

Chapter 9 – Respiratory Protection

1. General

Navy safety and occupational health (SOH) standards place primary emphasis on engineering, administrative and work practice controls to control workplace inhalation hazards exposures. Respirators are worn in instances where these controls are not feasible and/or are ineffective in reducing exposures below occupational exposure limits (OEL). Respiratory protection can also be provided as an interim measure while controls are being sought or installed.

- a. Details of the Occupational Safety and Health Administration (OSHA) respiratory protection requirements are detailed in reference 9-1. Navy SOH industrial respiratory protection program policy is detailed in chapter 15 of reference 9-2 and chapter B6 of reference 9-3. If OSHA and Navy policy conflict, Navy respirator policy takes precedence. Issues not specifically addressed in Navy policy do not constitute conflicts with OSHA policy.
- 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 outside of the respirator. That is, the exposure of the employee regardless of the use of a respirator.

2. Navy Comprehensive Respiratory Protection Program

- a. Each activity where respirators are used is required have a written respiratory protection program addressing all program elements per references 9-2 and 9-3. 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.
- b. Reference 9-2 details the respiratory protection program requirements, which includes:
 - (1) A designated Respiratory Protection Program Manager (RPPM) who is qualified, trained and designated in writing per the commanding officer.
 - (2) A facility for issuing and maintaining respirators that is centrally located.
 - (3) 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. SOPs should include emergency and rescue guidance where appropriate. When possible, anticipate emergencies, develop a hazard assessment and a contingency plan prior to the actual event. For more information on SOPs, see NMCPHC’s Respirator Toolbox Chapters titled “Respirator SOP Guidance” and “Generic



- Respirator SOP” which can be found on the Navy and Marine Corps Public Health Center’s (NMCPHC) [Industrial Hygiene Topics Webpage](#).
- (4) Training for respirator users and their supervisors.
 - (5) Medical evaluations for respirator users.
 - (6) Fit testing for respirator users.
 - (7) Procedures to ensure the quality of breathing air if supplied air respirators are used.
 - (8) An annual audit by the RPPM.
 - (9) A cartridge change out schedule for air purifying respirators.
- c. In contrast to the detailed SOPs required for a complete respirator program, 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 the National Institute for Occupational Safety and Health (NIOSH).
- (1) The 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 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. Approval information for a particular type of respirator may be found in the documentation that came with the respirator or by using the NIOSH [Certified Equipment List](#). The respirator assigned protection factor (APF), which is the level of protection provided by a class of respirators, is listed in appendix 9-A. Appendix 9-A is taken from reference 9-2. APFs only apply when respirators are used within the context of a comprehensive respirator program.
- (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 C supplied-air (airline) respirator. An airline respirator which delivers Grade D air from a source (e.g., air compressor) through 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 SCBA and SAR.
- (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.
- b. 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) 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 F1862/F1862M-17 Standard Test Method for Resistance of Medical Face Masks to Penetration by Synthetic Blood (Horizontal Projection of Fixed Volume at a Known Velocity) 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 OEL.
- c. Per references 9-2 and 9-3, military gas masks such as the M-50 and MCU-2A/P are only for chemical, biological, radiological, nuclear (CBRN) warfare, CBRN warfare training, and nuclear accidents. They must never be used as an air purifying respirator. The Navy chemical, biological, radiological, nuclear, explosive (CBRNE) respirator program is detailed in chapter 26 of reference 9-2. Additional information regarding CBRN environments can be found in reference 9-4.
- d. Per reference 9-1, an escape-only respirator is defined as a respirator intended to be used only for emergency exit. Examples of escape-only respirators used within the Navy are Emergency Escape Breathing Device (EEBD) and Supplemental Emergency Escape Device (SEED) per reference 9-3. These respirators must not be used for entry into a hazardous atmosphere. They are for escape only.
- e. For more information on respirator classification, see NMCPHC’s Respirator Toolbox Chapter titled “Respirator Classification,” which can be found on the NMCPHC’s [Industrial Hygiene Topics Webpage](#).

