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TECHNICAL MANUAL

NAVAL MARITIME CONFINED SPACE PROGRAM

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FOREWORD

Safety hazards posed by the presence of toxic, explosive, or oxygen deficient gases and vapors in confined spaces and poorly ventilated enclosed spaces and other locations are frequently insidious in nature and of extremely serious magnitude. The potential for these hazards exists at naval maritime facilities. The mission of the Naval Maritime Confined Space Program is to eliminate or significantly reduce such hazards. This will be accomplished through the services of specially qualified personnel and will involve organizational, administrative, educational, and technical procedures.

This manual has been prepared for the purpose of providing essential guidance and requirements to naval maritime facilities where the potential exists for the subject hazards, and continuous maintenance of this vital safety program. The manual addresses requirements, qualifications, and duties for Maritime Confined Space Program personnel; describes various hazards and precautions including sources for additional information in specific areas; and provides a general description of procedures employed in various confined space and poorly ventilated enclosed space operations. Further refinements to this manual may be required to enhance effectiveness in serving the purpose for which it was prepared. Constructive comments and recommendations are strongly solicited. Chapter 1, paragraph 1-9 provides additional information concerning submission of comments.

Ships, training activities, supply points, depots, Naval Shipyards and Supervisors of Shipbuilding are requested to arrange for the maximum practical use and evaluation of NAVSEA technical manuals. All errors, omissions, discrepancies, and suggestions for improvement to NAVSEA technical manuals shall be forwarded to: COMMANDER CODE 5E30 NAVSURFWARCENDIV 4363 MISSILE WAY PORT HUENEME CA 93043-4307 on NAVSEA Technical Manual Deficiency/Evaluation Report, form NAVSEA 4160/1. All feedback comments shall be thoroughly investigated and originators will be advised of action resulting there from. Users are encouraged to transmit deficiency submittals via the Naval Systems Data Support Activity Web page located at: <https://nsdsa2.phdnswc.navy.mil/tmder/tmder.htm> Individual electronic TMs do not contain NAVSEA 4160/1 but are linked to an electronic version on the resident CD-ROM. Therefore, we encourage the user to transmit deficiency submittals via the Naval Systems Data Support Activity Web page located above.

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SAFETY SUMMARY

SAFETY SUMMARY. The following are general safety precautions. They are precautions that personnel must understand and apply before entering or performing work in confined or poorly ventilated enclosed spaces or locations.

CONFINED SPACE OPERATIONS. Only properly trained and designated Maritime Confined Space Program personnel as required by this manual shall be permitted to perform initial entry of confined or poorly ventilated enclosed spaces or locations, to conduct atmospheric tests, and to make determinations of the conditions under which cold or hot work may be safely conducted therein, or adjacent thereto. Where it is advantageous to the government (e.g., necessary or financially prudent) to do so, contractor competent persons, qualified in accordance with 29 CFR 1915, may provide competent person services for Navy personnel under the terms and condition described in an appropriate written agreement between the provider of the services and the Navy.

GENERAL SAFETY PRECAUTIONS. General safety precautions related to the occupancy and performance of work in or on confined or poorly ventilated enclosed spaces and locations are:

1. Personnel will not be allowed to enter untested confined spaces and poorly ventilated enclosed spaces.
2. Procedures must exist for the prompt rescue of an incapacitated worker.
3. All confined or poorly ventilated enclosed spaces shall be considered hazardous and entry into or work in or on, such spaces is prohibited until the space has been tested and found to be safe.
4. Personnel entering spaces to conduct confined space and poorly ventilated enclosed space testing or cleaning operations shall be provided with appropriate personal protective clothing and equipment.
5. Personal protective clothing and equipment shall be cleaned and maintained in good operating condition.
6. Personnel should be especially aware that unlikely structures with hollow spaces, such as stanchions, railings, bitts, piping, and drums, present safety hazards if hot work is to be performed on the outside and will require evaluation prior to hot work starting.
7. Personnel exposed to contaminants during cleaning operations shall observe good hygiene practices.
8. Flammable and toxic vapors and materials may be present in, or become trapped in, sludge. Tests of the space may show satisfactory conditions. However, when the sludge is disturbed, toxic or flammable vapors may be released. Contact with the sludge may expose personnel to toxic contaminants. Adequate precautions shall be observed when personnel enter spaces where a sludge is present which may contain or may trap toxic or flammable materials.
9. General safety precautions for the control of other hazards—such as slip, trip, or fall hazards, electrical hazards, or low overheads and ladders—shall be provided consistent with applicable OSH Standards.

SAFETY SUMMARY - Continued

WARNING

Certain operations such as venting reactors and battery charging operations may exceed PELs and LELs. Personnel will not occupy the affected spaces during periods when concentrations are at or above 10% of the LEL or toxic concentrations are immediately dangerous to life or health (IDLH). (Page 4-5)

CHAPTER 1

INTRODUCTION

1-1. PURPOSE

The policies of the Department of the Navy regarding the Maritime Confined Space Program for operations involving entry into or work in, on or immediately adjacent to confined or poorly ventilated enclosed spaces are mainly concerned with the safety and health of personnel and the protection of naval ships and facilities. The purpose of this publication is twofold:

- a. To inform personnel engaged in confined or poorly ventilated enclosed space operations of the hazards and precautions associated with such operations; and,
- b. To prescribe in one central and authoritative publication, the regulations and procedures applicable to confined or poorly ventilated enclosed space entry and work and the requirements for establishing and administering Maritime Confined Space program.

1-2. SCOPE

This publication provides policy, information and guidance and the minimum mandatory requirements for the Confined Space Program at naval maritime facilities as defined in Appendix A . However, it is not all-inclusive and does not contain all conceivable operations and conditions that may be encountered in the Maritime Confined Space Program. Therefore, it is essential that all personnel carrying out Maritime Confined Space Program functions clearly understand the intent, principles, and concepts upon which these requirements are based so that, under circumstances not specifically covered, appropriate procedures will be followed. Areas that are not addressed are those hazards related to radiation, airborne non-explosive particles, or a biological agent.

1-3. APPLICABILITY.

The provisions of this manual apply to all Navy personnel engaged in shipbuilding, ship repair, ship breaking, and related employment ashore as noted below.

1-3.1 NAVAL MARITIME FACILITIES The provisions of this manual apply to Naval maritime facilities regardless of geographical location within the facility, and wherever Naval maritime facilities personnel conduct maritime operation worldwide, subject to the caveats in the paragraphs below.

1-3.2 NAVY SHORE NON-MARITIME COMMANDS.

1-3.2.1 Navy shore non-maritime commands conducting facilities-related confined or poorly ventilated enclosed space entry work within a naval maritime facility will comply with OPNAVINST 5100.23 (Series) except that a Marine Chemist or Gas Free Engineer (GIL) shall be used as required by 29 (TR 1915 Subpart B and this instruction.

1-3.2.2 Navy shore non-maritime facilities performing maritime operations shall comply with this instruction except that the Confine Space Program Manager (CPSM) may provide management of the requirements of this instruction, and perform or designate other personnel to perform duties limited to Navy competent persons, and shall maintain a list consistent with the provisions of paragraph 2-4.2a and 2-4.2b of this instruction. Personnel performing Navy competent person duties under the provisions of this paragraph shall complete the training and

OJT requirements of paragraph 2-4.2 except that the amount of maritime experience and OJT may be limited to the appropriate types of confined space operations performed by the activity as determined by the CSPM. A Marine Chemist or GFE shall be used as required by 29 CFR 1915 Subpart B and this instruction. The CSPM and GFE shall confer whenever both are conducting work on the same vessel at the same time, and should any disputes arise, the most stringent requirement shall be applied.

1-3.3 NAVY DIVING PROGRAM. The intent and purpose of this publication shall be applied and adopted, to the maximum extent practicable, within the Navy Diving Program.

1-3.4 NAVAL VESSELS AND SHIPS FORCE PERSONNEL. The regulations and procedures contained herein are applicable to naval vessels and Ships Force personnel conducting shore operations including ship overhaul and repair at Naval Maritime Facilities. The Shipboard (Afloat) Confined Space Program is governed by Naval Ships Technical Manual Chapter 074 Volume 3 (NSTM 074 Vol. 3), Gas Free Engineering Program and is applicable to underway and shore operations at operational and non-naval maritime facilities.

1-3.5 OVERSEAS OPERATIONS. The intent and purpose of this publication shall be applied and adopted to the maximum extent practicable to naval maritime facilities at overseas locations, noting, however, that various factors will impact and may take precedence over the applicability of this publication. According, on a case-by-case, country-by-country basis, the various Status of Forces Agreements (SOFAs), host nation laws, master labor contracts, and other treaties, contracts, or agreements must be considered before applying the provisions of this publication. In the event that the provisions of this manual are different from a SOFA, host nation law, master labor contract, or other treaty, contract, or agreement, the naval maritime facility shall follow the more stringent provision unless such document specifically requires otherwise.

1-3.5.1 EXCEPTION FOR A FOREIGN NATIONAL PERFORMING GFE COMPETENT PERSON SERVICES. Unless prohibited by the governing authority in the host nation (e.g., SOFA, host nation law, master labor contract, or treaty) a foreign national employee of the host nation hired on behalf of the Navy meeting all the requirements of a Navy Board Certified Gas Free Engineer in accordance with SECNAVINST 5100.16 (Series) (except the requirement of being a Department of the Navy employee) may perform the duties of a GFE and a Navy competent person. However, said foreign national employee SHALL NOT perform hot work certifications that would normally require a GFE or Marine Chemist for Navy civilian or U.S. civilian contractor employees. The Commanding Officer of the naval maritime facility concerned shall appoint said person in writing after consulting with the cognizant Navy legal counsel.

1-4. MANDATORY AND ADVISORY PROVISIONS

The requirements contained herein to which the terms "shall", "will", or "must" are used are mandatory. Advisory requirements are those in which "should" is used. Advisory requirements shall be complied with unless exceptions are authorized by the Gas Free Engineer. Permissive requirements are those in which "may" is used. No specific authorizations are required for use of, or deviation from, permissive requirements.

1-5. SUPPLEMENTARY INSTRUCTIONS

Higher authority instructions may implement additional more stringent requirements. Unless this manual specifically exempts or supersedes those requirements, they will be followed. Other instructions shall not relax the minimum requirements of this manual. Referenced documents are listed in Appendix B.

1-6. CONFLICTING REGULATIONS

Conflicts with this instruction pertaining to the requirements shall be identified to Commander, Naval Sea Systems Command (SEA 04R). Interim measures that provide optimum safety shall be the responsibility of the Commanding Officer until any such conflicts have been resolved.

1-7. ALTERNATIVE CRITERIA STANDARDS

Part of the provisions of this publication constitute Occupational Safety and Health (OSH) standards. When a command feels these standards must be modified for application to a particular working condition, a request for approval of an alternative criteria standard shall be submitted in accordance with the provisions of OPNAVINST 5100.23 (Series).

1-8. RESPONSIBILITIES FOR MARITIME CONFINED SPACE PROGRAM

1-8.1 COMMANDING OFFICER. The Commanding Officer, consistent with the inherent duties and responsibilities as set forth in Navy Regulations and as promulgated by directives from higher authority, is solely responsible for the safety and health of personnel, and the protection of property within the command. Accordingly, the Commanding Officer is responsible for establishing and conducting a complete and comprehensive Maritime Confined Space Program that meets the purpose, intent, and specific requirements of this publication. In so doing, the Commanding Officer shall enforce the mandatory requirements of this manual and be guided by the advisory provisions. The Commanding Officer shall initiate procedures and directives and require inspections necessary to effect compliance with the standards and regulations prescribed herein. It is also the Commanding Officer's responsibility to require that personnel of other agencies, including contractors, while within the purview of the command, conduct activities and operations in accordance with applicable laws and standards. The absence of a requirement in this manual does not necessarily indicate that safeguards are not required. Where no existing standard or regulation applies, or where interpretation is necessary, the Commanding Officer shall submit to Commander, Naval Sea Systems Command (SEA 04R) full particulars and details and shall, in the interim, take necessary action to control the identified hazard.

1-8.2 OFFICERS, DIRECTORS, AND MANAGERS. Management personnel, including department directors, division officers or managers, section heads and personnel occupying similar positions, who have under their control spaces, operations or personnel falling under the provisions of this manual, shall ensure that:

- a. The provisions, procedures, and requirements contained in this manual are fully met;
- b. Maritime Confined Space Program personnel perform all prescribed testing, apply all required controls and ascertain that spaces have been certified safe for the prescribed operations prior to commencement of such operations;
- c. Training is provided to employees entering confined or poorly ventilated enclosed spaces; and
- d. An annual drill is conducted to verify that procedures are established for emergency rescue and medical treatment and that all appropriate personnel are familiar with such procedures.

1-8.3 SUPERVISORY PERSONNEL. Supervisors shall be familiar with the provisions of this manual as they relate to personnel or operations under their supervisory control. They shall act positively to eliminate any potential hazards existing in operations under their control and shall:

- a. Explain to all employees under their immediate supervision the nature of the hazards associated with the operations and the precautions necessary to control such hazards;
- b. Strictly enforce observance of the safety and health requirements of this manual and pertinent referenced standards and regulations; and
- c. Promptly report to their immediate superior any unsafe conditions or procedures and, where warranted by the severity of such conditions, cease all operations until corrective action has been effected.

1-8.4 OPERATING PERSONNEL. All persons engaged in confined or poorly ventilated enclosed space entry or work are responsible for fully understanding and strictly observing the safety standards, regulations and procedures applicable to such work. Further, each person shall:

- a. Report to their immediate supervisor any condition, procedure or equipment that is considered unsafe;
- b. Warn others believed to be endangered by failure to observe the proper procedures or precautions or of any other hazard of which they are aware; and
- c. Report to their supervisor any injury or evidence of impaired health occurring in the course of work or duty, or which may affect the safety performance of duties.

1-8.5 SAFETY, HEALTH, AND FIRE PROTECTION MANAGERS. Safety, health and fire protection managers shall administer the Maritime Confined Space Program commensurate with the requirements of their respective areas of responsibility. Further, they shall coordinate their respective programs and efforts with the Maritime Confined Space Program to ensure optimum utilization of resources.

1-8.6 GAS FREE ENGINEER, MARITIME CONFINED SPACE PROGRAM SUPPORT PERSONNEL. The Gas Free Engineer is responsible for establishing and administering the overall activity Maritime Confined Space Program consistent with the requirements of this manual and other pertinent safety, health, and fire protection standards. Maritime Confined Space Program support personnel shall perform the duties and responsibilities specified herein and assigned by the activity Gas Free Engineer. Detailed duties and responsibilities of the Gas Free Engineer and Maritime Confined Space Program support personnel are set forth in Chapter 2 of this manual.

1-8.7 MARINE CHEMIST. In instances where a Gas Free Engineer is not available, a Marine Chemist shall be employed to perform Maritime confined space Program support services consistent with 29 CFR 1915 requirements.

1-9. REPORTING OMISSIONS OR ERRORS IN THIS MANUAL

Ships, training activities, supply points, depots, Naval Shipyards, and Supervisors of Shipbuilding are requested to arrange for the maximum practical use and evaluation of NAVSEA technical manuals. All errors, omissions, discrepancies, and suggestions for improvement to NAVSEA technical manuals shall be reported to the Commander, NAVSURFWARCENDIV, 4363 Missile Way, Port Hueneme, CA 93043-4307 on NAVSEA/ SPAWAR Technical Manual Deficiency/Evaluation Report (TMDER), NAVSEA Form 4160/1. To facilitate such reporting, one copy of NAVSEA Form 4160/1 is included at the end of each technical manual. All feedback comments shall be thoroughly investigated and originators will be advised of action resulting there from. Extra copies of NAVSEA Form 4160/1 may be requisitioned from DDSP Susquehanna Pennsylvania, 05 E Street, Mechanicsburg, PA 17055-5003. (S/N 0116-LP-019-5300).

1-10. DATE OF PUBLICATION

The date of publication of this technical manual and of revisions and changes thereto, as shown on the title page, is the estimated date the publication is to be distributed. The manual, revision, or change, however, is effective upon receipt, regardless of the date shown on the title page.

1-11. DEFINITIONS

The definitions applicable to this publication are supplied in Appendix A .

CHAPTER 2

MARITIME CONFINED SPACE PROGRAM REQUIREMENTS

2-1. INTRODUCTION

Each naval maritime facility, as appropriate, shall establish and administer a comprehensive Maritime Confined Space Program in accordance with the provisions of this manual. This chapter sets forth the minimum requirements for the Marine Confined Space Program.

