qualified to wear any type of respirator.

(2) Paragraph B0613 states: “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 [OPNAVINST 6120.3] 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.”

8. TRAINING.

a. Required training for respirator wearers includes proper selection, use, maintenance, and limitations of respirators. Instruction includes demonstrations on how the respirator should be worn, how to adjust it, and how to determine if it fits properly. Personnel who issue respirators and supervisors of personnel required to wear respirators must also receive respirator training.

b. Respirator issuers, wearers, and their supervisors are to receive initial training and annual refresher training. Retraining is also required when it is apparent that the employee has not retained the information presented in respirator training or when other situations arise in which retraining appears necessary for the employee to safely use the respirator. The purpose of training respirator issuers and supervisors is to further assure respirators are properly selected, used, and maintained. For specific training requirements, see paragraph 1511 of reference 9-2.

9. FIT TESTING.

a. For detailed information on fit testing, see Respirator Fit Testing. All tight-fitting negative and positive pressure respirators must be fit tested to ensure proper facepiece to face seal. Note that tight-fitting hooded respirators that seal around the neck are fit tested like tight-sealing full face respirators. Most escape-only respirators are either mouthpiece respirators or hooded devices that do not lend themselves to be fit tested.

   (1) Tight-sealing respirators cannot be worn when conditions, such as facial hair, jewelry, scars, etc. interfere with respirator fit or function.

   (2) In such cases, airline hoods/helmets and PAPR hoods/helmets that have no facepiece to face seal may be worn if they provide adequate protection.

b. Personnel required to wear tight-fitting respirators shall be qualitatively or quantitatively fit tested initially before wearing the respirator and annually.
c. Quantitative fit testing determines the amount of leakage occurring between the wearer’s face and the sealing surface of the respirator. Acceptable quantitative fit testing protocols described in Appendix A of reference 9-1 include:

(1) Generated aerosol quantitative fit testing, such as: (1) the laboratory quantitative fit testing chamber at Edgewood Chemical Biological Center used in NIOSH certification testing; and (2) the Joint Services Mask Leakage Tester (JSMLT), which is being used for military gas mask serviceability testing and for quantitatively fit testing military gas masks worn during military unique operations;

(2) Ambient aerosol quantitative fit testing, which is based on condensation nuclei counting (i.e., TSI Portacount® Pro Model 8030); and

(3) Controlled negative pressure quantitative fit testing, which measures the rate of pressure decay as a function of the rate of controlled leakage into an otherwise sealed respirator (i.e., Occupational Health Dynamics Quantifit®).

d. Qualitative fit tests involve a person’s response - either voluntary or involuntary - to a fit test challenge agent. These tests are fast, easily performed, and use inexpensive equipment. Because they are based on the respirator wearer’s subjective response, accuracy may vary. Qualitative fit tests include the irritant smoke test, isoamyl acetate (i.e., banana oil) test, and taste tests using sodium saccharin or Bitrex™. Procedures for these test methods are described in Appendix A of reference 9-1. Each qualitative fit test requires a sensitivity screening test to ensure that the individuals being fit tested can detect the fit test agent. If they cannot detect the challenge agent, then they cannot be fit tested by that method. Passing a qualitative fit test is equivalent to achieving a fit factor of 100 during quantitative fit testing.

(1) Fit testing negative pressure respirators. Fit testing negative pressure respirators, including non-powered air-purifying respirators and demand type atmosphere supplying respirators (which are no longer manufactured) can be either qualitative or quantitative. The fit factors of both quantitatively and qualitatively fit tested negative pressure air-purifying respirators include a safety factor of ten. Therefore, half mask and full face negative pressure respirators that are quantitatively fit tested must pass with a minimum fit factor of 100 and 500 to be allowed to be worn in atmospheres up to their assigned protection factors of 10 and 50 times the OEL, respectively.