4. Respirator Selection Guidelines

- a. Use only respirators approved by NIOSH or NIOSH/MSHA. 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. OSHA provides a [Respiratory Protection eTool](#) that can be used to assist in the determination of which respiratory protection is required. Reference 9-5 also describes the logic behind selecting a respirator.

- b. The required respiratory protection for immediately dangerous to life or health (IDLH) per reference 9-3 is a full facepiece pressure demand self-contained breathing apparatus (SCBA) certified by NIOSH for a minimum service life of thirty minutes or a combination full facepiece pressure demand SAR with auxiliary self-contained air supply. IDLH is defined by reference 9-1 as “an atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects or would impair an individual's ability to escape from a dangerous atmosphere.” 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. SCBA worn during firefighting and by CBRN first responders must be NIOSH CBRN approved/NFPA 1981 compliant per reference 9-6. An atmosphere is considered to be IDLH when:
- (1) The identity or concentration of a contaminant is unknown (e.g., interior structural firefighting) or the atmosphere is known or suspected to have concentrations above the IDLH level for that contaminant or;
 - (2) Oxygen deficient atmospheres where the oxygen content is below 19.5% at sea level, which is equivalent to an atmospheric oxygen partial pressure (PO₂) <148 mmHg. Per section 1910.134(d)(2)(iii) of reference 9-1 there is an exception to this. If the employer can demonstrate that, under all foreseeable conditions, oxygen levels in the work area can be maintained within the ranges specified in Table II of reference 9-1, shown below (i.e., between 19.5% and a lower value that corresponds to an altitude-adjusted oxygen partial pressure equivalent to 16% oxygen at sea level), then any atmosphere supplying respirator may be used.

Table 9-1

Altitude (ft.)	Oxygen deficient Atmospheres (% O ₂) for which the employer atmosphere-may rely on supplying respirators
Less than 3,001	16.0-19.5
3,001-4,000	16.4-19.5
4,001-5,000	17.1-19.5
5,001-6,000	17.8-19.5
6,001-7,000	18.5-19.5
7,001-8,000 ¹	19.3-19.5



NOTE: Taken from reference 9-1

¹Above 8,000 feet the exception does not apply. Oxygen-enriched breathing air must be supplied above 14,000 feet.

- 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 per reference 9-1 (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 ($MUC = APF \times OEL$) or a MUC established by respirator manufacturers (see reference 9-5). 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 (IH) methods, by the applicable OEL.
 - (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 that is greater than the hazard ratio. See appendix 9-A for more details. If air-purifying respirators are being used, the appropriate filters, cartridges or canisters can then be selected.
- d. For more information on respirator selection, see NMCPHC's Respirator Toolbox Chapter titled "Respiratory Hazard Evaluation for Respirator Selection," which can be found on the NMCPHC's [Industrial Hygiene Topics Webpage](#).

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. OSHA lists three methods of estimating the service life of chemical cartridges in OSHA's [Respiratory Protection eTool](#).
 - (1) Experimental tests are the most reliable method, especially for multiple chemicals; however this typically requires time and money.
 - (2) 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.
 - (a) Mathematical Modeling is inexpensive and takes up little time; however it is typically limited to one contaminant and not useful for mixtures. OSHA provides the [Advisor Genius](#) which can assist in determining the proper respiratory protection based on parameters such as the oxygen content of the work area, the type of contaminant and the concentration of the contaminant.
 - (b) [MultiVapor™](#) Version 2.2.5 Application provided by NIOSH is a tool that can be used to estimate breakthrough times of cartridges to help the industrial hygienist determine change-out schedules for chemical cartridges.
 - (3) OSHA lists several "rules of thumb" which can be used to estimate service life of respirator cartridges. It suggests that:
 - (a) If the chemical's boiling point is $> 70\text{ }^{\circ}\text{C}$ and the concentration is less than 200 ppm you can expect a service life of 8 hours at a normal work rate.
 - (b) Service life is inversely proportional to work rate.
 - (c) Reducing concentration by a factor of 10 will increase service life by a factor of 5.
 - (d) Humidity above 85% will reduce service life by 50%.
 - (e) These generalizations should only be used in conjunction with one of the other methods of predicting service life for specific contaminants, such as empirical modeling.
- d. For more information on cartridge or canister change schedules, see NMCPHC's Respirator Toolbox Chapter titled "Chemical Cartridge Change Schedules," which can be found on the NMCPHC's [Industrial Hygiene Topics Webpage](#).