2-2. BASIC PROGRAM REQUIREMENTS

Each naval maritime facility shall issue an instruction, directive, manual, or other implementing document establishing a Maritime Confined Space Program consistent with the provisions of this manual. At a minimum, the document shall include provisions for:

- a. Observance of the procedures herein for all confined space and poorly ventilated enclosed space entry or work;
- b. The organizational location of the Gas Free Engineer and Maritime Confined Space Program support personnel and procedures for obtaining services of Maritime Confined Space Program personnel for the performance of required space testing, treatment and certification;
- c. Staffing of the Maritime Confined Space Program function with personnel appropriate to the activity, qualified and certified in accordance with paragraph 2-6 in sufficient numbers to meet the operating requirements of the activity;
- d. Inspection of operations and enforcement of the provisions of Maritime Confined Space Program policies and procedures as stated herein;
- e. Instrumentation of the type necessary in sufficient quantity and in adequate repair and calibration to meet the Maritime Confined Space Program requirements of the activity;
- f. Training or indoctrination of personnel managing, supervising, instructing in or performing affected operations in the hazards of confined or poorly ventilated enclosed spaces and the safety precautions necessary to control such hazards; and
- g. Maintenance of required records, logs and other administrative requirements in support of the Maritime Confined Space Program.

2-3. STAFFING

All naval maritime facilities shall be adequately staffed, as appropriate, with personnel qualified in accordance with paragraph 2-4 : to perform Maritime Confined Space Program services. At a minimum, each naval maritime facility shall have:

- a. One person trained, qualified and certified as a Gas Free Engineer, or shall make provision for procuring and using the services of a National Fire Protection Association (NFPA) Certified Marine Chemist or a certified Gas Free Engineer from another naval maritime facility; and
- b. Maritime Confined Space Program support personnel (Gas Free Engineers or Nave competent persons) properly trained, qualified and certified to meet the requirements of this manual and the workload requirements of the particular activity.

NOTE

The intent of this instruction is not to require a GFE at each naval maritime facility. Naval maritime facilities can develop and implement a compliant Maritime Confined Space Program if provisions are made for procuring and using the services of a Marine Chemist or GFE from another facility. In such instances, the facility is still required to develop and implement a written Maritime Confined Space Program, designate a Maritime Confined Space Program Manager, and ensure all training and documentation requirements are met.

2-4. MARITIME CONFINED SPACE PROGRAM PERSONNEL

The categories and commensurate training and qualification requirements for Maritime Confined Space Program personnel have been established as the result of careful and extensive evaluation of a number of factors which include: nature and extent of confined space and poorly ventilated enclosed space entry and work normally conducted at naval maritime facilities; knowledge, experience and performance capabilities required to properly recognize and control Maritime Confined Space Program hazards and problems; and requirements of Public Law 91-596, Occupational Safety and Health Act (OSHA) of 1970; Code of Federal Regulations 29 CFR 1915; Executive Order (EO) 12196; and implementing Department of Defense (DoD) and Department of the Navy (DON) directives. The categories of Maritime Confined Space Program personnel, with required qualifications, are established as presented in the following subparagraphs. Military personnel who have served as an Afloat GFE or GFE assistant under NSTM 074V3 upon rotating ashore may be certified as a Navy competent person by the cognizant Navy GFE upon demonstration of the required knowledge and skills.

2-4.1 GAS FREE ENGINEER (GFE). The Gas Free Engineer shall be qualified and certified by the Navy Gas Free Engineer Certification Board per SECNAVINST 5100.16 (Series).

2-4.2 NAVY COMPETENT PERSON. The Navy competent person shall have a high school education or equivalent and at least 6 months applicable experience in a naval maritime facility environment or in safety, fire or health inspections. Navy competent persons shall satisfactorily complete the formal training course of instruction specified in paragraph 2-5b and shall complete 120 hours of field service training. Navy competent persons who only perform shore-side confined space certifications shall satisfactorily complete the formal training course of instruction in paragraph 2-5b and shall complete 80 hours of field service training.

- a. The Gas Free Engineer shall certify that the Navy competent person has the following skills and knowledge:
 1. Ability to understand and carry out written or verbal instructions provided by Gas Free Engineers, Marine Chemist, and Certified Industrial Hygienists;
 2. Knowledge of 29 CFR 1915, subparts B, C, D and E, and this instruction;
 3. Knowledge of the structure, location, and designation of spaces where work is done;
 4. Ability to calibrate and use testing equipment including, but not limited to, oxygen indicators, combustible gas indicators, carbon monoxide indicators, and carbon dioxide indicators, and to interpret accurately the test results of that equipment;
 5. Ability to perform all required tests and inspections that are or may be reasonably expected to be, performed by a Navy competent person as set forth in 29 CFR 1915 Subpart B, C, D & H and this instruction;
 6. Ability to inspect, test, and evaluate spaces to determine the need for further testing by the Gas Free Engineer, Marine Chemist, or Certified Industrial Hygienist; and

7. Ability to maintain the records required by 29 CFR 1915 and this instruction.
- b. The Gas Free Engineer shall maintain a current roster of designated Navy competent persons, with the activity name, Navy competent person's name, and the date the employee completed training as a competent person.

NOTE

Gas Free Engineer "In Training" is a person who is in the process of obtaining the necessary educational experience and/or training toward certification as a Navy GFE. Duties and responsibilities assigned to such personnel shall be in accordance with paragraph 2-10.3.

2-5. NAVY CONFINED SPACE PROGRAM PERSONNEL RELATIONSHIPS

The qualification, certification, and designation requirements for Navy Confined Space Program personnel are specifically related to the various types of activities and the nature of operations normally conducted within each activity. Further, the intent and purpose of appropriate laws, regulations, and directives must be observed. Therefore, the following relationships of Navy Confined Space Program personnel and operations shall be observed:

2-5.1 INTERCHANGEABILITY OF CONFINED SPACE PROGRAM PERSONNEL. Navy Confined Space Program personnel, when used for Navy Confined Space Program services at a command other than the command to which they are assigned, must meet the appropriate qualification and training requirements applicable to the command and operations for which the services are to be performed. The performance of such services is authorized where the GFE is certified. The following relationships shall be observed:

- a. While at a Naval Maritime Facility, upon written approval of the Naval Maritime Facility GFE, Ships Force GFE Personnel may issue Navy Gas Free Certification and Test Logs for entry and cold work by Ships Force personnel in accordance with NSTM 074 Vol. 3. Note however that the provisions of this manual apply whenever Naval Maritime Facility GFEs or Navy Competent Persons certify confined or poorly ventilated enclosed spaces for Ships Force entry.
- b. The Gas Free Engineer, due to their extensive training and experience, may also perform confined space program duties for ship's force (NSTM 074V3) personnel and non-maritime (OPNAVINST 5100.23 Chapter 27) personnel.
- c. Maritime Confined Space Program personnel may retest and maintain a confined space certificate initially issued by a Marine Chemist for operations involving government personnel, provided that such personnel are functioning within their respective areas of authority and responsibility as set forth in 29 CFR 1915 and this instruction, and further provided that atmospheric conditions within that space are maintained within the conditions established by the Marine Chemist certificate. Where atmospheric conditions have changed, the space must be retested and recertified by a Marine Chemist or Gas Free Engineer as appropriate.

2-5.2 ORGANIZATIONAL RELATIONSHIP OF MARITIME CONFINED SPACE PROGRAM PERSONNEL. The Gas Free Engineer, irrespective of placement within the activity organization, shall be directly responsible to the Commanding Officer or to the command's designated safety and occupational persons shall be directly responsible to the GFE, irrespective of their placement within the activity organization, for all duties and responsibilities prescribed by this manual or by the GFE in fulfilling responsibilities for the proper execution of the Maritime Confined Space Program.

2-6. GAS FREE ENGINEER AND NAVY COMPETENT PERSON TRAINING

- a. The candidate GFE must satisfactorily complete the Naval Occupational Safety and Health and Environmental Training Center Course A-493-0030, Confined Space Safety, attaining a grade of 90 percent or higher for the course. The official point of contact for course convening dates, locations and quota allocations is: Commanding Officer, Naval Occupational Safety and Health, and Environmental Training Center, 9080 Breezy Point Crescent, Norfolk, VA, 23511-3998.
- b. The candidate Navy competent person training shall be based on the essential elements of A-493-0030, this manual and local implementing instructions. The lesson plans shall be approved by the local GFE. Supplementary training for the Navy competent person may be obtained through the Shipyard Competent Person Training Program sponsored by the Occupational Safety and health Administration (OSHA).

2-7. MARITIME CONFINED SPACE PROGRAM PERSONNEL CERTIFICATION AND RECERTIFICATION

2-7.1 NAVY GAS FREE ENGINEER CERTIFICATION BOARD. The Navy Gas Free Engineer Certification Board (hereafter called the Board) is established for the purpose of certifying Gas Free Engineers for service in naval maritime facilities. The Board's charter (membership and duties) are set forth in SECNAVINST 5100.16 (Series, Navy Gas Free Engineer Certification/Recertification Process." The Board acts on the certification of GFE applicants and grants or denies certification or recommends additional training to GFE candidates depending upon the results of a thorough Board review of each individual applicant's professional and practical qualifications, training record and other relevant accomplishments. The Board also reviews the performance of all Gas Free Engineers at least every five (5) years or after a significant incident involving the GFE program and, appropriately, recertify or decertify the GFE. Applicants for certification and re-certification should follow the guidance of SECNAVINST 5100.16 (Series).

2-7.2 CERTIFICATION OF GAS FREE ENGINEERS.

- a. The GFE candidate will maintain a record of his education, training, knowledge and experience. The record shall include, but not be limited to, the following information:
 1. Course(s) completed including dates and grades achieved; and
 2. OJT (each major experience) including: hours and location; trainer; name of ship or barge; identification of typical tanks or spaces inspected; type of work in progress; tests performed; and test instruments used.
- b. The candidate's records will be forwarded to the chairman of the GFE Certification Board for review. The Board will advise the Commanding Officer sponsoring the GFE candidate concerning its determination as to the candidate's eligibility for certification as a GFE.

2-7.3 GAS FREE ENGINEER CERTIFICATION PROCESS. In addition to the requirements of SECNAVINST 5100.16 (Series), the certification process for the Gas Free Engineer includes the following considerations:

- a. The Commanding Officer, OSH Director by direction of the Commanding Officer, or a GFE with the written approval of the Commanding Officer, may recommend Gas Free Engineer candidates to the Board for certification at least 120 days prior to the certification requirement date;
- b. The Board reviews the GFE candidate application, interviews the GFE candidate, and either grants, delays, or

denies certification. The Board will justify any delays or denials of certification, and the candidate may reapply when all Board concerns leading to delay or denial of the certificate have been satisfied;

- c. A certificate, upon granting, shall be placed in an employee's military or civilian personnel folder, and is good for five (5) years from the date of issue. The certificate is transferable from one naval maritime facility to another. The Gas Free Engineer Certification does not grant Marine Chemist equivalency to Navy GFEs for contractor work operations;
- d. The Commanding Officer may select any Board certified Gas Free Engineer to serve as a naval maritime facility Gas Free Engineer and must appoint him or her in writing. The appointment will be subject to suspension, in the event of a significant incident involving the GFE's work, pending naval maritime facility and, if required, Board investigation; and
- e. Appointment of Gas Free Engineers by the Commanding Officer shall be made only after the Board has certified the candidates as Gas Free Engineers.

2-7.4 RECERTIFICATION OF GAS FREE ENGINEERS. On a five-year cycle, the Commanding Officer shall recommend the GFE for recertification to the Board at least 120 days prior to the recertification date required. The request for recertification shall provide information sufficient to enable the Board to review and assess the performance and activity of the GFE. Only GFEs who are actively basis), or alternative requirements as established by the Navy GFE Certification Board) and have demonstrated satisfactory work performance will be recertified. GFEs who have not been actively engaged in Maritime Confined Space Program work shall complete a minimum 40 hours of OJT under the direct supervision of a certified Gas Free Engineer or Marine Chemist to refresh their Maritime Confined Space Program skills, prior to recertification.

2-7.5 NAVY COMPETENT PERSON DESIGNATION. Navy competent persons shall be designated by the Commanding Officer upon recommendation of the GFE, or by the GFE when authorized to do so by the Commanding Officer. Designation of a Navy competent person shall be made only after it has been ascertained that the candidate has satisfactorily met all requirements specified in paragraph 2-4.2 . Navy competent persons shall be re-designated annually by demonstration that the individual has been actively engaged in Maritime Confined Space Program work (i.e., 10 certificates per year) and has performed such work satisfactorily. Navy competent persons who have not been actively engaged in Maritime Confined Space Program work (as defined above) shall complete a minimum of 40 hours of on-the-job training prior to re-designation by the Commanding Officer or the Gas Free Engineer.

2-7.6 MARITIME COMFINED SPACE PROGRAM REVIEW, EVALUATION, AND AUDIT. The Commanding Officer shall make, or cause to be made, a written evaluation of the Maritime Confined Space Program at least annually or following an incident to ensure all aspects of the program are being properly conducted. The annual evaluation of the Maritime Confined Space Program shall include, but not be limited to, the following audit criteria:

- a. Naval maritime facility personnel managing, supervising, and performing confined or poorly ventilated enclosed space operations are knowledgeable of the requirements and hazards of such operations;
- b. Maritime Confined Space Program personnel are properly trained and qualified;
- c. Instrumentation is in sufficient quantity and is properly calibrated, used, and maintained;
- d. Records of all instrument calibration and field test checks are maintained; and
- e. Navy confined space and poorly ventilated enclosed space certificates are correctly issued, posted, and maintained.

2-7.7 CERTIFICATION RECORD. Maritime Confined Space Program personnel certifications and designations shall be made a part of the individual's personnel record as appropriate.

2-8. CONTRACTOR OPERATIONS

- a. Where contractors are performing naval maritime facility operations subject to 29 CFR 1915 and desire to use Navy competent person services, the following provisions shall be observed:
 1. The contractor, when performing naval maritime facility operations subject to 29 CFR 1915, shall provide a Marine Chemist or a competent person as appropriate under the provisions of 29 CFR 1915 or, if the contractor desires and upon approval of the Commanding Officer (CO) of the naval maritime facility use the services of a Navy GFE or Navy competent person for competent person services under the provisions of 29 CFR 1915 and this manual. Contractors are not required to use the services of a Navy GFE or Navy competent person. COs are not required to provide such services but have the discretion to do so only when providing such services is advantageous to the government (e.g., necessary or financially prudent). Navy competent persons are not authorized to provide competent person services for contractor personnel on non-Navy owned and operated vessels.
 2. When the CO approves the provision of Navy competent person services for contractor personnel, the CO shall ensure that a roster containing the information required by 29 CFR 1915.7, along with copies of training certifications for each Navy GFE or Navy competent person, is provided to the contractor prior to the provision of such services. The contractor shall record its agreement to accept Navy competent person services and shall ensure that the Navy GFE or Navy competent person is qualified to perform such services. The contractor shall ensure that its employees who may enter confined spaces and poorly ventilated enclosed spaces are trained in accordance with 29 CFR 1915 and the Navy's confined space certification procedures (including understanding Navy confined space certificates) and that its employees comply with confined space and poorly ventilated enclosed space entry procedures. The contractor shall maintain records of such training. The provision of Navy competent person services to the contractor does not form an employer/employee relationship between the contractor and the Navy competent person. However, the provision of Navy competent person services in no way relieves the contractor of its obligations under any law or regulation to ensure, among other things, a safe and healthful workplace for its employees and that the Navy competent person is qualified to perform such services. The provision of Navy competent person services to the contractor shall be implemented through an appropriate written agreement (e.g., contract, contract modification, Memorandum of Agreement) and such written agreement shall set forth the terms and conditions defining the provision of such services and incorporate section 2-8 of this manual.
- b. Navy GFEs shall not certify spaces that require the services of a Marine Chemist under the provisions of 29 CFR 1915 for contractor personnel.
- c. The contractor, when performing non-shipboard construction and demolition operations within a naval maritime facility, shall provide a qualified person as required in 29 CFR 1926.
- d. Where contractors are performing maritime operations subject to 29 CFR 1915 and choose to provide competent person services to naval maritime facility personnel, the following provisions shall be observed:
 1. Upon approval of the CO, and if the contractor agrees, naval maritime facility personnel may enter a confined space and poorly ventilated enclosed space for purposes of inspection, cleaning, or cold work under a contractor competent person record of tests and inspections issued under the provisions of 29 CFR 1915. COs are not required to use such services but have the discretion to do so when using such services is advantageous to the government (e.g., necessary or financially prudent).
 2. When the CO approves the provision of contractor competent person services for Navy personnel pursuant to this subparagraph, the CO shall ensure, prior to the provision of such services, that the contractor provides to the CO's designated representative a roster containing the information required by 29 CFR

1915.7, along with copies of training certifications for each contractor competent person. The CO shall record the agreement to accept contractor competent person services and shall ensure that the contractor competent person is qualified to perform such services. The CO shall ensure employees who may enter confined spaces and poorly ventilated enclosed spaces under this subparagraph are trained in accordance with 29 CFR 1915 and the contractor's confined space certification procedures (including understanding contractor record of tests and inspections) and that employees comply with confined space and poorly ventilated enclosed space entry procedures. The CO shall maintain records of such training. The provision of contractor competent person services to the Navy does not form an employer/employee relationship between the Navy and the contractor competent person. The provision of contractor competent person services in no way relieves COs of their obligations under any law or regulation to ensure, among other things, a safe and healthful workplace for their employees and that the contractor competent person is qualified to perform such services. Except as provided below, the provision of contractor competent person services to the naval maritime facility shall be implemented through an appropriate written agreement (e.g., contract, contract modification, Memorandum of Agreement) and such written agreement shall set forth the terms and conditions defining the provision of such services and incorporate section 2-8 of this manual. If naval maritime facility personnel enter a space solely for the purpose of inspecting or monitoring contract performance, the written agreement mentioned above is not required.