(2) Fit testing positive pressure respirators. Tight-fitting, positive pressure respirators, including PAPRs shall be fit tested in the negative pressure mode (fit tested as negative pressure air-purifying respirators). This can be accomplished by either temporarily converting the facepiece, per manufacturer's instructions, into a negative pressure air-purifying respirator or by using a “surrogate” negative-pressure facepiece with sealing surfaces and materials that are identical to the wearer's positive pressure facepiece. In other words, if the facepiece sealing surfaces and materials are indistinguishable from the positive pressure respirator facepiece, then the negative pressure, air-purifying respirator can be worn as a surrogate during fit testing. For industrial use, including firefighting, OSHA allows positive pressure respirators to be either qualitatively or quantitatively fit tested. Fit testing positive pressure respirators ensures there is no gross leakage in the facepiece seal. Positive pressure half mask and full face respirators that are quantitatively fit tested must pass with a minimum fit
factor of 100 and 500, respectively. Individuals may wear positive pressure respirators up to the assigned protection factor of the respirator (see Appendix 9-A) after passing either qualitative or quantitative fit testing.

10. **WEARER SEAL CHECKS.**

a. Wearer seal checks are also known as user seal checks. The respirator wearer must check the seal of their respirator by using positive and negative pressure seal checks every time they don the respirator. These pressure checks are NOT substitutes for quantitative or qualitative fit tests. It is essential to adequately train respirator wearers to perform these seal checks, which should be done according to the manufacturer’s recommendations or by using the following procedures:

(1) Negative pressure wearer seal check for elastomeric facepieces.

(a) The inlet opening of the respirator’s canister(s), cartridge(s), or filter(s) is closed off by covering with the palm of the hand(s) or by squeezing a breathing tube or blocking its inlet so that it will not allow the passage of air.

(b) The respirator wearers inhale gently and hold their breath for at least 10 seconds.

(c) If the facepiece collapses slightly and no inward leakage of air is detected, then the respirator has been properly donned and the facepiece is not leaking.

(2) Positive pressure wearer seal check for elastomeric facepieces.

(a) The exhalation valve or breathing tube, or both, is closed off and the wearer exhales gently.

(b) If a slight positive pressure can be built up inside the facepiece (e.g., facepiece bulges slightly outward) without detecting any outward leakage of air between the sealing surface of the facepiece and the wearer’s face, then the respirator has been properly donned.

(c) For some respirators, this test method requires that the respirator wearer first remove the exhalation valve cover from the respirator and then replace it after completing the test. These tasks are often difficult to carry out without disturbing the fit of the respirator. Both OSHA (in the preamble to reference 9-1, page 1239) and paragraph 1513.c. of reference 9-2 state that there are respirators that cannot be properly user seal checked. Such respirators cannot be used to control exposures.

(3) Wearer seal checks for filtering facepiece respirators.

(a) Conduct filtering facepiece wearer seal checks by inhaling or exhaling sharply while blocking air flow though the filter. Air should not be leaking around the facepiece perimeter.

(b) Consult the NIOSH list of *Manufacturer's Donning Procedure User Instructions* for wearer seal check instructions for a specific filtering facepiece respirator.
11. **CLEANING.**

   a. For NIOSH approval to remain valid, respirators must be maintained in their original condition and NIOSH approved configuration. To accomplish this, respirators must be cleaned, inspected, repaired, and stored per manufacturers’ instructions. Respirator maintenance can only be performed by personnel trained to do so by the RPPM.

   b. See **Respirator Maintenance** for detailed information on cleaning and sanitizing respirators. Clean and sanitize respirators regularly using the following schedules:

      (1) Respirators issued for the exclusive use of one worker will be cleaned and sanitized as often as necessary to be maintained in a sanitary condition.

      (2) Respirators used by more than one worker will be thoroughly cleaned and sanitized before use by another worker.

      (3) Respirators for emergency use will be cleaned and sanitized after each use.

      (4) Respirators used in fit testing and training will be cleaned and sanitized after each use.

12. **INSPECTION.**

   a. Respirators are to be inspected and maintained according to the respirator user instructions. For detailed information on respirator inspection, see **Respirator Maintenance**.

   b. Emergency use respirators must be inspected monthly in addition to before and after each use. Maintain inspection records.

      (1) According to section 2606.c.(3) of reference 9-2, since CBRN respirators are worn for emergency use, they will be inspected monthly according to manufacturer’s instructions and a written inspection record will be maintained for the life of the respirator. Also, employees shall inspect their respirators for serviceability prior to donning them.

      (2) OSHA monthly emergency respirator inspection is not applicable to CBRN escape respirators because inspection will destroy the vacuum sealed protective storage package.

13. **STORAGE.**

   a. Respirators have to be stored in a convenient, clean, and sanitary location.