6. Breathing Air for Atmosphere Supplying Respirators

- a. Reference 9-1 requires procedures to ensure adequate quality, quantity and flow of breathing air for atmosphere-supplying respirators. It requires that compressed and liquid oxygen shall meet at least the requirements for Grade D breathing air described in reference 9-7. References 9-2 and 9-3 also require meeting the Grade D requirements of

reference 9-7. It also requires that cylinders of purchased breathing air have a certificate of analysis from the supplier stating that the breathing air meets the requirements for Grade D breathing air. There are also specific low moisture content requirements. See reference 9-7, table 1 for maximum concentrations of the air constituents for each grade of compressed breathing air. A blank box in the table indicates no maximum limiting characteristic. This does not mean that the substance is not present, but indicates that testing that component is not a requirement for compliance with the specification.

- b. More information on Grade D Air Limiting Characteristics can be found in NMCPHC's Respirator Toolbox Chapter titled "Compressed Breathing Air," which can be found on the NMCPHC's [Industrial Hygiene Topics Webpage](#).
 - (1) Per references 9-2 and 9-3, breathing air must be sampled and analyzed quarterly for all shore-based and shipboard breathing air compressors (both oil-lubricated and non-oil-lubricated).
 - (2) Collect and analyze breathing air using the procedures specified in reference 9-7.
- c. According to reference 9-2, newly purchased compressors must 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 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. In reference 9-1, OSHA states 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.

- f. For more information on compressed breathing air, see NMCPHC’s Respirator Toolbox Chapter titled “Compressed Breathing Air,” which can be found on the NMCPHC’s [Industrial Hygiene Topics Webpage](#).

7. Medical Evaluation

- a. Per reference 9-2 personnel at shore-based commands must be found medically able to wear respirators prior to fit testing. Civilians will be medically evaluated according to reference 9-8. Medical evaluation is age dependent, according to the following schedule:

(Up to 34)	(35-44)	(45+)
5 years	2 years	1 year

- (1) Appendix 15-A of reference 9-2, Respirator Use Questionnaire, is filled out by the respirator wearer’s supervisor to provide the cognizant Bureau of Medicine and Surgery (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.
 - (2) Appendix 15-A of reference 9-2 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.
 - (3) The electronic Respirator Use Questionnaire is OPNAV Form 5100/35.
- b. Per reference 9-2, 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. Shipboard military respirator medical evaluations are addressed in reference 9-3, 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 PHA.
 - c. For more information on medical evaluations, see NMCPHC’s Respirator Toolbox Chapter titled “Respirator Medical Evaluation,” which can be found on the NMCPHC’s [Industrial Hygiene Topics Webpage](#).



8. Training

- a. Per reference 9-2, 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 references 9-1, 9-2 and 9-3.

9. Fit Testing

- a. Fit testing is a qualitative or quantitative protocol used to evaluate sealing surface leakage of a specific tight-fitting respirator while worn by an individual. Individuals do not have to be issued the same respirator that they are fit tested with as long as they are issued a respirator that is the same make, model, style, size and material of respirator with which they are fit tested. There are two categories of respirator fit testing, which include qualitative and quantitative fit testing methods.
 - (1) Qualitative Fit Testing. Qualitative fit testing (QLFT) involves a test subject's response (either voluntary or involuntary) to a fit test challenge agent during a series of test exercises while wearing a respirator. These tests are fast and easily performed using 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 type of qualitative fit test requires a sensitivity screening test to ensure that the individuals being fit tested can detect the fit test agent. Individuals who cannot detect the challenge agent 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. In qualitative fit test protocols (except for irritant smoke), the concentration during the fit tests is about 100 times higher than the sensitivity screening tests concentration.
 - (2) Quantitative fit testing. Quantitative fit testing (QNFT) uses an instrument to determine the amount of leakage between the sealing surface of the respirator and the face by measuring the concentration of a test agent both inside and outside of



the respirator during a series of test exercises and then calculating an overall fit factor. All tight-fitting negative and positive pressure respirators must be fit tested to ensure proper facepiece to face seal. 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.