- e. Where Navy personnel and contractor personnel are to occupy the same certified space, the Navy confined space certificate and or contractor competent person record of tests and inspections issued for that space must indicate the concurrent Navy and contractor work operations in that space to ensure conflicting operations do not occur and to ensure that the competent person(s) issuing the confined space certificate and/or the record of tests and inspections are fully aware of all work operations to be performed in that space.
- f. In all cases involving contractor operations within naval maritime facilities, the Contracting Officer 29 CFR 1915, and that the contractor's shipyard competent person shall be adequately qualified and that all operations are to be conducted in accordance with the provisions of 29 CFR 1915.

2-9. ADMINISTRATIVE AND RECORD KEEPING REQUIREMENTS

2-9.1 CONFINED SPACE TEST LOG. Confined space logs shall be maintained for all tests and inspections of confined or poorly ventilated enclosed spaces required by the provisions of this manual. The confined spaces certificates are acceptable as a substitute for the confined space log provided the certificate contains all of the information required for the log. The log, at a minimum, shall contain the following information:

- a. Date and time of test or inspection;
- b. Location and identification of the space and ship or building;
- c. Equipment identification (ID) number, tests conducted and test results;
- d. Prescribed actions or instructions (ventilation, personal protective equipment (PPE) required, etc.);
- e. Type of work to be performed, i.e. hot work, spray painting, etc.; and
- f. Name of the person conducting the test or inspection.

2-9.2 CONFINED SPACE CERTIFICATE. A confined space certificate, as required by Chapter 3 of this manual, shall be issued for each confined or poorly ventilated enclosed space tested in accordance with the requirements of this manual.

2-9.3 RECORDS RETENTION. All confined space logs and/or certificates shall be on file for a period of at least 3 months from the completion date of the specific job for which they were generated.

2-10. DUTIES AND RESPONSIBILITIES

2-10.1 GAS FREE ENGINEER. The Gas Free Engineer shall be responsible for:

- a. Establishing and administering the Maritime Confined Space Program as required by this manual;
- b. Ensuring that procedures for the application of the provisions contained herein for confined space and poorly ventilated enclosed space testing, treatment and certification prior to entry or work are established;
- c. Ensuring that required instrumentation in sufficient quantity to meet the requirements of the activity Maritime Confined Space Program is procured, maintained and calibrated;
- d. Ensuring that all activity Maritime Confined Space Program support personnel are properly trained and qualified as specified herein, including knowledge of the proper Maritime Confined Space Program procedures; proper use and calibration of instrumentation; and selection, issue, and maintenance of personal protective equipment (PPE) and emergency procedures for the specific activity;
- e. Providing information for the indoctrination of all appropriate activity personnel, other than Maritime Confined Space Program personnel, regarding the hazards of confined spaces and poorly ventilated enclosed spaces;
- f. Providing visual inspection and testing of confined or poorly ventilated enclosed spaces, and preparing, issuing, and posting confined space certificates for the spaces, indicating the safe or unsafe conditions and required control measures of the space and operations therein;
- g. Establishing requirements for cleaning, ventilating, inerting, pressing-up, or other treatments that may be required for confined or poorly ventilated enclosed spaces;
- h. Observing, as needed, operations to verify that proper procedures are followed prior to commencement of, during and after hot work in, on, or adjacent to confined or poorly ventilated enclosed spaces;
- i. Observing, as needed, operations to verify that personnel do not work alone or unobserved while working with hazardous substances in confined or poorly ventilated enclosed spaces;
- j. Observing, as needed, operations to verify that procedures are established for emergency rescue and medical treatment and that all appropriate personnel are familiar with such procedures;
- k. Establishing procedures for the maintenance of safe conditions requiring work to be stopped and all personnel to be removed from a space or location when a change that alters the safe conditions within the space is detected or suspected;
- l. Ensuring that the Commanding Officer and/or the appropriate department head or director are notified when any hazardous situation is detected that causes work stoppage and/or personnel evacuation; and
- m. Ensuring that Maritime Confined Space Program records are maintained.

2-10.2 NAVY COMPETENT PERSONS. Navy competent persons shall:

- a. Conduct visual inspections and tests of confined and poorly ventilated enclosed spaces as required by this manual and as may be prescribed and directed by the GFE;

- b. Ensure that confined or poorly ventilated enclosed space signs and certificates are correctly issued, posted, maintained, and updated;
- c. Observe operations, as needed, to verify that posted certificate directions are being properly followed;
- d. Cause all work to stop and require all personnel to evacuate a confined or poorly ventilated enclosed space where an unsafe condition is detected or suspected and shall immediately notify the GFE and the immediate job supervisor;
- e. Calibrate, use and maintain required test instruments;
- f. Observe operations, as needed, to verify that personnel do not work alone or unobserved when working with hazardous substances in confined or poorly ventilated enclosed spaces; and
- g. Perform record keeping duties as prescribed by the GFE.

2-10.3 GFE "IN TRAINING". Gas Free Engineers "In Training" (GFEITs) are in the process of obtaining the required education, experience and/or OJT toward certification as a GFE. Duties and responsibilities assigned to GFEITs shall be consistent with the level and degree of experience and training satisfactorily completed.

- a. For GFEITs working alone at naval maritime facilities, the scope of duties and responsibilities assigned shall be confirmed in writing by a GFE Certification Board member.
- b. The GFEIT shall obtain phonecon advice for any gas free actions outside the scope of duties and responsibilities confirmed per paragraph 2-10.3a above, and make note of the action as OJT accomplished.
- c. The GFEIT shall update the scope of duties and responsibilities and have them confirmed per paragraph 2-10.3a above as training and experience dictate.

2-10.4 LINE MANAGEMENT PERSONNEL. Line managers shall:

- a. Consult Maritime Confined Space Program personnel before beginning work in, on or adjacent to confined or poorly ventilated enclosed spaces;
- b. Ensure that all appropriate personnel under their control are indoctrinated regarding the hazards of confined spaces and poorly ventilated enclosed spaces;
- c. Monitor operations under their control to ensure that proper procedures are followed prior to beginning, during and following hot work in, on or adjacent to confined or poorly ventilated enclosed spaces;
- d. Monitor operations under their control to ensure that personnel do not work alone or unobserved while working with hazardous substances in confined or poorly ventilated enclosed spaces;
- e. Ensure that procedures are established for emergency rescue and medical treatment during operations under their control in confined or poorly ventilated enclosed spaces and that all appropriate personnel are familiar with such procedures; and
- f. Ensure that work is stopped and all personnel are removed from a space or location when a change that alters the safe conditions within the space is detected or suspected.

CHAPTER 3

MARITIME CONFINED SPACE PROGRAM PROCEDURES

3-1. INTRODUCTION

This chapter sets forth information and requirements for evaluation, testing, treatment, and certification of confined or poorly ventilated enclosed spaces or other dangerous atmospheres.

3-2. NEED FOR MARITIME CONFINED SPACE PROGRAM

Personnel entering or working in or on confined and poorly ventilated enclosed spaces or other dangerous atmospheres may encounter a number of potentially serious hazards. Such hazards may include:

- a. Lack of sufficient oxygen to support life;
- b. Excessive oxygen levels which increase the danger of fire or explosion;
- c. Presence of flammable or explosive atmospheres and materials; and
- d. Presence of toxic atmospheres and materials.

These hazards are not always readily apparent, detectable by odor or visually obvious, which may result in personnel entering confined spaces and poorly ventilated enclosed spaces without consideration of the potential dangers. Therefore, all confined and poorly ventilated enclosed spaces shall be considered to contain the most unfavorable and unsafe conditions, and entry into, or work in or on, such spaces is prohibited until the tests, evaluations and prescribed procedures of this manual have been performed by qualified Maritime Confined Space Program personnel to ensure that safe conditions exist and are maintained.

3-3. EVALUATION OF CONFINED OR POORLY VENTILATED ENCLOSED SPACE OR OTHER DANGEROUS ATMOSPHERE HAZARDS

Many factors must be evaluated prior to entry into, or work in or on, a confined or poorly ventilated enclosed space. Such evaluations should include, but are not necessarily limited to, the following considerations:

- a. The contents and any previous contents of the space which may result in the presence of flammables, toxic agents or oxygen depleted or enriched atmospheres;
- b. The location and configuration of the space including restricted access, obstructions, and remoteness, which may inhibit or interfere with movement, ventilation, rescue efforts or firefighting efforts;
- c. The types of operations that are conducted within the space, particularly those which, by the very nature of the process, produce toxic agents, flammables, oxygen depletion or enrichment or ignition sources;
- d. Fixtures, devices or equipment within the space which may create or contribute to hazardous conditions including piping systems, conduits, ducts, machinery and pressurized lines;
- e. The presence of other hazards such as slippery surfaces, deteriorated or unstable ladders and corrosive materials; and
- f. The boundary spaces and their contents to ensure that fire or explosion will not be caused in these spaces by the operation to be conducted.

3-4. CLASSIFICATION OF CONFINED OR POORLY VENTILATED ENCLOSED SPACES

Confined or poorly ventilated enclosed spaces include those with open tops, but with a depth or configuration sufficient to restrict the natural movement of air, and those which are normally closed with limited or restricted openings for entry and exit. Confined or enclosed spaces may also include non-shipboard areas such as mixers, dip tanks, sewage treatment facilities, pits, trenches, certain types of storage tanks, fuel tanks, collection, holding and transfer (CHT) tanks, silos, sewers, utility tunnels, boilers, condensers, voids, wing tanks and similar spaces. Confined or poorly ventilated enclosed spaces are classified based on existing or potential hazards.

3-4.1 CLASS I SPACE. A Class I Space contains atmospheres or conditions which are, or which may be reasonably expected to become, immediately dangerous to life or health (IDLH). Such conditions include the presence of flammable vapors at a concentration of 10% or greater of the lower explosive limit (LEL), oxygen content less than 19.5% or greater than 22%, the presence of toxic agents which exceed a level from which a person could escape within 30 minutes without impairing symptoms or irreversible health effects or any combination of these conditions.

3-4.2 CLASS II SPACE. A Class II Space contains atmospheres or conditions which are, or which may reasonably be expected to become, dangerous, but not immediately dangerous to life or health (IDLH). Such conditions include the presence of flammables, flammable atmospheres in concentrations at or greater than 1% but less than 10% of the lower explosive limit (LEL), oxygen content at or greater than 19.5% but at or less than 22%, the presence of toxic agents at concentrations below levels which are IDLH but at or above established Permissible Exposure Limits (PELs) or any combination of these conditions.

3-4.3 CLASS III SPACE. A Class III Space contains atmospheres or conditions which are, or which may reasonably be expected to become, contaminated, but not to a level which is dangerous or immediately dangerous to life or health (IDLH). Such conditions include the presence of flammables or flammable atmospheres in concentrations less than 1% of the lower explosive limit (LEL), oxygen content consistent with outside ambient conditions (between 20% and 21%), the presence of toxic agents at concentrations below established Permissible Exposure Limits (PELs) or any combination of such conditions. A Class III Space can easily degrade to a Class II Space. Therefore, close attention to the prescribed conditions for flammables, oxygen and toxic agents must be reliably and consistently maintained.

3-4.4 CLASS IV SPACE. A Class IV Space contains essentially no flammables or toxic agents, has an oxygen content consistent with outside ambient conditions (between 20% and 21%) and presents little potential for generation of hazardous conditions as described above in paragraphs [3-4.1](#), [3-4.2](#) and [3-4.3](#).

NOTE

The oxygen contents in air, expressed in Class I, II, III, and IV Spaces, are approximate percentages. It must be recognized that minor deviations may occur due to atmospheric pressure or instrument accuracy. The oxygen content of atmospheres in confined or **poorly ventilated** enclosed spaces should be as close as possible to that contained in the outside air.

NOTE

Oxygen shall not be added to a confined or **poorly ventilated** enclosed space to elevate the percentage of oxygen within the space. Ventilation should be used to achieve an oxygen level within the space that is consistent with that of the outside atmosphere.

3-5. ENTRY AND WORK RESTRICTIONS FOR CLASS I AND CLASS II SPACES

These restrictions apply to entry and work in or on Class I and Class II confined or poorly ventilated enclosed spaces.

3-5.1 CLASS I SPACES. Entry into and work in or on Class I Spaces shall not be permitted under normal operations and is authorized only under the following circumstances:

- a. Entry into Class I Spaces is authorized only in cases of rescue efforts, installation of ventilation and extreme emergencies. In the event of any such emergency entry or work, personnel entering the space shall be trained emergency response personnel equipped with an approved respirator for entry into IDLH atmospheres, and with other emergency and personal protective equipment suitable for the conditions and exposure. Emergency rescue personnel, equipped with equipment that may be necessary to effect a rescue, shall be stationed immediately outside the entry to the confined or poorly ventilated enclosed space. Communications shall be established and maintained between the person entering the space and attendant personnel outside the space. Where flammable or explosive vapors, gases or materials are present, only approved explosion-proof, spark-proof or intrinsically safe equipment shall be used and all other potential ignition sources shall be prohibited.
- b. Non-emergency personnel equipped with and briefed on the use of required equipment may enter with emergency personnel escort to perform tests or trade-cognizant actions necessary to render the space safe. These entries shall be undertaken only after initial hazard evaluation shows that personnel safety can be maintained and that the entry is necessary.
- c. Hot work may be performed on the external areas of a Class I Space from outside the space, provided that the work performed does not transfer heat or other ignition sources to internal areas that may cause ignition of atmospheres within the space. Controlled heat welding, using documented processes that control opposite surface temperature as low as possible and not to exceed 400°F (204°C) is considered satisfactory if approved by a Gas Free Engineer or Marine Chemist.
- d. Hot work may be performed on the external areas of a Class I Space when the atmosphere inside the space does not contain a flammable, explosive or oxygen enriched atmosphere. A Class I Space classification, in this case, would be based on oxygen depletion or the presence of toxic agents and would include spaces that are inerted, pressed-up or a combination thereof.

3-5.2 CLASS II SPACES.

- a. Flammables, toxic agents, or deviations of oxygen contents within a space may be due to the materials and conditions within the space. The cause or source of the contamination shall be identified and removed to the maximum degree possible by cleaning, ventilating, or other such treatments prior to entry or work.
- b. Where operations are conducted which introduce flammables, toxic agents or oxygen deviations within the space, such as spray finishing, welding, cutting and solvent cleaning, the following shall be observed:
 1. Where toxic or flammable materials are, or may be, introduced into the space, general, dilution and/or local exhaust ventilation, or combinations thereof, shall be provided in accordance with the requirements of [Chapter 4](#);
 2. Where toxic materials are, or may be, introduced into the space, personnel within the space shall be provided with approved respiratory protective equipment suitable for the exposure; and
 3. Where flammable gases or vapors are, or may be, introduced into the space, approved explosion-proof, spark-proof, or intrinsically safe equipment shall be used and all potential ignition sources shall be closely controlled.