      (1) Ensure that respirators are stored in such a manner as to protect against dust, harmful chemicals, sunlight, excessive heat or cold, excessive moisture, and insects. Storage containers include plastic bags capable of being sealed and plastic containers with tight-fitting lids, such as freezer containers.

      (2) Store the respirator so that the facepiece and exhalation valves will rest in a normal position. Do not hang the respirator by its straps. These precautions will help avoid distorting respirator components and stretching the straps.

   b. Emergency use respirators. Respirators placed at stations and work areas for emergency use should be accessible at all times. They should be stored in clearly marked compartments dedicated to emergency equipment storage.
c. Special Considerations for Storing CBRN Respirators. CBRN gas masks and tight-fitting PAPRs are stored per the Minimum Packaging Requirements (MPC) established by NIOSH and the respirator manufacturer. MPC is the protective packaging used to store and maintain the CBRN respirator and its components after the respirator has been issued for use. Failure to store CBRN respirators in the recommended MPC may allow damage to occur that could affect the respirator or its components’ ability to provide the expected level of protection.

(1) Examples of common minimum packaging configurations include hard plastic carriers, clamshell containers, canvas carry bags, drawstring plastic bags, and sealed canister bags.

(2) Each respirator manufacturer is likely to have unique MPC requirements. The manufacturer’s user instructions and the NIOSH full approval label will identify the MPC.

14. WORK AREA SURVEILLANCE.

a. Respirators are selected based on the hazards to which employees are exposed and as determined by the BUMED industrial hygiene (IH) surveys. The IH surveys identify the contaminant(s), the nature of the hazard(s), the concentration(s) of contaminants in the breathing zone, the recommended respiratory and personal protective equipment, and if appropriate, medical surveillance.

b. In addition, the local industrial hygienist documents deficiencies in the respirator program during the industrial hygiene survey and brings them to the attention of the RPPM and the activity being surveyed.

15. RESPIRATOR PROGRAM AUDIT.

a. Per references 9-2 and 9-3, the respirator program is audited annually by the RPPM and periodically reviewed and evaluated by the cognizant industrial hygiene office during baseline and periodic industrial hygiene surveys. Checklists are very useful when performing program audits and reviews. A checklist for shore-based Navy industrial respirator programs and for Navy CBRN respirator programs is provided as guidance in Respirator Program Reviews. Although checklists can be used for both the annual RPPM audit and the periodic BUMED program review, the two program evaluations differ in the thoroughness of workplace inspection and program records evaluation. More specifically, the RPPM performs a complete workplace inspection and record audit, while BUMED performs a representative workplace inspection and program record review. This information is also applicable to shipboard respirator program reviews.

b. BUMED PERIODIC REVIEW. A checklist may be beneficial to the BUMED IH when conducting a workplace inspection of personnel wearing respirators. The BUMED IH periodic review of the respirator program is not intended to be a complete audit of the respirator program like the RPPM annual audit. BUMED IH is not expected to inspect each individual respirator wearer at the command.

(1) The BUMED IH respirator program review occurs during the periodic industrial hygiene survey.
(2) In the workplace, BUMED IH randomly inspects respirators, has respirator wearers perform positive and negative pressure wearer seal checks, observes how respirators are cleaned and stored, and asks the workplace supervisor for the worksite SOP. If respirator SOP instructions are not clear to the BUMED IH reviewer, they are probably not clear to the respirator wearer.

(3) BUMED IH records the names of individuals they encounter during the workplace inspection and takes this list of personnel to the RPPM to see if they are included on the RPPM’s roster. If they’re not on this list, find out why! Check the list of respirator users in the RPPM’s records to ensure that fit testing, medical evaluation, and training are current. The RPPM will have a signed Appendix 15-A (or OPNAV 5100/35 Form) for each medically qualified civilian respirator wearer. The RPPM can confirm from command records or from local medical treatment facility Individual Medical Readiness point of contact that military personnel in the respirator program are fit for full duty and therefore medically qualified to wear all types of respiratory protection.

(4) Check other record keeping requirements, including records for Grade D breathing air quality testing, supplied air compressor inspection and maintenance, monthly emergency use respirator inspections, RPPM training, cartridge change schedules, and the annual RPPM program audit.

(5) The BUMED respirator program review/evaluation can either be a separate document or an annex to the periodic Industrial Hygiene Survey report. BUMED IH verifies corrections during the next periodic review.