- (a) Tight-sealing respirators cannot be worn when conditions, such as facial hair, jewelry, scars, or other things interfere with respirator fit or function.
- (b) 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 and are approved by the RPPM.
- (c) 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® Respirator Fit Tester 8038); 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®).
- (3) A quantitative fit test fit factor of 100 means that the concentration outside the respirator is 100 times greater than the concentration inside the respirator. Therefore, in qualitative fit testing, if the challenge agent is not detected the person passes the qualitative fit test and is assumed to have a fit factor equivalent to passing a quantitative fit test with a fit factor of 100.
- b. Fit testing negative pressure air-purifying respirators. Fit testing negative pressure respirators 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. See reference 9-1 for more details.
- c. Fit testing positive pressure respirators. Tight-fitting, positive pressure respirators, such as 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.

- d. For more information on fit testing, see NMCPHC's Respirator Toolbox Chapter titled "Respirator Fit Testing," which can be found on the NMCPHC's [Industrial Hygiene Topics Webpage](#).

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 in accordance with the manufacturer's recommendations or by using the following procedures per appendix B-1 of reference 9-1:
 - (1) Negative Pressure Check. Close off the inlet opening of the canister or cartridge(s) by covering with the palm of the hand(s) or by replacing the filter seal(s), inhale gently so that the facepiece collapses slightly and hold the breath for ten seconds. The design of the inlet opening of some cartridges cannot be effectively covered with the palm of the hand. The test can be performed by covering the inlet opening of the cartridge with a thin latex or nitrile glove. If the facepiece remains in its slightly collapsed condition and no inward leakage of air is detected, the tightness of the respirator is considered satisfactory.
 - (2) Positive Pressure Check. Close off the exhalation valve and exhale gently into the facepiece. The face fit is considered satisfactory if a slight positive pressure can be built up inside the facepiece without any evidence of outward leakage of air at the seal. For most respirators this method of leak testing requires the wearer to first remove the exhalation valve cover before closing off the exhalation valve and then carefully replacing it after the test.
 - (3) Manufacturer's Recommended User Seal Check Procedures. The respirator manufacturer's recommended procedures for performing a user seal check may be used instead of the positive and/or negative pressure check procedures provided that the employer demonstrates that the manufacturer's procedures are equally effective.

11. Cleaning

- a. General cleaning procedures are provided in appendix B-2 of reference 9-1. The manufacturer's cleaning recommendations may also be used as long as they are equal or more stringent than the requirements of reference 9-1. Reference 9-2 also describes the proper method for cleaning respirators. 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 per references 9-2 and 9-3.
- b. Per reference 9-1, 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.
- c. For more information on respirator maintenance, see NMCPHC's Respirator Toolbox Chapter titled "Respirator Maintenance," which can be found on the NMCPHC's [Industrial Hygiene Topics Webpage](#).

12. Inspection

- a. Per reference 9-2 and 9-3, cleaning, inspection and maintenance of respirators should only be conducted by trained personnel. Respirators are to be inspected and maintained according to the respirator user instructions. Respirators used for routine use must be inspected before and after use and during cleaning per reference 9-1. The respirator wearer should ensure that the respirator has all pieces and is not damaged prior to donning the respirator and again after doffing the respirator. This includes checking the facepiece, head straps, valves and cartridges, and to ensure that any elastomeric part is pliable and does not show any signs of deterioration.
 - (1) An emergency situation is defined by reference 9-1 as any occurrence such as, but not limited to, equipment failure, rupture of containers or failure of control equipment that may or does result in an uncontrolled significant release of an airborne contaminant. Emergency use respirators must be inspected monthly in addition to before and after each use per reference 9-1.
 - (2) OSHA monthly emergency respirator inspection is not applicable to CBRN escape respirators because inspection will destroy the vacuum sealed protective storage package, however they must be inspected prior to donning.

- b. Emergency escape-only respirators should be inspected prior to being used in the workplace per reference 9-1.