3-6. GENERAL REQUIREMENTS FOR ENTRY AND WORK

All confined or poorly ventilated enclosed spaces shall be considered hazardous and entry into, or work in or on, such spaces is prohibited until they have been tested and found to be safe. Where the operation to be conducted in the space introduces, or has the potential to introduce, hazards into the space, actions must be taken consistent with the nature of the work to control the hazards and maintain safe conditions in the space throughout the duration of the operation.

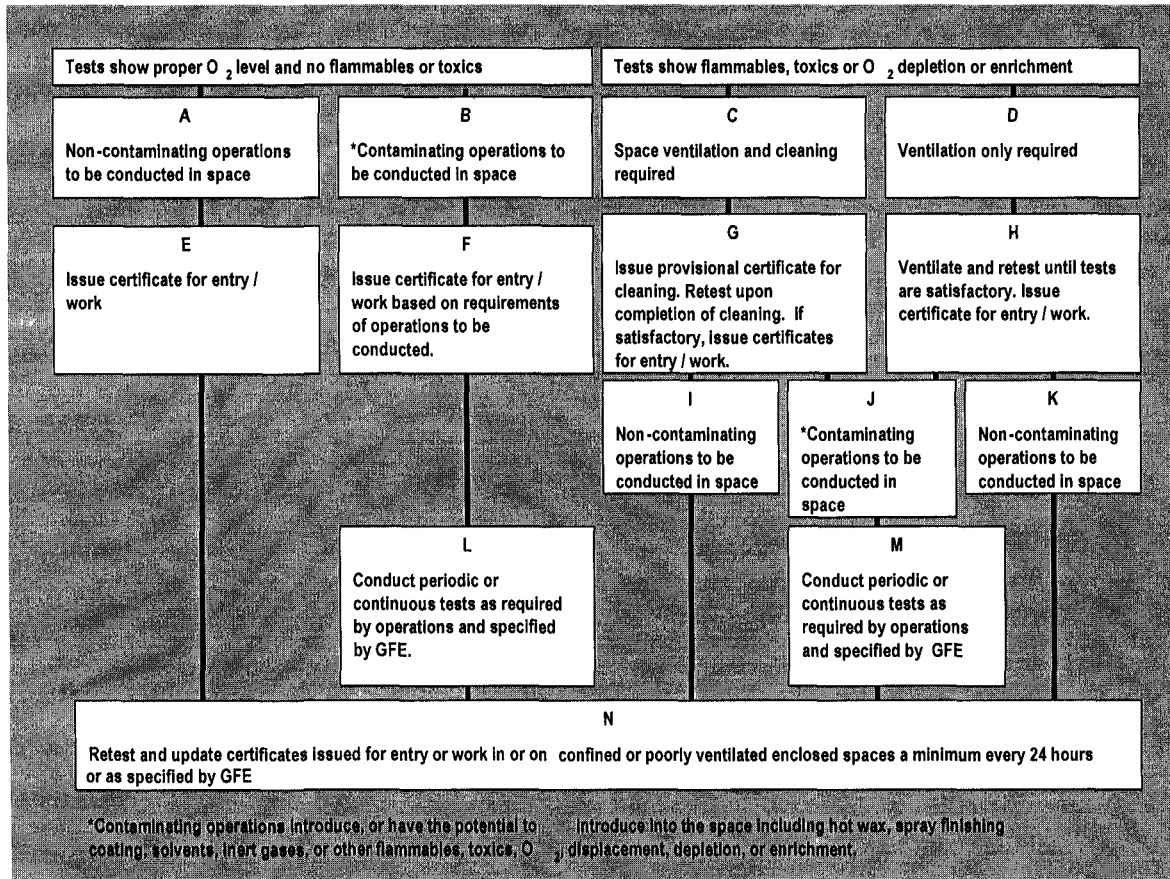


Figure 3-1 Confined and Poorly Ventilated Enclosed Space Testing Flow Chart

Figure 3-1 illustrates the general conditions that may be encountered on initial testing of confined and poorly ventilated enclosed spaces and those which may be caused by operations within the space that may introduce hazards into the space. It is emphasized that Figure 3-1 addresses only general conditions to illustrate basic confined space and poorly ventilated enclosed space testing and certification procedures and does not attempt to cover special requirements or considerations relating to items such as hot work, lockout, blanking-off, isolation and cleaning procedures. These areas are addressed separately elsewhere within this manual. Specific requirements for initial testing and certification, retesting and updating certificates are contained in paragraphs 3-8.4, 3-8.5 and 3-8.6. The following provisions relate to the conditions illustrated by Figure 3-1:

- a. Certificates issued for entry into or work in or on confined or poorly ventilated enclosed spaces shall be valid for 24 hours maximum, unless a Gas Free Engineer extends this standard time limit. A GFE may allow certificates to be issued with this standard time limit extended beyond 24 hours based upon his/her personal knowledge of the space, work operations, prevailing space conditions, and a personal inspection of the space

by either the Navy competent person or GFE, as appropriate. Spaces shall be continuously or periodically tested as necessary, and the certificate updated to maintain safe conditions within the space (Step N, Figure 3-1).

- b. When significant work interruptions occur and operations or conditions are such that, in the judgment of the Gas Free Engineer, a deterioration of safe conditions within the space could occur, the space shall be retested/ reinspected prior to re-entry or work in the space (Step N, Figure 3-1);
- c. When contaminating operations are to be conducted within the space, periodic or continuous testing shall be conducted in accordance with the nature of the operations as specified by the Gas Free Engineer (Steps L and M, Figure 3-1);
- d. When contaminating operations such as spray finishing, welding or solvent cleaning are to be conducted within a confined or poorly ventilated enclosed space, the certificate shall specify the requirements applicable to the operations, such as the provision of ventilation, personal protective equipment (PPE), respiratory protection, explosion-proof and non-sparking equipment or suitable fire protection equipment. Where such requirements are specifically covered by process instructions or standard operating procedures (SOPs), the certificate may reference the appropriate instruction or procedure (Steps B and J, Figure 3-1);
- e. When, upon initial testing, it is determined that ventilation is required to remove detected contaminants or to provide adequate oxygen content, the space shall be ventilated and retested, repeatedly if necessary, until test results are satisfactory before a certificate for entry or work is issued (Steps C and D, Figure 3-1);
- f. When, upon initial testing, it is determined that cleaning is required to remove contaminants from a space, a provisional certificate for cleaning shall be issued and shall specify any conditions which must be observed (Step G, Figure 3-1);
- g. When hazardous conditions are detected by periodic or continuous testing, retesting for certificate updating or any other means, all work shall be stopped immediately and personnel shall be removed from the space. The Gas Free Engineer and the appropriate job supervisor shall be immediately notified of the conditions. Entry and work shall not be resumed until all unsafe conditions have been corrected or controlled, and the space has been retested and recertified; and
- h. When personnel work in a confined or poorly ventilated enclosed space, someone outside the space shall perform frequent checks on them. Communications between personnel outside the space and personnel entering and working in a confined space or poorly ventilated enclosed space shall be established and maintained. The type of communication, such as voice, signal line, or electronic means, and the frequency of contact, such as continuous or periodic check, shall be determined by the Gas Free Engineer based on the nature of the space, operations, and degree of hazard. The frequency of the checks shall be established as often as necessary to ensure that the safety of the employees in the space is maintained.

3-7. TESTING PROCEDURES FOR CONFINED AND POORLY VENTILATED ENCLOSED SPACES

3-7.1 TESTING AND EXAMINATION. The testing and examination of a confined or poorly ventilated enclosed space will involve certain steps as a matter of established routine. The following provisions shall be incorporated into test and examination procedures:

- a. Initial testing shall be performed from outside the space. Testing into the interior of the space may be performed by drop tests or insertion of sample probes and hoses.
- b. Tests for oxygen content shall be conducted first using an approved oxygen meter. Oxygen content should be approximately 21% since the normal oxygen content of ambient air at sea level is 20.9%. Oxygen content less than 19.5% or greater than 22% represents a potentially dangerous situation.

- c. Tests for combustible vapors shall then be conducted with an approved combustible gas indicator. The Navy standard requires that combustible atmospheres be maintained below 10% of the lower explosive limit (LEL); however, due to the many variables involved with testing instruments and the frequent inability to obtain finite readings, any reading at all observed on the combustible gas test instrument should be considered as evidence of potentially unsafe conditions in the space. Hot work may only be performed if the source of the gases and/or vapors is determined and adequately controlled below 10% of the LEL.
- d. Tests for the presence of specific toxic agents depend upon the nature of the space and its contents or previous contents.
- e. When initial tests indicate the presence of hazardous concentrations of flammables, toxic agents, or deviations in oxygen content, personnel shall not enter the space. The space shall be ventilated and cleaned, as required, to remove flammable and toxic atmospheres and provide the proper oxygen content. If toxic agents, flammables or oxygen deviations are detected, the source/cause shall be determined and eliminated whenever possible or otherwise controlled at acceptable non-hazardous levels.
- f. When initial tests do not indicate the presence of hazardous concentrations of flammables, toxic agents, or deviations from normal oxygen content, the space shall be entered and tests identified in paragraphs [3-7.1b](#), [3-7.1c](#), and [3-7.1d](#) shall be performed progressively throughout the space. If these tests indicate the presence of hazardous concentrations of flammables, toxic agents or deviation from normal oxygen content, the tester shall exit the space and the space shall be ventilated.
- g. The space shall be inspected for the presence of flammable, combustible, or toxic residues, blisters, scale, rags, rope, wood, and other materials that may become dangerous upon the application of heat. Additionally, any specific structure, equipment, or location that contains flammable atmospheres at or above 10% of the lower explosive limit (LEL), or oxygen content below 19.5% or greater than 22%, should be tested and inspected.
- h. Where cleaning and ventilation fail to remove hazardous concentrations of toxic agents or flammables from a space, or where it is possible that such conditions may be encountered, such as with flammable or toxic vapors trapped in sludge blankets that may be released when the blanket is disturbed, and it is necessary for personnel to enter the space to conduct confined space and poorly ventilated enclosed space testing, inspections, or other evaluations, such entries shall be subject to the following restrictions:
 - 1. All entries into spaces that contain hazardous concentrations of toxic agents or flammables must be specifically authorized by the Gas Free Engineer.

NOTE

Piping systems containing Aqueous Film Forming Foam (AFFF) are likely to be contaminated with hydrogen sulfide in excess of the permissible exposure limit and possibly at IDLH levels. Salt water and the foam concentrate biodegrade, yielding hydrogen sulfide. Opening the system piping will contaminate the space.

- 2. Personnel entering spaces that contain hazardous concentrations of toxic agents or flammables shall be equipped with approved respiratory protection, safety clothing and equipment, and approved explosion-proof, non-sparking or intrinsically safe equipment as necessary. Personnel entering the space may be equipped with a harness and a lifeline. A reliable attendant, with an assistant, shall be stationed outside the space to render aid in the event of an emergency. Communications between the person in the space and attendant(s) outside the space shall be established and maintained.
- 3. Personnel shall not enter spaces that contain flammable atmospheres at or above 10% of the lower explosive limit (LEL), or toxic atmospheres that are IDLH, except as authorized in [paragraph 3-5.1a](#).

NOTE

Gasoline tanks, **collection, holding and transfer (CHT)** tanks, and similar spaces **that** contain, or previously contained, highly toxic materials or flammable materials, shall not be entered when combustible gas or toxicity tests indicate any presence of flammables or toxic agents, in this regard, the Gas Free Engineer must make a careful professional evaluation of all conditions prior to authorizing entry.

4. Personnel shall not enter a space having an oxygen content less than 19.5% or greater than 22%.

NOTE

Spaces with elevated or reduced pressure levels or regulated oxygen content, such as hyperbaric chambers, are excluded from coverage under the requirements of this manual. Such operations shall be conducted in accordance with appropriate governing regulations or documents such as the Navy Diving Manual.

3-7.2 PERIODIC AND CONTINUOUS TESTING. Many operations, due to the potential to generate hazardous conditions, require periodic or continuous monitoring as the work progresses to ensure that safe conditions are maintained. The frequency and types of testing to be conducted are dependent upon prevailing conditions and the nature of the operations. No single rule can be established for all operations and conditions. The Gas Free Engineer shall establish the frequency and type of tests for periodic or continuous monitoring. The following types of operations shall be carefully evaluated to determine the need for periodic or continuous monitoring:

- a. Hot work that has the potential of generating hazardous concentrations of toxic agents;
- b. Hot work in the presence of preservatives, seepage of flammables from seams or rivets, and similar operations;
- c. Application of preservatives, paints, epoxies, and similar operations, which may involve hazardous concentrations of toxic or flammable vapors;
- d. Cleaning operations, sludge removal, and similar operations, which may produce or cause release of hazardous concentrations of toxic or flammable vapors; and
- e. Any other similar operations that possess the potential for producing or releasing toxic, flammable, or asphyxiating atmospheres or materials into a space.

3-8. SPACE CERTIFICATION

Upon completion of testing, inspection, evaluation, space cleaning and ventilation, as appropriate, a Navy confined space certificate shall be issued. The Navy confined space certificate shall indicate the conditions found to exist at the time it was issued, any requirements necessary to maintain the conditions within the space and any requirements associated with the operations to be conducted within the space. Figures [3-2](#), [3-3](#), and [3-4](#) illustrate the three types of Navy confined space certificates that are to be used to indicate the category of certification that applies.

3-8.1 CERTIFICATE DISTRIBUTION. When Navy confined space certificates are issued, distribution shall be as follows:

- a. One copy shall be posted at the main entrance or most commonly used access to the space;
- b. One copy shall be posted at all other access areas that are open and readily accessible to personnel;
- c. One copy shall be retained for the Gas Free Engineer's files;
- d. One copy shall be provided to the department requesting the Maritime Confined Space Program service if requested; and
- e. Other copies shall be distributed as may be required by the administrative or operational requirements particular to the ship, unit, or activity.

3-8.2 CERTIFICATE CONTENT. Navy confined space certificates shall contain, at a minimum, the following information:

- a. Date, time, type, and results of tests for each space.
- b. Equipment identification (ID) number.
- c. Frequency and type of tests for periodic or continuous monitoring, if required.
- d. Date and time of certificate expiration.
- e. Date and time of retesting and update of certificate, as applicable.
- f. Name, signature, and an identification number of Maritime Confined Space Program personnel performing tests or retests.
- g. Name of ship, unit or activity.
- h. Location or identification of the space, compartment, or item inspected.
- i. Type of operation for which the certificate was requested, such as hot work or cleaning.
- j. Category of conditions found to exist from those listed below in paragraph 3-8.3.
- k. Requirements for special conditions or operations within the space not otherwise covered by local instructions and corresponding or special test results shall be noted under remarks.

3-8.3 CATEGORY OF CERTIFICATION. The following categories of certification, indicating the conditions found at the time tests were conducted, shall be noted on the Navy confined space certificate.