(6) Remember that the BUMED IH periodic review is not intended to be as thorough as the RPPM annual audit. However, BUMED’s evaluation of respirator use in the workplace and program records must be complete enough to determine the effectiveness of the overall respirator program.

16. REFERENCES.


### Appendix 9-A-1: Assigned Protection Factors

<table>
<thead>
<tr>
<th>Type of respirator</th>
<th>Quarter mask</th>
<th>Half mask</th>
<th>Full facepiece</th>
<th>Helmet/hood</th>
<th>Loose-fitting facepiece</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air-Purifying Respirator</td>
<td>5</td>
<td>10</td>
<td>10/50&lt;sup&gt;G&lt;/sup&gt;</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Filtering Facepiece Respirators</td>
<td>—</td>
<td>5</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Powered Air-Purifying Respirator (PAPR)</td>
<td>—</td>
<td>50</td>
<td>1,000</td>
<td>25/1,000&lt;sup&gt;C&lt;/sup&gt;</td>
<td>25</td>
</tr>
</tbody>
</table>

#### Supplied-Air Respirator (SAR) [Airline Respirator]<sup>E</sup>

<table>
<thead>
<tr>
<th>Mode</th>
<th>Quarter mask</th>
<th>Half mask</th>
<th>Full facepiece</th>
<th>Helmet/hood</th>
<th>Loose-fitting facepiece</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand mode</td>
<td>—</td>
<td>10</td>
<td>10/50&lt;sup&gt;G&lt;/sup&gt;</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Continuous flow mode</td>
<td>—</td>
<td>50</td>
<td>1,000</td>
<td>25/1,000&lt;sup&gt;C&lt;/sup&gt;</td>
<td>25</td>
</tr>
<tr>
<td>Pressure-demand or other positive-pressure mode (i.e., Continuous flow SAR meeting NIOSH pressure demand requirements are approved as pressure demand SAR.)</td>
<td>—</td>
<td>50</td>
<td>1,000&lt;sup&gt;F&lt;/sup&gt;</td>
<td>—</td>
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</table>

#### Self-Contained Breathing Apparatus

(Open & Closed Circuit SCBA)

<table>
<thead>
<tr>
<th>Mode</th>
<th>Quarter mask</th>
<th>Half mask</th>
<th>Full facepiece</th>
<th>Helmet/hood</th>
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<td>10/50&lt;sup&gt;G&lt;/sup&gt;</td>
<td>50</td>
<td>—</td>
</tr>
<tr>
<td>Pressure-demand</td>
<td>—</td>
<td>—</td>
<td>10,000</td>
<td>10,000</td>
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</tbody>
</table>

<sup>A</sup> Employers may select respirators with greater protection factors than what is required by the hazard.

<sup>B</sup> APFs are only applicable if all elements of an effective respirator program are established and enforced according to the Respirator Chapter of OPNAVINST 5100.23 Series.

<sup>C</sup> The employer must have evidence that testing of these respirators demonstrates performance at a level of protection of 1,000 or greater to receive an APF of 1,000. OSHA accepts respirator manufacturers' empirical test data demonstrating that hooded respirators provide an APF of 1,000. In the absence of such testing, these respirators are to be treated as loose-fitting facepiece respirators, and receive an APF of 25.

<sup>D</sup> These APFs do not apply to respirators used solely for escape. For escape respirators used in association with contaminants that are regulated by OSHA substance specific standards (e.g., acrylonitrile, formaldehyde, benzene), refer to the appropriate substance-specific standards. Paragraph (d)(2)(ii) of reference 9-1 states that “Respirators provided only for escape from IDLH atmospheres shall be NIOSH certified for escape from the atmosphere in which they will be used.”

<sup>E</sup> When using a combination respirator ensure that the APF is appropriate to the mode of operation in which the respirator is being used. For example, a combination full facepiece pressure-demand SAR with an air-purifying canister would have an APF of 1,000 in the pressure-demand mode; but would have an APF of 50 in the negative pressure air-purifying mode.

<sup>F</sup> The protection provided by combination, full facepiece pressure-demand SARs with auxiliary SCBA is equivalent to the protection provided by full facepiece pressure-demand SCBA; therefore, the APF of 10,000 for pressure-demand SCBA applies.

<sup>G</sup> APF is 10 when qualitatively fit tested and 50 when quantitatively fit tested.