13. Storage

- a. Per reference 9-1, respirators must 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 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 IH 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 required to be audited annually by the RPPM, and periodically reviewed and evaluated by the cognizant IH office during baseline and periodic IH surveys. Checklists are very useful when performing program audits and 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. RPPM Annual Audit.
 - (1) It is recommended that the RPPM use a checklist when conducting the annual audit of the respirator program. A checklist that may be used by the RPPM can be found in appendix 9-B. Appendix 9-C may also be useful for afloat commands. It is recommended that the annual RPPM audit be documented using the form in appendix 9-B of this chapter.
 - (2) In addition to the checklist, the RPPM audit includes examination of respirators in the workplace. The RPPM performs a complete inspection of all workplaces where respirators are worn to ensure proper respirator use. Besides the annual audit, the RPPM needs to perform frequent, random inspections to assure that respirators are properly selected, used, cleaned, and maintained. The RPPM should keep records of these ongoing surveillance findings. In addition to workplace inspections, the RPPM performs an annual audit of all records associated with the respirator program including respirator training; medical evaluation; fit testing; cartridge change out schedules; monthly inspection of emergency respirators; and compressor inspection and maintenance, including testing for Graded D air quality. Included in this audit is a review of the periodic BUMED Industrial Hygiene Surveys, which contains the written records documenting hazard assessment and the logic on which respirator selection is based. All problems identified during the RPPM audits and the periodic BUMED program evaluations must be corrected as soon as possible.
 - (3) The Respiratory Protection Program review conducted by the BUMED Industrial Hygienist during the periodic or baseline IH survey does NOT alleviate the command's RPPM from conducting a complete workplace inspection and records audit annually in accordance with reference 9-2. The BUMED IH review only encompasses representative workplace inspections and program records review and is not as detailed as the required RPPM annual audit; however, the results of the BUMED IH review can be used to supplement or support the RPPM evaluation.

c. BUMED IH Respirator Program Review.

- (1) BUMED IH is required to use a checklist when conducting the respiratory protection program review for supported commands per the requirements of reference 9-9. The checklists to be used by BUMED IH can be found in appendix 9-C for afloat commands, and appendix 9-D for ashore commands. The checklists were created as part of the IH survey report standardization initiative to ensure standardized review of a command's respiratory protection program.
- (2) In addition to the checklist, the local BUMED should accomplish 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. The BUMED IH respirator program review is scheduled to occur at the time of the periodic industrial hygiene survey. Therefore, BUMED IH will evaluate respirator use throughout the command's workplaces during the normal course of their periodic survey.
- (3) BUMED IH should inspect respirators, have the respirator wearers perform positive and negative pressure user seal checks, see how respirators are cleaned and stored, and ask the workplace supervisor for the worksite SOP. If SOP respirator instructions are not clear to the BUMED IH reviewer, they are probably not clear to the respirator wearer.
- (4) BUMED IH should record the names of individuals they encounter in their workplace inspection and take this list of personnel to the RPPM and check to see if they are included on the RPPM's roster. Check the list of respirator user names in the RPPM's records to ensure that fit testing, medical evaluation, and training are up-to-date.
- (5) Check the RPPM's 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 out schedules, and the annual RPPM program audit.

d. CBRN respirator program inspection

- (1) CBRN respiratory protection programs include all elements of the respirator program described in Chapter 15 of reference 9-2 along with additional requirements for respirator selection; respirator use and limitations; respirator inspection, cleaning, and decontamination; respirator training; fit testing; program evaluation; and respirator cartridge change out schedules.
- (2) In addition to the program audit and evaluation requirements of Chapter 15, paragraph 2607.c.(5) of reference 9-2 requires an additional on-site program evaluation for the CBRN Respirator Program, in which "The Incident Safety Officer will conduct frequent inspections of the incident site to ensure that the correct respirators are being used, are being worn properly, and are in good working condition. The Incident Safety Officer will convey this information to the CBRN RPPM, who will maintain a record of inspection dates and findings."