- a. "NO ENTRY—NO HOT WORK." This category shall be noted on the certificate (figure 3-2) when:
 1. There is danger of poisoning due to toxic materials, vapors or gases present, or likely to evolve under prevailing conditions, or danger of suffocation due to an oxygen deficiency (less than 19.5%);
 2. There is danger of fire or explosion due to the presence of flammables or explosive materials, vapors or gases, or oxygen enrichment present, or likely to evolve, under prevailing conditions;
 3. There is danger of fire, explosion, or toxic hazards in the presence of hot work due to the existence of flammable, explosive, toxic or reactive residues, vapors or gases, or oxygen enrichment; or
 4. There is a danger of fire, explosion, or toxic hazards in the presence of hot work, due to boundary spaces that have not been protected.
- b. "SAFE FOR ENTRY WITH PPE—NOT SAFE FOR HOT WORK." This category shall be noted on the certificate (Figure 3-3) when a limited/enter with restrictions certificate is required for cleaning and similar operations, including conditions as follows:

1. Toxic materials, vapors, or gases may be present or may evolve in the space, but at levels less than IDLH, and within the approved levels of prescribed respiratory protective devices and other personal protective equipment (PPE);
 2. Flammable vapors may be present or may evolve, but at levels less than 10% of the lower explosive limit (LEL), and where controls can be installed to maintain levels below that limit;
 3. There is danger of fire, explosion, or excessive toxic agent levels in the presence of hot work in the space or from boundary spaces that have not been protected;
 4. Hot work in boundary spaces to the space for which a limited/enter with restrictions certificate has been issued is prohibited; or
 5. Oxygen content is satisfactory (19.5% to 22%).
- c. "SAFE FOR ENTRY—NOT SAFE FOR HOT WORK." This category shall be used on the certificate (Figure 3-3) for a space when:
1. Toxic materials, vapors, or gases, if present, are below Permissible Exposure Limits (PELs), or are not likely to evolve in excess of the PELs and oxygen content is sufficient (19.5% to 22%) and suitable for personnel, or such conditions are adequately and consistently controlled by ventilation;
 2. There is danger of fire or explosion or excessive toxic agents in the presence of hot work due to flammable or explosive materials, vapors or gases; or
 3. There is danger of fire, explosion, or excessive toxic agents in the presence of hot work due to boundary spaces which have not been protected.
- d. "SAFE FOR ENTRY—SAFE FOR HOT WORK.". This category shall be used on the certificate (Figure 3-4) when:
1. Toxic materials, vapors, or gases are not present, or likely to be evolved, and oxygen content is sufficient and suitable for personnel, or such conditions are controlled by proper ventilation within established Permissible Exposure Limits (PELs);
 2. Flammable materials, vapors, or gases have been removed, are not likely to evolve, or are controlled by ventilation;
 3. Surrounding boundary spaces have been inspected and protected; and
 4. Combustible material in the area has been removed or otherwise protected to eliminate fire danger.
- e. "NO ENTRY—SAFE FOR PERSONNEL AND HOT WORK OUTSIDE, INERTED WITH __OR PRESSED-UP WITH WATER." This category shall be used on certificates (Figure 3-2) when:
1. An inerting medium has been introduced into the space in sufficient concentration to achieve a non-flammable atmosphere that will be maintained to ensure proper inert atmospheres;
 2. Oxygen content in the space will not support combustion or life; and
 3. Required measures have been taken to isolate the space and to maintain isolation until the inerting medium is removed.

3-8.4 INITIAL CERTIFICATION

- a. The Gas Free Engineer (GFE) shall initially certify spaces as follows:
 1. Entry into confined or poorly ventilated enclosed spaces that contain toxic materials above 50% of the Permissible Exposure Limit (PEL);
 2. Hot work within, on, or immediately adjacent (through heat transfer or spark/hot slag contact) to spaces or items that contain or have last contained combustible or flammable liquids or gases;

3. Hot work within, on, or immediately adjacent (through heat transfer or spark/hot slag contact) to fuel tanks that contain or have last contained fuel; and
 4. Hot work on pipelines, heating coils, pump fittings, or other accessories connected to spaces that contain or have last contained fuel.
- b. The Navy competent person may initially certify spaces as follows:
1. Entry into confined or poorly ventilated spaces that are known to contain toxic materials, but which do not cause the actual exposure of personnel to exceed 50% of the Permissible Exposure Limit (PEL). If initial test find levels that cannot be vented and maintained below 50% of the PEL, a GFE or Certified Industrial Hygienist (CIH) must test and determine if a SAFE FOR ENTRY certificate can be issued;
 2. Entry into fuel tanks that used to carry Navy fuels such as Navy Distillate, DFM, and JP-5 that have flash points of 105°F (40.6°C) and above; and
 3. Hot work within, on, or adjacent to spaces that do not require initial certification by the GFE.

3-8.5 CONTINUOUS OR PERIODIC TESTING AND MAINTAINING CERTIFICATES. Many factors may contribute to the deterioration of safe conditions within a confined or poorly ventilated enclosed space, including operations being conducted within the space, environmental conditions, and work interruptions. Operations that may create hazardous conditions include, but are not limited to, welding, cutting, burning, and spray finishing. Environmental conditions that may create hazardous conditions include, but are not limited to, increased temperatures in spaces resulting in accelerated vaporization, seepage or leakage, and presence of volatile solvents. During work interruptions, the presence of solvents, solvent soaked rags, welding or cutting torches, and secured ventilation may result in hazardous conditions.

Certificates for Class I Spaces shall require continuous testing and monitoring of conditions. The period of certificate validity for Class II, III, and IV Spaces and the requirements for testing and maintaining validity of the certificate shall be specified by the Gas Free Engineer. Periodic or continuous testing for maintaining the validity of the initial certificate shall be performed when, in the professional judgment of the GFE, the safe conditions within the space may deteriorate or the limitations of the certificate may be exceeded. The paramount consideration is the maintenance of safe conditions within the space during operations and after interruptions in operations. Therefore, testing, re-certifying conditions and updating of certificates may be required when work interruptions occur, such as breaks and lunch periods, which, in the judgment of the GFE, could result in deterioration of safe conditions within the space or result in the limitations of the certificate being exceeded. GFEs or Navy competent persons may perform retesting and updating of the certificates.

- a. Certificates for spaces shall be valid for a period of time determined by the GFE and may be maintained by continuous or periodic testing and visual inspection as provided in paragraph 3-8.5. Recertification time limits outlined below are recommended guidelines that shall be balanced against numerous variables, including work process, temperature, and other ambient conditions. The GFE will consider these guidelines and use professional judgment in designating time limits for re-testing spaces. At a minimum, the Navy competent person or the GFE, as appropriate, will evaluate the actual conditions within the space to validate conditions of the recertification.

NOTE

Space	Recommended Recertification Time Limits
Class I	Continuous testing and monitoring, as appropriate.
Class II	Every 12 hours.
Class III	Every 24 hours.
Class IV	Not considered hazardous; discretion of the Navy GFE.

3-8.6 TESTING AND RECERTIFYING SPACES. Work shall be stopped and the space retested in accordance with paragraphs 3-7 and 3-8 when:

- a. Conditions have deteriorated or events have occurred which result in a change in or degradation of conditions;
- b. Changes have occurred within the space, such as detecting hazards sufficient to warrant stopping operations and removing personnel or when new operations or materials have been introduced into the space which were not noted on the initial certificate; or
- c. The time limit of the certificate has expired.

<small>(FORM NAME)</small>		
<small>(FORMS CONTROL NUMBER)</small>		
<h1>CONFINED SPACE CERTIFICATE</h1> <h2>READ PRIOR TO WORK</h2> <p>This certificate indicates the condition that existed at the time tests were conducted. The hot work operator must inspect for the presence of visible dangerous conditions. No hot work is to be performed on boundaries, closed structures, or lines unless specifically designated on this certificate.</p>		
UNIT/ACTIVITY/SHIP	COMPARTMENT/SPACE	
<h1>DANGER</h1> <p>___ NO ENTRY -- NO HOT WORK</p> <p>___ NO ENTRY -- SAFE FOR PERSONNEL AND HOT WORK OUTSIDE</p> <p>___ INERTED WITH _____</p> <p>___ PRESSED UP WITH WATER</p>		
HOT WORK LOCATION:	RECERTIFICATION REQ'D:	
	DATE/TIME	
REMARKS:		
TEST DATA: _____ % Oxygen _____ % LEL		
Other (specify) _____		
EQUIP ID # _____		
INSPECTED BY	ID#	ISSUE DATE / TIME
_____ # of Accesses		

Figure 3-2 NO ENTRY—NO HOT WORK or NO ENTRY—SAFE FOR PERSONNEL AND HOT WORK OUTSIDE, INERTED WITH__OR PRESSED-UP WITH WATER Certificate (paragraphs 3-8.3.a, e).

FORMS CONTROL NUMBER

CONFINED SPACE CERTIFICATE

READ BEFORE EACH ENTRY

This certificate indicates the condition that existed at the time tests were conducted. Certificate becomes void if atmospheric or physical conditions change, space is closed, ship is moved, or solid cover is put over opening.

UNIT/ACTIVITY/SHIP

EXPIRATION DATE /
TIME

COMPARTMENT/SPACE

WORK PERMITTED:

_____ SAFE FOR ENTRY – NOT SAFE FOR HOT WORK

SPECIFIC WORK: _____

_____ SAFE FOR ENTRY WITH PPE -- NOT SAFE FOR
HOTWORK

SPECIFIC WORK: _____

REQUIREMENTS FOR WORK PERMITTED BY THIS CERTIFICATE:

___ Mechanical Ventilation ___ Respirator ___ Other _____

REMARKS

TEST DATA: _____ % Oxygen _____ % LEL

Other (specify) _____

EQUIP ID # _____

INSPECTED BY

ID #

ISSUE DATE / TIME

_____ # of Accesses

Figure 3-3 SAFE FOR ENTRY WITH PPE—NOT SAFE FOR HOT WORK or SAFE FOR ENTRY— NOT SAFE FOR HOT WORK Certificate (paragraphs 3-8.3.b, c).

(FORM NAME) (FORMS CONTROL NUMBER)		
<h1>CONFINE(D) SPACE CERTIFICATE</h1> <h2>FOR AND BEFORE ENTRY</h2> <p><i>(Faint, illegible text describing the purpose and scope of the certificate)</i></p>		
UNIT/ACTIVITY/SHIP	_____ _____	
COMPARTMENT/SPACE	_____ _____	
WORK PERMITTED: _____ SAFE FOR ENTRY -- SAFE FOR HOT WORK		
HOT WORK LOCATION: _____		
REQUIREMENTS FOR WORK PERMITTED BY THIS CERTIFICATE: _____ Mechanical Ventilation _____ Respirator _____ Firewatch Other _____		
REMARKS _____ _____ _____		
TEST DATA: _____ % Oxygen _____ % LEL Other (specify) _____ EQUIP ID # _____		
INSPECTED BY	ID #	ISSUE DATE / TIME
_____	_____	_____
		_____ # of Accesses

Figure 3-4 SAFE FOR ENTRY—SAFE FOR HOT WORK Certificate (paragraph 3-8.3.d).

3-9. EMERGENCY AND RESCUE PROCEDURES

Emergency and rescue procedures, in order to be most effective, must be planned consistent with the nature of the operations and the conditions within the confined or poorly ventilated enclosed space. Adequate consideration of emergency and rescue procedures must be made in the evaluation of confined or poorly ventilated enclosed space hazards (see paragraph 3-3). When personnel are entering and working in confined or poorly ventilated enclosed spaces, the GFE shall verify that emergency and rescue plans/procedures consider the following requirements:

- a. An emergency rescue control point shall be established at a location suitable to supply emergency rescue assistance within a reasonable period of time. The location must be clearly evaluated dependent upon the nature and conditions of the operation and the space. In some cases, such as in the case of emergency entries into the spaces which are IDLH, it may be necessary to locate the rescue control point immediately adjacent to the space. In other cases, a centrally located control point may serve a wide area involving multiple confined or poorly ventilated enclosed spaces. Fire and Medical Department response teams may also serve as rescue control points;
- b. Emergency rescue control points shall be manned with an adequate number of trained and qualified personnel to enable rescue of personnel from confined and poorly ventilated enclosed spaces. Rescue personnel must practice their skills at least annually. Practice drills shall include the use of mannequins and rescue equipment necessary for simulated rescue operations from confined and poorly ventilated enclosed spaces. If an actual rescue is performed during the 12-month period, an additional practice drill is not required;
- c. Rescue personnel entering a space to attempt rescue shall be equipped with a NIOSH or MSHA approved pressure-demand, self-contained breathing apparatus, harness and lifeline (where feasible) and any other personal protective equipment (PPE) applicable to the conditions;
- d. In all cases where conditions of entry and work in a confined or poorly ventilated enclosed space require the use of respiratory protective devices and lifelines (where feasible) with attendants as set forth in paragraphs 3-5.1a , 3-6h and 3-7.1h(2) , the attendants shall be equipped with a NIOSH or MSHA approved pressure demand, self-contained breathing apparatus and any other PPE applicable for the conditions;
- e. Attendant personnel shall be thoroughly instructed that no rescue attempt involving entry shall be made until the rescue control point has been notified and assistance has arrived. However, rescue efforts by means of the lifeline (where used) shall be made from outside the entry point until assistance arrives to allow entry;
- f. All personnel involved in confined or poorly ventilated enclosed space entry or work shall be instructed in the proper procedures to be followed during rescue efforts, including the location of the rescue control point and the means of notifying the control point in the event of an emergency; and
- g. Medical services and treatment shall be readily available for personnel overcome or injured in confined or poorly ventilated enclosed space incidents. Location of medical facilities and means of communication shall be incorporated into emergency and rescue plans.

3-10. INSTRUMENTATION

The Gas Free Engineer (GFE) shall ensure that necessary instrumentation and equipment consistent with the nature of operations and potential exposures are readily available in sufficient and properly maintained quantities to meet the minimum needs of the activity. At a minimum, instruments for conducting the following tests shall be available:

- a. Combustible atmospheres;

- b. Oxygen content;
- c. Toxic atmospheres—capability to test for known or potential exposures, such as carbon monoxide, carbon dioxide, and hydrogen sulfide; and
- d. Air flow—capability to test ventilation systems to ensure prescribed ventilation is being maintained.

3-10.1 APPROVED INSTRUMENTS. Where available, instruments that have been tested and approved by NIOSH or MSHA should be used for conducting confined space and poorly ventilated enclosed space testing. All equipment that may be used in a flammable atmosphere shall be approved as explosion-proof or intrinsically safe for the atmosphere by Underwriters Laboratories (UL), Factory Mutual (FM) or MSHA. Maritime Confined Space Program personnel shall be thoroughly trained in the operation of the instruments and shall consult and observe manufacturers' instructions and directions regarding the capability and limitations of the instruments. Instruments shall be used only for their designed purpose and within the limitations specified by the manufacturer.

3-10.2 LIMITATIONS OF INSTRUMENTS. Many instruments presently available for conducting confined space and poorly ventilated enclosed space testing have limitations that may affect the accuracy of the test results. Examples of such limitations include:

- a. Combustible gas indicators which function through a circuit imbalance created by the combustion of the sample inside the instrument will not function correctly in oxygen deficient or oxygen enriched atmospheres;
- b. Instruments that are not necessarily designed to function correctly or safely in all classes of hazardous atmospheres may be unsafe to use in some hazardous atmospheres. For example, a combustible gas indicator designed for use only in a Class I Division I Group D atmosphere may be unsafe to use in the presence of Group A or Group B atmospheres such as acetylene or hydrogen;
- c. Certain contaminants present in the atmosphere may interfere with the function of the instrument and directly affect the instrument's accuracy. Therefore, readings must be adjusted to correct for the presence of such materials. Other materials may "poison" the sensors or filaments of the instrument and produce false readings or instrument failure; and
- d. Changes in altitude or atmospheric pressure can affect the performance of certain instruments, requiring that the instruments be recalibrated under the existing conditions.

3-10.3 CALIBRATION AND MAINTENANCE. Instruments shall be field tested per manufacturer's instructions or tested against a known "gas" standard prior to each work shift in which the instruments are used. A record shall be maintained of all calibration and field test checks. Where instruments fail to respond or respond incorrectly to known calibration conditions, the instrument shall be removed from service.

3-11. PERSONAL PROTECTIVE EQUIPMENT (PPE)

Personnel entering or working in confined or poorly ventilated enclosed spaces shall be protected with, and required to use, personal protective equipment (PPE) appropriate to the operations and exposures in accordance with the requirements of OPNAVINST 5100.23 (Series). The Gas Free Engineer (GFE) shall insure that Maritime Confined Space Program personnel are trained in the use of personal protective equipment (PPE) and, when required, provided with and use the proper PPE.

3-11.1 RESPIRATORY PROTECTION. Only respiratory protective equipment that has been NIOSH or MSHA approved shall be used for confined space and poorly ventilated enclosed space operations. Such equipment shall

be used only for the purpose and exposures for which it was tested and approved. A seal of approval is placed on all approved equipment. A careful evaluation of all exposures or potential exposures must be made before proper respiratory protective devices can be determined. Such evaluations shall include, at a minimum:

- a. Types of contaminants present or likely to be present or generated, including dusts, mists, fumes, and vapors;
- b. Concentration of contaminants present;
- c. Appropriate permissible exposure limits (PELs) of the contaminants, including threshold limit values-time weighted average (TLV-TWA) and threshold limit values-ceiling (TLV-C);
- d. Current NIOSH IDLH values of contaminants; and
- e. Oxygen content in air present.

3-11.2 RESPIRATORY PROTECTION PROGRAM. The activity respiratory protection program shall incorporate Maritime Confined Space Program personnel and operations involving entry or work in or on confined or poorly ventilated enclosed spaces.

3-12. BREATHING AIR

Breathing air supplied to respiratory protective devices, such as self-contained breathing apparatus, hose mask, or supply line air mask shall, at a minimum, meet the requirements of the specifications for Grade D breathing air as described in OPNAVINST 5100.23 (Series). For more details, see also 29 CFR 1910.134 and the document "Compressed Gas Association Commodity Specification for Air" jointly published as Compressed Gas Association Pamphlet G7.1 and American National Standard, ANSI Z86.1 (latest edition).

3-13. SPACES WITH RESTRICTED ACCESS AND HAZARDOUS ATMOSPHERES

More than one means of access shall be provided to a confined or poorly ventilated enclosed space, which has a hazardous atmosphere, or in which a hazardous atmosphere may be generated, except where the structure or configuration of the space makes this impractical.

3-13.1 BLOCKED ACCESS. When a non-breakaway type ventilation duct blocks access to a confined or poorly ventilated enclosed space which can be served by multiple accesses, at least two alternative means of access shall be immediately available. Where breakaway ducting is used, the access is not considered to be blocked.

3-13.2 SINGLE ACCESS. When a confined or poorly ventilated enclosed space, due to its structure, arrangement, or configuration, can have only a single access and the ventilation duct blocks or partially blocks the access, only breakaway ducting will be used.

CHAPTER 4

VENTILATION

4-1. INTRODUCTION

Confined or poorly ventilated enclosed spaces sometimes contain atmospheres that are flammable, toxic, oxygen depleted, or oxygen enriched. Natural ventilation is generally insufficient to achieve an adequate interchange between the contaminated air inside the space and fresh air outside the space. This lack of air interchange is particularly true in confined spaces and poorly ventilated enclosed spaces that have limited access openings. Ventilation provided by air-moving devices provides an effective means of removing contaminated air from a confined or poorly ventilated enclosed space, introducing clean respirable air into a space, and controlling the level of hazards created by contaminants in the space or evolved from operations conducted within the space.

4-2. BASIC REQUIREMENTS

No single rule or set of rules can be established which will cover all ventilation requirements applicable to confined or poorly ventilated enclosed spaces. It must be recognized that the objective of ventilation in confined or poorly ventilated enclosed spaces is to:

- a. Remove flammable or toxic air from the space and maintain safe levels of concentration in terms of Permissible Exposure Limits (PELs) or Lower Explosive Limits (LELs), as appropriate;
- b. Provide fresh, respirable air in the space for breathing; and
- c. Capture and remove contaminants generated within the space, or dilute such contaminants to safe levels of concentrations in terms of PELs or LELs.

These objectives can be achieved only by a comprehensive evaluation of the requirements based on the space in question, the contents of the space and the operation to be conducted within the space. Ventilation requirements may be calculated based upon all aspects of the space and operations. Evaluation of ventilation must be based on measurements taken of the ventilation system and the atmosphere of the space to ensure that safe conditions are achieved and maintained. This chapter sets forth requirements and provides additional guidance in the application of ventilation in confined or poorly ventilated enclosed spaces.

4-3. VENTILATION PRIOR TO ENTRY OR WORK

Confined or poorly ventilated enclosed spaces shall be ventilated, prior to entry or work, to the degree necessary to reduce flammables and toxic agents to below acceptable levels, and to provide proper oxygen content within the space as required by [Chapter 3](#).

Ventilation requirements for entry into, and work in, confined or poorly ventilated enclosed spaces are dependent upon the nature of the space, its contents, and the operations to be conducted within the space. For purposes of the Maritime Confined Space Program, requirements will be considered for general ventilation, dilution ventilation, and local exhaust ventilation. Operations conducted within a confined or poorly ventilated enclosed space may require the application of a single type of ventilation, or may require the application of two types, such as general ventilation combined with a local exhaust ventilation system. These principles must be applied in terms of meeting the objectives as stated in paragraph 4-2 above.

4-3.1 GENERAL VENTILATION. General ventilation may be used in a confined or poorly ventilated enclosed space to provide uncontaminated respirable air for breathing. It may suffice to maintain concentrations of toxic and flammable atmospheres to acceptable levels where the source of such contaminants is small or evolution of

airborne contaminants is low. The level recommended for general ventilation needs to be based on the operations occurring at the time. In general, when personnel decide to use general ventilation, a list of these operations needs to be made and the amount of ventilation shall be determined by using appropriate references. Acceptable references are "Industrial Ventilation—A Manual of Recommended Practice" published by ACGIH (the American Conference of Industrial Hygienist) and "Ventilation for Acceptable Indoor Air Quality " ANSI ASHRAE Standard 62.1-2004.

4-3.2 DILUTION VENTILATION. Dilution ventilation consists of introducing uncontaminated air into a space in order to dilute the contaminated air within the space to an acceptable level. Dilution ventilation is provided by exhausting contaminated air from the space, usually from a point most remote from the access, thus drawing uncontaminated air in through the access. Dilution ventilation is not as effective as local exhaust ventilation in contaminant control, but may be required for certain types of operations, such as spray finishing, which cannot be effectively controlled with a local exhaust ventilation system. Dilution ventilation requirements may be calculated based on the generation rate of the contaminant, the specified level or percentage of LEL or PEL required to be achieved by dilution, and the applicable PEL or LEL of the contaminant involved. The provisions of "Industrial Ventilation" by the American Conference of Governmental Industrial Hygienists shall be used in determining dilution ventilation requirements for operations conducted within confined or poorly ventilated enclosed spaces.

4-4. VENTILATING FLAMMABLE ATMOSPHERES

Fans, blowers, motors and other such equipment used to ventilate atmospheres that contain flammable or explosive vapors, fumes, mists, dusts or similar atmospheres shall be approved explosion-proof equipment. Equipment shall be bonded and grounded as appropriate to control static electricity accumulation and discharge.

4-5. VENTILATION SYSTEM ARRANGEMENTS

Ventilation systems should be arranged to provide the best possible distribution of air throughout the space and to provide clean, respirable make-up air to replace contaminated air removed from the space.

4-5.1 AIR CIRCULATION. The location of exhaust duct inlets and make-up air inlets is extremely important to achieving proper air distribution throughout a confined or poorly ventilated enclosed space. Locating an exhaust fan in the top of a deep, single-opening confined space and poorly ventilated enclosed space, where make-up air enters the space through the same opening in which the fan is located, will accomplish very little. Short circuiting will occur with the fan exhausting most of the make-up air entering the space before it can circulate through the space. The distribution of air in this case can be greatly improved by extending the duct from the fan exhaust inlet to the bottom of the space. Air distribution and circulation can be vastly improved when make-up air and exhaust air move through separate openings in the space.

4-5.2 MAKE-UP AIR. Make-up air drawn into a space to replace contaminated air must be clean and contain sufficient oxygen content for respiration. Make-up air inlets should not be located near exhaust outlets since this may result in contaminated exhaust air being recirculated into the space. Where make-up air and exhaust air move through the same opening, ducting should be provided to carry exhaust air a sufficient distance away from the opening to prevent recirculation of contaminated air.

4-5.3 EXHAUST OUTLETS. Ventilation exhaust, which contains flammables or toxic agents, shall be vented to the outside atmosphere at a location that will accommodate dilution and dispersal of the contaminants. Exhaust outlets shall not be placed in locations that will allow exhaust air to contaminate adjacent spaces, accumulate or pocket in low areas or expose personnel to harmful or dangerous atmospheres. Exhaust air shall be discharged

outboard to the weather. Certain systems may require filtration of exhaust air prior to exhausting to the outside atmosphere. Such systems shall be fitted with the filtration or separation devices appropriate for the contaminant. Systems shall comply with all applicable state and federal environmental protection relations.

4-5.4 CONTAMINANTS LIGHTER OR HEAVIER THAN AIR. Contaminants that are lighter or heavier than air will tend to accumulate in the greatest concentration in the higher or lower areas, respectively, of a confined or enclosed space. Diffusion will occur over time dispersing the contamination throughout the space, however, the greatest and most dangerous concentrations will occur in the higher or lower locations of the space until dispersion has occurred. Hydrogen sulfide gas, which is heavier than air, is very soluble in water, as much as four volumes of gas to one of water. Thus, the highest concentration is just above the water. Increased temperatures from heated processes or natural causes will increase evaporation and convection rates and cause vapors and gases to diffuse and rise throughout the space. Ventilation arrangements and the placement of ventilation ducts should consider these characteristics. This will allow the ventilation system to capture and remove the contaminants at the point of greatest concentration and with the least amount of dispersal of the contaminants throughout the space.

4-5.5 BLOWING VERSUS DRAWING AIR. Air should not be blown into a space that contains flammable or toxic materials or hazardous atmospheres. Blowing air into a space will serve to agitate and evaporate the contaminants, dispersing them throughout the space. Blowing air into a space also results in an uncontrolled expulsion of hazardous atmospheres from the space through any and all openings that may be available. This may result in contamination of adjacent spaces and areas. Drawing air from the space may be less efficient from an air movement standpoint, but it produces a controlled capture and removal process. Air may be blown into a space only when no flammable or toxic materials are present or are being generated by the work process, and ventilation is required only to provide clean, respirable air for breathing and general comfort.

4-5.6 VENTILATION DUCTING. Ventilation ducting shall be supported to allow negative pressure exhaust ventilation. Non-combustible and self-extinguishing ducting should be used when ventilating for hot work. Pressurized plastic ducting shall not be used for the ventilation of toxic and/or flammable vapors (painting, tile setting, etc.).

4-6. VENTILATION REQUIREMENTS FOR SPECIFIC OPERATIONS

Ventilation requirements for certain operations are expressed within this section. However, it must be emphasized that these requirements serve only as guidance. Determination as to the effectiveness of ventilation in reducing and maintaining safe levels of flammables and toxic agents and the provision of proper breathing air can only be achieved through proper sampling of the atmosphere within the space. Compliance with specified ventilation requirements does not, in itself, ensure that no flammable or toxic hazards will exist due to the many variables that affect any given work situation. In many cases, it may be necessary to use ventilation in combination with approved respiratory protective devices. For example, dilution ventilation may be used to maintain flammable vapors at a concentration of less than 10% of the LEL. The ventilation provided may not be sufficient to dilute the contaminant to acceptable personnel exposure limits (PELs) due to the fact that much higher volumes of air are normally required to dilute to PEL values. In such a case, ventilation may be used to control flammable vapor concentrations and approved respiratory protective devices used to protect personnel from toxic agent exposures. Each work situation must be evaluated by qualified personnel to ensure that the ventilation provided is achieving the desired effect. Tests, measurements, samples, and evaluations shall be performed prior to initial entry by the Gas Free Engineer (GFE), Navy competent person, or Industrial Hygienist (IH) as appropriate to the nature of the operation and contaminants.

4-6.1 WELDING, CUTTING, BURNING, AND BRAZING. Ventilation requirements are as follows:

a. LOCAL EXHAUST VENTILATION.

1. Where welding, cutting, burning, brazing, or similar operations are conducted within confined or poorly ventilated enclosed spaces, local exhaust ventilation shall be provided, whenever possible, to capture and remove contaminants from the work space. The local exhaust system shall have an airflow sufficient to maintain a velocity in the direction of the exhaust inlet of 100 linear feet per minute (fpm) in the zone of operation when the exhaust inlet is at its most remote distance from the point of operation. It must be noted that capture velocities decrease drastically as the distance between the exhaust inlet and the point of operation increases. Flanged exhaust inlets are approximately 25% more efficient than unflanged inlets and should be used for local exhaust systems. Table 4-1 illustrates flow rates with duct sizes and calculated velocities at various distances from the exhaust inlet; it may be used as guidance in establishing local exhaust systems.
2. Exposure levels of toxic materials shall not exceed PEL levels. Personnel shall be equipped with approved respiratory protective devices appropriate for the exposure, except where industrial hygiene (IH) sampling tests and evaluations clearly establish that concentrations of contaminants within the workers breathing zones are within PEL levels. Process characterization data base information may be used to predict expected contaminant levels. Ventilation is required, even though respiratory protective devices are used, to provide a controlled means of capturing and removing toxic contaminants from the work space. This will avoid uncontrolled dispersal of toxic materials, possible contamination of adjacent spaces, and exposure to personnel not directly associated with the operation.
3. Where highly toxic metals or other materials are involved in the operation, greater airflows may be required to ensure proper capture of contaminants and to provide more dilution. Personnel shall always be equipped with approved respiratory protective devices when working with highly toxic materials since even slight interference with, or failure of, the ventilation system may result in significant personnel exposures. Such toxic metals and materials include, but are not limited to: beryllium; cadmium; cleaning and degreasing compounds; fluorine compounds; halogenated hydrocarbons; lead; mercury; stainless steels involving chemical flux, iron powder or gas-shielded arc; and zinc.

b. DILUTION VENTILATION.

1. Where local exhaust ventilation cannot be provided effectively due to the location, configuration, or nature of the space, or similar restrictive factors, dilution ventilation shall be provided. It must be recognized that dilution ventilation is seldom successfully applied to fume and dust control operations due to uneven rates of contaminant evolution, lack of accurate data of amount of contaminant generated and high volumes of dilution air required. Work in confined spaces and poorly ventilated enclosed spaces with poor air circulation and distribution or with workers immediately adjacent to the point of operation where contaminants are at their highest level of concentration further compounds the problems. Therefore, personnel shall be equipped with approved respiratory protective devices appropriate for the exposure, except where industrial hygiene (IH) sampling tests and evaluations clearly establish that concentrations of contaminants are consistently and reliably maintained within acceptable PEL levels. Process characterization data base information may be developed and used to predict expected contaminant levels. Dilution ventilation provides a means of diluting, collecting and removing contaminated air from the space in a controlled manner. Care shall be taken to ensure that adjacent areas and spaces are not contaminated and that exhaust discharges are filtered to remove the contaminant or are located in an area that will permit rapid dispersal in the outside atmosphere as appropriate.
2. Dilution ventilation flow rates shall be based upon the requirements of the Code of Federal Regulations, 29 CFR 1915 and the American Conference of Governmental Industrial Hygienists (ACGIH) Industrial Ventilation Manual as follows:
 - (a) One (1) air change every three (3) minutes, but not less than 2000 cfm per welder where 5/32" or 3/16" rod is used, 3500 cfm per welder where 1/4" rod is used or 4500 cfm per welder where 3/8" rod is used. Dilution airflows must be shown by test and evaluation to be adequate to consistently and reli-

ably maintain concentrations of contaminants in the workers breathing zones at or below acceptable Permissible Exposure Limits (PELs) or personnel shall be equipped with approved respiratory protective devices; and

- (b) Where highly toxic metals or materials are involved, procedures for local exhaust ventilation (paragraph 4-6.1.a) shall be followed.

Table 4-1 Exhaust Ventilation Flow Rates

Distance From Exhaust Inlet (Inches)	Duct Size (Inches)	Airflow (cfm)	Velocity Unflanged (fpm)	Velocity Flanged (fpm)
6	4	350	135	180
8	5	550	120	163
10	5	800	113	150
12	6	1200	118	157

Note

Values are based upon a minimum duct velocity of 4000 fpm.
Velocity values were calculated from the following formulas:

$$V = Q / (10X_2 + A)$$
 for unflanged openings

$$V = Q / [0.75(10X_2 + A)]$$
 for flanged openings
 where:

$$V = \text{velocity in feet per minute (fpm)}$$

$$Q = \text{airflow in cubic feet per minute (cfm)}$$

$$X = \text{distance from exhaust inlet in feet (1 ft = 12 in)}$$

$$A = \text{area of duct in square feet (sf)}$$

These formulas are not completely accurate for distances beyond 1 1/2 duct diameters away from the exhaust inlet. Losses in velocity that occur beyond 1 1/2 duct diameters away are not as severe. However, use of the formulas for the full distances shown allows for error and variance in the system installation and provides a degree of safety factor in achieving the required velocity of 100 feet per minute (fpm) in the zone of operation.

4-6.2 PAINTING, COATING, AND USE OF SOLVENTS. Paint and preservative coating removers, cleaning solvents, liquid vehicles for paints and preservative coatings and similar materials are toxic and flammable. Where operations involving such materials are conducted in confined or poorly ventilated enclosed spaces, standard, explosion-proof, or intrinsically safe (whichever is applicable in light of anticipated conditions) ventilation shall be used to control the hazards. Generally, contaminants generated from these types of operations are dispersed over a wide area rather than at a single point of generation. Multi-point, exhaust ventilation which dilutes the contaminants with incoming air as well as removing them is the most effective in controlling contaminants.