- (3) Military Unique/Warfighting CBRN respirator use: Per reference 9-2: "Authorization for military gas masks, such as the M-50, is only for chemical, biological, and radiological (CBR) warfare, CBR warfare training, and nuclear accidents when used according to DOD 3150.8M of 22 February 2005." The newest version of this manual available is DODD 3150.08-M CE-01, DoD Response to Nuclear and Radiological Incidents of 31 Aug 18 (not updated in the OPNAV M-5100.23). The M-50 mask is not NIOSH approved and is considered military unique per CBRN program policy. Navy personnel are required to be quantitatively fit tested in the M-50 mask every 5 years per references 9-10 and 9-11. The Marine Corps does not require a 5 year quantitative fit test for the M-50, but relies on confidence chamber/gas chamber exercises to qualitatively fit test the mask annually per reference 9-12.

16. References

- 9-1. 29 CFR 1910.134, OSHA Respiratory Protection Standard
- 9-2. OPNAV M-5100.23, Navy Safety and Occupational Health Manual
- 9-3. OPNAVINST 5100.19 Series, Navy Safety and Occupational Health Program Manual for Forces Afloat
- 9-4. Operations in Chemical, Biological, Radiological, and Nuclear Environments. Joint Publication 3-11 of 28 Oct 20.
- 9-5. National Institute for Occupational Safety and Health (NIOSH): Respirator Selection Logic. DHHS (NIOSH) Publication No. 2005-100. Cincinnati, OH: NIOSH, 2004.
- 9-6. Letter to All manufacturers, NIOSH NPPTL and NFPA Joint Approval Process for NFPA 1981 2007 Edition Respirator Approvals. Centers for Disease Control and Prevention (CDC), National Institute for Occupational Safety and Health (NIOSH), National Personal Protective Technology Laboratory (NPPTL) of 8 Dec 06
- 9-7. Compressed Gas Association (CGA). CGA G-7.1-2018, Commodity Specification for Air. CGA, Arlington, VA. 2018.
- 9-8. NAVMCPUBHLTHCEN Technical Manual: Medical Surveillance Procedures Manual and Medical Matrix (Edition 12). NMCPHC-TM OM 6260, Revised 20 Jan 21
- 9-9. BUMED Itr 5100 Ser M44/21UM40034 of 22 Apr 21
- 9-10. E-Mail NAVSURFWARCEN PC Mr. I. Harkness/NAVMCPUBHLTHCEN Mrs. J. Brunson of 12 Apr 17
- 9-11. Joint CBRN-D Equipment Assessment Program. Position Paper for Joint Policy for Protective Mask Quantitative Fit Test (QNFT) Interval of 28 Mar 06
- 9-12. E-Mail USMC Mr. R. Godwin/NAVMCPUBHLTHCEN Mrs. J. Brunson of 6 Jan 21

Appendix 9-A – Assigned Protection Factors ^D

Type of respirator ^{A, B}	Quarter Mask	Half Mask	Full Face-Piece	Helmet/Hood	Loose-Fitting Face-Piece
Air-Purifying Respirator	5	10	10/50 ^G	————	————
Filtering Facepiece Respirators	————	5	————	————	————
Powered Air-Purifying Respirator (PAPR)	————	50	1,000	25/1,000 ^C	25
Supplied-Air Respirator (SAR) [Airline Respirator] ^E					
Demand mode	————	10	10/50 ^G	————	————
Continuous flow mode	————	50	1,000	25/1,000 ^C	25
Pressure-demand or other positive-pressure mode (i.e., Continuous flow SAR meeting NIOSH pressure demand requirements are approved as pressure demand SAR.)	————	50	1,000 ^F	————	————
Self-Contained Breathing Apparatus (Open & Closed Circuit SCBA)					
Demand	————	10	10/50 ^G	50	————
Pressure-demand	————	————	10,000	10,000	————

^A Employers may select respirators with greater protection factors than what is required by the hazard.

^B 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.

^C 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.

^D 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.*”

^E 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.

^F 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.

^G APF is 10 when qualitatively fit tested and 50 when quantitatively fit tested.



Appendix 9-B – Respiratory Protection Program Manager (RPPM) Audit Checklist



Appendix 9-C – BUMED IH Periodic Respiratory Protection Program
Review Checklist (Afloat)



**Appendix 9-D – BUMED IH Periodic Respiratory Protection Program
Review Checklist (Ashore)**