- a. DILUTION TO PERMISSIBLE EXPOSURE LIMITS (PELs). Where dilution ventilation is used to control toxic exposures, ventilation shall be designed to dilute contaminants to 25% or less of established PEL values. Due to the nature of ventilation problems in confined and poorly ventilated enclosed spaces as described in paragraph 4-6.1.b1 , personnel shall be equipped with approved respiratory protective devices, except where industrial hygiene (IH) sampling tests and evaluations clearly establish that concentrations of contaminants are consistently and reliably maintained within acceptable PELs.

WARNING

Certain operations such as venting reactors and battery charging operations may exceed PELs and LELs. Personnel will not occupy the affected spaces

Warning - precedes

during periods when concentrations are at or above 10% of the LEL or toxic concentrations are immediately dangerous to life or health (IDLH).

- b. DILUTION TO LOWER EXPLOSIVE LIMITS (LELs). Ventilation shall be provided to dilute contaminants to below 10% of the LEL of the materials involved. Personnel shall be equipped with appropriate approved respiratory protective equipment. Ventilation shall be continuous during operations and shall continue after operations until the space is free of contaminants. Final testing of the space shall be conducted after the ventilation system has been secured for at least 10 minutes. Frequent or continuous testing of the space shall be conducted during operations to ensure flammable atmospheres do not develop. When concentrations of flammable vapors reach or exceed 10% of the LEL, operations shall be stopped and personnel removed from the space. Operations shall not be resumed until ventilation deficiencies have been corrected. In this regard, it must be recognized that, in operations such as spray painting, flammable concentrations may exist at some point within the cone shaped space from the spray nozzle if the paint solvent has a flash point below ambient temperature. The existence of this flammable concentration within the spray cone is not cause to discontinue operations. The effect of dilution ventilation on the total atmosphere within the space must be determined. Where flammable concentrations are found to exist outside the spray cone, the dilution ventilation system must be considered deficient and the actions described above shall be taken.
- c. DILUTION VENTILATION FLOW RATES. Flow rates for dilution ventilation for maintaining specified PEL exposure levels or less than 10% of the lower explosive limits (LELs) shall be determined and calculated in accordance with the ACGIH Industrial Ventilation Manual.

4-6.3 ABRASIVE BLASTING. Contaminants produced by abrasive blasting in confined or poorly ventilated enclosed spaces cannot reasonably be controlled by ventilation. Personnel performing such operations shall be equipped with approved respiratory protective devices and other personal protective equipment (PPE) as prescribed by OPNAVINST 5100.23 (Series) requirements. Ventilation shall be provided with sufficient airflow to remove suspended dust particles from the atmosphere and, thereby, increase the visibility within the space. To achieve an acceptable level of visibility and reduction of dust concentration, a minimum of 80 cfm of air should be supplied per square foot (sf) of floor area of the space. Air velocity in exhaust ducts should be at least 4500 fpm to provide adequate transport of dust particles. Exhaust air shall be filtered or otherwise processed to remove contaminants as may be required by state or federal environmental protection requirements.

CHAPTER 5

HOT WORK

5-1. INTRODUCTION

The provisions of this chapter apply to all hot work performed in confined or poorly ventilated enclosed spaces and hot work performed on closed structures or containers such as pipes, ducts, tubes, jacketed vessels, and similar items.

5-2. HOT WORK OPERATIONS

Hot work, for the purpose of the Maritime Confined Space Program, includes all flame heating, welding, torch cutting, brazing, carbon arc gouging, or any work which produces heat, by any means, of 400°F (204°C) or more, and, in the presence of flammables or flammable atmospheres, other ignition sources such as spark or arc producing tools or equipment, static discharges, friction, impact, open flames or embers, and non-explosion-proof lights, fixtures, motors, or equipment. When, based on objective evidence (e.g., mock-up testing by the welding engineer, etc.), the temperature will not reach or exceed 400°F (204°C) on the opposite side, the requirements pertaining to hot work for the opposite side (e.g., 'Safe For Hot Work' certification, fire watch and insulation removal) can be waived by the Gas Free Engineer.

5-3. SPACE CLEANING AND VENTILATING

Prior to beginning hot work in a confined or poorly ventilated enclosed space, the space shall be tested, inspected, cleaned and ventilated as required by the provisions of this manual, and certified "Safe For Hot Work". Extraneous flammable or combustible materials such as scrap wood, paper, rope and rags, shall be removed from the space to a degree sufficient to eliminate any fire hazards. Combustible materials that cannot be removed shall be adequately protected. Local exhaust ventilation ducting for the hot work operation shall be of noncombustible construction and shall be free of hazardous levels of combustible residues.

5-4. BOUNDARY SPACES

Adjacent spaces (above, below, and on all sides) affected by the hot work being performed in a space shall be inspected and tested, cleaned, ventilated, or inerted as appropriate and certified 'Safe For Hot Work' prior to beginning hot work. The provisions of 29 CFR 1915 shall be observed in the treatment of boundary spaces.

5-5. FIRE PREVENTION

5-5.1 FIRE WATCH. When any riveting, welding, burning or other fire or spark producing operation is to be conducted in the presence of unprotected or unshielded combustible materials, coatings, or residues that may cause ignition, a fire watch shall be established at the worksite. All fire watch personnel shall be trained in the nature of any fires that might occur and in the proper use of the fire extinguishing equipment provided. Where hot work may create burn through or temperature increases in a wall, bulkhead, or other separating structure that may cause ignition of combustible material on the opposite side of the structure, a fire watch shall be established on the side opposite the worksite. A system of communication shall be established to permit the fire watch to convey the development of hazardous conditions on the opposite side of the structure.

5-5.2 FIRE EXTINGUISHING EQUIPMENT. Suitable fire extinguishing equipment shall be provided based upon the nature and extent of the flammable and combustibles present and the fires which may be expected to

occur. Vaporizing liquid extinguishers shall not be used in confined or poorly ventilated enclosed spaces. CO₂ extinguishers should be used only after careful evaluation of the exposure has ensured that discharge of CO₂ into the space is not likely to cause a hazard to personnel. Water extinguishers or water hoses equipped with variable pattern nozzles are most suitable for hot work in the presence of ordinary (Class A) combustible material, residues, or coatings. Fire extinguishing equipment shall be selected based on:

- a. The extinguishing agent's ability to suppress the fire;
- b. Any hazards which may be created by the discharge of the agent into the space; and
- c. The capacity of the equipment in relationship to the size and intensity of the anticipated fire.

5-6. HOT WORK IN THE WAY OF PRESERVATIVE COATINGS

5-6.1 FLAMMABLE/COMBUSTIBLE COATINGS. The flammability of coatings shall be determined prior to beginning hot work. Where flammability of the coating is unknown, tests shall be conducted to determine the flammability of the coating or worst-case conditions must be assumed to exist. Coatings known, or found by tests, to be highly flammable (i.e., scrapings burn with extreme rapidity) shall be removed from the location of the hot work for a distance sufficient to prevent ignition or outgassing (from temperature increase) of coating materials in the unstripped areas. The distance required for stripping of highly flammable coating materials will vary according to the material involved and the nature of the hot work, but in no case shall it be less than 4 inches on all sides from the outermost limits of the hot work. At a minimum, a 1-1/2 inch water hose with fog nozzle or fog applicator shall be provided in the immediate vicinity, charged and ready for instant use, except where prohibited by the nature of the space or ship, such as in submarines. Periodic or continuous testing shall be conducted upon beginning hot work to ensure that flammable atmospheres are not being produced. Where significant outgassing is detected, hot work shall be stopped and further stripping conducted, artificial cooling methods employed or other means applied to prevent temperature increases in the unstripped areas. Flame or uncontrolled heat shall not be used for stripping flammable/combustible coatings. Effort shall be made to prevent hot slag or sparks from falling onto flammable/combustible coatings in the area of the hot work. The wetting down of surrounding areas to reduce ignition potential may also be used to minimize ignition, consistent with the nature of the operation. Ventilation shall be provided in accordance with Chapter 4.

5-6.2 TOXIC COATINGS. Coatings which may release toxic vapors upon the application of heat shall be stripped from the area of the hot work. The distance required shall be sufficient to prevent temperature increases in the unstripped surfaces which would result in toxic vapor or fume release, but in no case shall it be less than 4 inches on all sides, from the outermost limits of the hot work. In the absence of sufficient stripping to protect against toxic vapor or fume release, personnel shall be equipped with approved respiratory protection. Ventilation shall be provided in accordance with Chapter 4 for the removal of toxic vapor or fumes from the space.

5-6.3 SOFT, GREASY, PRESERVATIVE COATINGS. Soft, greasy, protective coatings may present hazards more serious than those presented by hard surface coatings. Some soft coatings may have much lower flash points, produce outgassing at lower temperatures, or may ignite more easily from hot slag or sparks. Some materials may, under certain conditions, "surface flash", which would involve the coated area. Before hot work is performed in a confined or poorly ventilated enclosed space coated with soft, greasy preservatives, such materials shall be stripped, cleaned or otherwise removed from the area of hot work for a distance sufficient to prevent outgassing and to prevent ignition from heat, sparks or slag. The space shall be tested and certified, after the completion of cleaning, as "Safe For Hot Work" in accordance with Chapter 3.

5-7. HOT WORK IN THE PRESENCE OF SCALING

Blisters, scales and similar conditions inside tanks which have held flammable/combustible materials may, even after cleaning and ventilating, retain residues of flammable/combustible materials. Hot work in the presence of such conditions must be evaluated by a GFE to determine the proper procedures and control measures required for the operation. The following factors must be considered:

- a. Material last contained in the tank and previous cargoes that might alter the characteristics of existing residues;
- b. Flash point and auto ignition temperature of residues. Tests shall be conducted, where necessary, to determine this information;
- c. Extent (i.e., depth, porosity, and percent of surface covered) of scaling and blistering; and
- d. Possibility of a surface flash would involve the entire space.

Scale or blisters which contain highly flammable (flash point of 100°F (37.8°C) or less) such as gasoline and JP-4, shall be completely cleaned and removed from the space prior to beginning hot work. Scale or blisters containing combustible residues (flash point above 100°F (37.8°C)) such as fuel oil and JP-5, shall be cleaned away from the area of the hot work for a distance sufficient to prevent temperature increase in the uncleaned areas to a level which would produce flammable vapors. The area cleaned shall be a minimum of 4 inches on all sides from the outermost limit of the hot work. In all cases, the area cleaned must be sufficient to prevent outgassing from surrounding areas and to prevent ignition of residues. Areas below the hot work shall be cleaned or be protected by screens or other devices which will capture sparks and slag, or use similar protective measures. Water wet-down of areas around the area of hot work should be considered to reduce the vaporization of residues and reduce the possibility of small fires and flashes. Fire watches with suitable fire extinguishing equipment, capable of extinguishing any resulting fire, shall be provided in accordance with paragraph 5-5.1.

5-8. PIPES, TUBES, COILS

Pipes, tubes, coils or similar items which service or enter and exit a confined or poorly ventilated enclosed space shall be flushed, blown, purged or otherwise cleaned and certified safe for hot work prior to beginning hot work on such items. Where such items are not so treated and certified, hot work on them is prohibited and the certificate for the space shall contain a notation to that effect. Valves to pipes, tubes or similar items shall be closed and the pipes blanked off to prevent inadvertent discharge or backflow of materials into the space.

5-9. HOT WORK IN THE PRESENCE OF PRESSURIZED SYSTEMS

Prior to beginning hot work in areas containing pressurized systems (such as hydraulic systems and refrigeration systems) that could be affected by hot work, the systems shall be depressurized. Piping, fittings, valves, and other system components shall be protected from damage resulting from contact with flames, arcs, hot slag, or sparks. Care shall be taken to ensure that all contamination within the space, such as leaking hydraulic fluids, is cleaned and removed prior to beginning hot work. Hydraulic fluids and refrigerants in the presence of high temperatures can decompose and produce highly toxic byproducts.

5-10. GAS WELDING, CUTTING, AND BRAZING

5-10.1 COMPRESSED GAS CYLINDERS. Compressed gas cylinders shall be transported, handled and stored in accordance with OPNAVINST 5100.23 (Series). Compressed gas cylinders or gas manifolds used in welding and cutting operations shall not be taken into a confined or poorly ventilated enclosed space. Compressed gas

cylinders or gas manifolds shall be placed outside these spaces in well-ventilated areas (e.g., hanger bays) not subjected to any fire, explosion, or emergency that might occur within the space.

5-10.2 GAS WELDING AND CUTTING EQUIPMENT. Gas welding and cutting equipment such as hoses, connections and torches, shall be inspected, tested, operated and maintained in accordance with the Code of Federal Regulations 29 CFR 1915 and OPNAVINST 5100.23 (Series), as appropriate.

5-10.3 GAS SUPPLIES. Gas supplies shall be turned off at the cylinder or manifold outside the confined or poorly ventilated enclosed space when equipment is to be unattended or unused for periods of time, such as at breaks or lunch periods. At shift changes or overnight, gas supplies shall be turned off and torches and hoses removed from the confined or poorly ventilated enclosed space. Open-ended hoses shall be immediately removed from the space to open air when torches or other devices are removed from the hose.

5-11. ELECTRIC ARC PROCESSES

5-11.1 ELECTRIC ARC UNITS OR MACHINES. Electric arc units or machines shall not be taken into a confined space and poorly ventilated enclosed space. Such units shall be placed outside the space.

5-11.2 ELECTRIC ARC EQUIPMENT. Electric arc equipment shall be inspected, tested, operated, and maintained in accordance with the provisions of 29 CFR 1915 as appropriate.

5-11.3 ELECTRODE HOLDERS. When electrode holders are to be left unattended for a short period of time, such as at breaks or lunch periods, the electrodes shall be removed from the holders, holders placed in a safe location or protected and the power switch to the equipment opened. If unattended for periods of time, such as overnight, electrode holders shall be removed from the space and the power supply to the equipment disconnected.

5-12. INERT GAS PROCESSES

When using processes that involve the use of inert gases, measures shall be taken to ensure the confined or poorly ventilated enclosed space does not become oxygen deficient. Adequate ventilation shall be provided to remove inert gases discharged into the space during the operations and to maintain required oxygen levels. Hoses, connections, and fittings shall be inspected to ensure no leaks are present. Inert compressed gas sources shall be located outside the confined or poorly ventilated enclosed space and shall be turned off at the source when equipment is unused or unattended. If unattended for a period of time, such as overnight, the equipment shall be removed from the space or completely turned off and disconnected at the source.

5-13. HAZARDOUS BY-PRODUCTS

Welding or cutting operations that produce high levels of ultraviolet radiation shall not be conducted within 200 feet of unshielded chlorinated solvents.

5-14. HOT WORK ON CLOSED CONTAINERS OR STRUCTURES

Closed containers or hollow structures that have contained flammable substances shall be tested by the GFE before welding, cutting, or heating is undertaken on them. Before heat is applied to a closed container or hollow structure, a vent or opening shall be provided for the release of any built-up pressure during the application of heat. Before welding, cutting, heating, or brazing is begun on structural voids such as shield bays, rudders, skegs,

bilge keels, fair waters, masts, booms, support stanchions, pipe stanchions, or railings, the Navy competent person shall inspect the object and, if necessary, test it for the presence of flammable residues, liquids, or vapors. If flammable residues, liquids, or vapors are present, the object shall be made safe. Objects such as those listed above shall also be inspected to determine whether water or other non-flammable liquids are present, which, when heated, would build up excessive pressure. If such liquids are determined to be present, the object shall be vented, cooled, or otherwise made safe during the application of heat. Jacketed vessels shall be vented before and during welding, cutting, or heating operations in order to release any pressure which might build up during the application of heat.

5-15. EXPLOSIVES

Hot work in the area of magazines or other locations where explosives are present shall be conducted in accordance with the provisions of NAVSEA OP 4, "Ammunition and Explosives Safety Afloat," or NAVSEA OP 5, "Ammunition and Explosives Safety Ashore," as appropriate.

5-16. PAINTING

Most paints used on naval ships are both combustible and toxic. Hot work in the area of painting operations requires the enforcement of precautions to prevent fires and promote safety and health. In this regard, the provisions of 29 CFR 1915, Subpart C and the requirements of NSTM Chapter 631, "Preservation of Ships in Service," shall be applied as deemed appropriate by the GFE.

CHAPTER 6

SPACE CLEANING

6-1. INTRODUCTION

Cleaning is often required before hot work is approved in tanks and voids. Cleaning may disturb residues and sludges in cargo and sanitation tanks releasing toxic or flammable gases.

6-2. MARITIME CONFINED SPACE PROGRAM PERSONNEL RESPONSIBILITIES

Maritime Confined Space Program personnel are responsible for the following shipboard cleaning requirements:

- a. Testing, evaluation, and certification of the confined or poorly ventilated enclosed space;
- b. Recommending safety and health controls such as ventilation and personal protective equipment (PPE) before cleaning is started; and
- c. Ensuring that effective safe work practices are selected to clean the space.

6-3. CLEANING METHODS

There are many different methods and techniques that may be used to effectively clean a confined or poorly ventilated enclosed space. No single method can be prescribed which will meet the requirements of the various conditions that may be encountered. The method of cleaning selected is dependent upon the nature of the space to be cleaned and the material contained within the space. MIL-HDBK-291(SH), "Cargo Tank Cleaning," may be used as guidance for cleaning operations of shipboard fuel tanks.

6-4. STEAM CLEANING

Steam cleaning is the most effective method of cleaning tanks that have contained low flash point hydrocarbon fuels and solvents. Steam cleaning is effective in removing materials that have permeated seams, scale, blisters, concrete, etc. However, steam cleaning presents certain problems that must be given proper consideration:

- a. Temperatures of tank walls being steam cleaned should not be allowed to exceed 230°F (110°C). Excessive temperatures may cause buckling of walls, warping, or cracking of structures, and may also adversely affect flammable or combustible materials within boundary spaces.
- b. Tanks that contain liners or coatings may be adversely affected by steam. In such cases, cleaning methods other than steam shall be used. However, it should be recognized that it will be more difficult to thoroughly remove materials such as gasoline when a cleaning method other than steaming is used. Also, residual contamination of the space is more likely.
- c. Care must be taken to ensure that excessive pressure does not build up in the space being steam cleaned. Hatches and vent covers shall be opened to allow adequate venting during the steaming process. The steam pressure shall not exceed the tank operating pressure.
- d. Steam jets can produce static buildup and discharge and should not be used in spaces that contain concentrations of flammable vapors at or above 10% of the LEL.

6-5. GENERAL SAFETY PRECAUTIONS

Good safety and health practices must be observed for confined or poorly ventilated enclosed space cleaning operations. The following safety precautions apply:

- a. Personnel entering spaces to conduct confined and poorly ventilated enclosed space testing shall be provided with appropriate personal protective clothing and test equipment;
- b. Personal protective clothing and equipment shall be cleaned and maintained in good operating condition;
- c. Personnel exposed to contaminants during cleaning operations shall observe good hygiene practices;
- d. Flammable and toxic vapors and materials may be present in, or become trapped in, sludge. Tests of the space may show satisfactory conditions. However, when the sludge is disturbed, toxic or flammable vapors may be released. Maritime Confined Space Program personnel shall conduct testing as often as necessary to maintain safe conditions in the space during the cleaning operations. Contact with the sludge may expose personnel to toxic contaminants. Adequate precautions shall be observed when personnel enter spaces where sludge is present which may contain or may trap toxic or flammable materials; and
- e. General safety precautions for the control of other hazards, such as slip, trip or fall hazards, electrical hazards, low overheads, ladders, and unguarded openings shall be provided consistent with OPNAVINST 5100.23 (Series).

CHAPTER 7

INERTING, PRESSING-UP, AND STEAM BLANKETING

7-1. INTRODUCTION

This chapter sets forth the requirements for inerting, pressing-up, and steam blanketing. These techniques for achieving safe conditions within a space for the purpose of performing hot work on exterior boundaries are less desirable than cleaning a space as described in Chapter 6 and shall be used only where normal cleaning may not be practical.

7-2. RESTRICTIONS

Hot work may be permitted on the exterior boundary of a space that has been inerted, pressed-up, or steam blanketed in accordance with the requirements contained herein and subject to the following restrictions:

- a. Inerting, pressing-up, or steam blanketing shall not be used on spaces containing highly volatile materials including gasoline, aviation gas, JP-4, or similar materials which have a flash point of 100°F (37.8°C) or less;
- b. The thickness, condition, and integrity of the material upon which the hot work is to be performed has been tested, evaluated, and determined to be adequate in relation to the nature of the hot work to be performed to prevent burn through, rupture, or other structural failure. The tests, evaluations, and determinations shall be made in writing by persons competent in the area of concern such as a welding engineer;
- c. The space must be capable of being totally isolated from the other tanks or spaces including all interconnecting pipelines and common vents;
- d. The working area outside the space can be made, certified, and maintained "Safe for Entry" and "Safe for Hot Work";
- e. The displaced vapor-air mixture and inerting media (gas, liquid, or steam-vapor mixtures) can be disposed of safely;
- f. Prior to inerting or pressing-up spaces such as fuel tanks, the tanks shall be leak-tested in accordance with established air test schedules or by other similar tests to ensure that no unidentified gas path exists; and
- g. Spaces that contain both liquid and free air space must meet the requirements for either gas inerting (7-3) or pressing-up (7-4) depending on the location of the hot work.

7-3. GAS INERTING

The atmosphere in a confined or poorly ventilated enclosed space may be rendered inert by introducing inert or non-flammable gas into the space in quantities sufficient to displace the oxygen-vapor mixture of the space and reduce the oxygen content to a level that will not support combustion. It should be noted that the oxygen content that will support combustion varies with the contaminant present and the inerting media. Therefore, to compensate for any mixtures of materials or unknown materials which may be present, as well as uneven diffusion and dispersal of inerting gases, oxygen levels shall be reduced to a level at or below 6% or 50% of the amount required to support combustion, whichever is less, in order to consider the space properly inerted.

7-3.1 LIQUID LEVELS. Liquid levels of the space to be inerted must be at a level that will allow free distribution of the inerting gas to all portions of the space above the liquid. A minimum of 12 inches of space must

be present between the top of the liquid and the lowest edges of any structural members or baffles that impede the distribution of inerting gas. Liquid levels shall be adjusted as necessary to provide adequate space for distribution of the inerting gas.

7-3.2 GENERAL PROCEDURES FOR GAS INERTING. The following general procedures for inerting should be used when inerting a space with a gas inerting medium:

- a. Ensure that all conditions as stated in paragraphs 7-2 and 7-3.1 above have been met;
- b. Isolate the tank, including all interconnecting vents and pipes;
- c. Calculate the volume of free air/vapor space above the liquid. From this volume, determine the amount of inerting gas required for the initial injection of gas into the space. To allow for uneven distribution and diffusion, the initial gas injection should equal 100% of the free space of the tank. Compressed gases may be converted from pounds (lbs) to cubic feet (cf) for purposes of this calculation: 1 lb carbon dioxide = 8.75 cf; and 1 lb nitrogen = 13.75 cf. Similar values for other inerting gases may be obtained from publications of the Compressed Gas Association. Where bulk, non-compressed gas is used, a flow meter may be used to determine the quantity of gas injected into the space;
- d. Install the necessary fittings for injection of the inerting gas and venting of vapor-air mixtures. Gases heavier than air should have the inerting gas inlet at the bottom of the head space to be inerted (within 6 inches of the liquid level) and the outlet vent at the top of the head space. For inerting gases lighter than air, the inlet and outlet locations should be reversed. The inlet and outlet should be spaced as far apart as possible;
- e. Conduct the initial injection of inerting gas. Tests for oxygen content shall be conducted at the vent. Injection should continue until a reading at the vent is at or below 6% or 50% of the amount required to support combustion, whichever is less. Care shall be taken to ensure that the pressure rating of the space is not exceeded. Pressure for inerting should not exceed 1 pound per square inch (psi). Pressure on the space shall be continuously monitored during the course of the hot work. If pressure shows any significant rise, work shall be stopped and the cause of the pressure rise determined and corrected before hot work resumes;
- f. When, due to the nature of the space, a positive pressure cannot be applied and maintained, a continuous flow of inerting gas through the space shall be maintained. Periodic tests shall be conducted at the vent to ensure inert conditions are maintained; and
- g. Upon completion of the hot work, sufficient time shall be allowed for all surfaces affected to cool to normal temperatures. The inerting medium shall then be ventilated from the space to the outside atmosphere.

7-3.3 VENTING GASES. Gases vented from the space during the inerting process and inerting media and gases vented from the space upon completion of the work shall be vented to the outside atmosphere. Where tank vents do not vent to the outside, fittings and vent hose shall be attached to the vent as necessary to provide venting to the outside atmosphere. When atmospheric conditions are such that exhausted gases are not quickly dissipated, an explosion-proof blower shall be used to ensure vented gases are adequately dispersed. Care shall be exercised to ensure that vented gases do not drift into other spaces, compartments, or low areas. Ensure that safe conditions are maintained during the venting procedures.

7-3.4 USE OF COMPRESSED CARBON DIOXIDE. When compressed carbon dioxide is introduced into a space as an inerting medium, rapid discharge of the carbon dioxide can result in freezing, which creates excessive turbulence and uneven distribution of the gas. Further, particles that can generate and discharge static electricity and produce ignition of a flammable atmosphere may be created. Where carbon dioxide is used as an inerting medium, the following conditions shall be observed:

- a. Bulk, non-compressed, low-pressure carbon dioxide shall be used wherever possible;
- b. Where compressed, high pressure carbon dioxide is used, it shall be introduced into the space through an expansion manifold or receiver; and
- c. Flow rate shall be closely controlled to prevent rapid discharge that could result in freezing.

7-4. PRESSING-UP

Pressing-up is a means of eliminating flammable vapor-air mixtures from a space by filling the space with a liquid. Pressing-up should be accomplished only as a last resort, since it may be a hazardous operation even under the best of conditions.

7-4.1 RESTRICTIONS. In addition to the requirements of paragraph 7-2, the following restrictions shall be observed for pressing-up operations:

- a. Flammable liquids shall be pumped, to the maximum degree possible, from the tank or space to be pressed up;
- b. The tank or space shall be pressed-up with water only;
- c. Hot work shall be restricted to an area at least 36 inches below the water level. No hot work shall be permitted on the tank top or in areas above the water level where residual fuels might be present. It must be noted that residual fuels retained in the tank below the lowest point of the suction line will in most cases, rise to the top of the water used to press-up. The depth and extent of any residual fuels on top of the water must be determined in order to effectively restrict hot work to areas 36 inches below the water level. Where such residuals are excessive, it may be necessary to pump them out and continue pressing-up with water until the residuals on top of the water are eliminated; and
- d. Care shall be taken to ensure that the strength capacity of the tank/space is not exceeded.

7-5. STEAM BLANKETING

Steam blanketing is a method of making a space "Safe For Hot Work" on the outer boundaries by using steam to displace and carry off flammable vapor-air mixtures within a space. Steam blanketing is an alternative when either cleaning the space, as described in Chapter 6, or gas inerting, as described in paragraph 7-3, is not practical. Steam blanketing can be effectively used for closed items, such as rudders and skegs, which may contain flammable rust inhibitors or coatings.

7-5.1 REQUIREMENTS. The following requirements apply to steam blanketing operations:

- a. The restrictions specified in paragraph 7-2 must be met;
- b. All surrounding compartments and spaces must be examined and a determination made that a rise in temperature from the steaming operations will not cause damage to the surrounding compartments or their contents;
- c. All liquid in the space shall be removed;
- d. The steam inlet should be located at the top of the space and the outlet within 6 inches of the bottom of the space, since steam is lighter than air;
- e. A steam pressure gauge shall be installed near the steam outlet. Pressure within the space shall be continuously monitored throughout the entire steam blanketing process. Should pressure within the space rise above 1 psig, the cause for the pressure rise should be determined and corrected before steaming is continued;

- f. The steam should be introduced well in advance of hot work operations (approximately 3 hours) and remain on throughout the entire operation. Tests shall be conducted at the outlet to ensure no flammable vapor-air mixtures are present prior to beginning hot work;
- g. The steam shall be visible during the course of operations. If the steam becomes too dry to be visible, water shall be injected into the steam inlet line until the steam is again visible. Hot work shall not proceed until the cause for the lack of visible vapor in the steam outlet has been determined and corrected; and
- h. Temperatures of space walls and boundaries shall be monitored. Tank or space boundaries shall not be heated in excess of 230°F (110°C) without the approval of cognizant authority.

APPENDIX A

DEFINITIONS

ADJACENT SPACES

Those spaces bordering a subject space in all directions, including all points of contact, corners, diagonals, decks, tank tops, and bulkheads.

AFLOAT GAS FREE ENGINEER

Uniformed service members designated as either a "Shipboard (Surface Afloat) Gas Free Engineer", or a "Submarine (Subsurface) Afloat Gas Free Engineer" in accordance with S9086-CH-STM-030/CH-074V3 (Series).

AMBIENT

The surrounding area on all sides of a particular location. Normal ambient pressure or atmosphere refers to the normal conditions for a particular location outside a confined or poorly ventilated enclosed space.

APPROVED (FOR THE PURPOSE)

Equipment or materials which have been tested, evaluated and determined to be acceptable by a recognized testing laboratory or inspection agency according to the requirements of a particular code or specification and the requirements of a specific purpose, environment or application. For example, Underwriters Laboratory (UL) tests and labels electrical equipment for use in hazardous locations and the National Institute for Occupational Safety and Health (NIOSH) and the Mine Safety and Health Administration (MSHA) test and approve respiratory protective equipment for various types of exposures.

ATMOSPHERE

A gaseous mass enveloping a particular location or contained within a confined or poorly ventilated enclosed space.

ATMOSPHERIC CONTAMINANT

A substance or material contained in the atmosphere which is foreign to the normal composition of the atmosphere, usually occurring in the form of a dust, fume, vapor, gas or mist.

AUTO-IGNITION TEMPERATURE (POINT)

The minimum temperature required to initiate self-sustained combustion independent of external ignition sources or heat.

BOUNDARY (ADJACENT) SPACES

Those spaces in all directions from the subject space including all points of contact, corners, diagonals, docks, tank tops and bulkheads.

COLD WORK

Any construction, alteration, repair or shipbreaking that does not involve fire or spark-producing operations.

COMBUSTIBLE LIQUIDS

Any liquid having a flash point at or above 100°F (37.8°C). This includes any mixture having components with flash points of 100°F (37.8°C) or higher which make up a total of 99% or more of the total volume of the mixture.

COMMANDING OFFICER

Any Naval Shipyard Commander, Commanding Officer or Officer-in-Charge of a naval maritime facility.

CONFINED SPACE

A space which, by design, has limited or restricted openings for entry and exit, lacks natural ventilation, contains or produces hazardous contaminants or has an oxygen deficiency or enrichment. Confined spaces and poorly ventilated enclosed spaces are not intended for normal continuous personnel occupancy. This includes spaces such as tanks, voids, cofferdams and double bottoms.

CONTAMINANT

A material or agent which is foreign to a specified or desired condition or circumstance.

CONTAMINATING OPERATIONS

Operations which introduce, or have the potential to introduce, hazards into the space, including, but not limited to, hot work, spray finishing, coatings, solvents, inert gases or other flammables, toxic agents, and oxygen displacement, depletion or enrichment.

CONTINUOUS TESTING

The conducting of tests throughout the course of an operation with not more than 15 minutes between tests.

DIFFUSION

A process of equalization or the process by which particles of liquids, gases or solid intermingle when introduced one into another.

ENCLOSED SPACE

A space, which by its nature or design, is of such a shape, depth or other feature that natural ventilation or the natural movement of air is restricted. Such spaces include open top storage tanks, degreasers, dip tanks, pits and trenches.

NOTE

Hangar decks and well decks are not normally considered enclosed spaces.

EXPLOSIVE LIMITS

The range of concentration of a material, expressed in percent in air, which will explode if ignited. Limiting concentrations are termed the Lower Explosive Limit (LEL) and the Upper Explosive Limit (UEL). Concentrations below the LEL are too "lean" to react, while concentrations above the UEL are too "rich" to react.

EXPLOSION-PROOF

An apparatus, device or piece of equipment that is tested and approved for use in hazardous atmospheres (flammable or explosive) as defined in the National Electrical Code (NEC).

FLAMMABLE LIMITS

The range of concentration of a material, expressed in percent in air, which will burn if ignited. Limiting concentrations are termed the Lower Flammable Limit (LFL) and the Upper Flammable Limit (UFL). Concentrations below the LFL are too "lean" to burn, while concentrations above the UFL are too "rich" to burn.

FLAMMABLE LIQUIDS

Any liquid having a flash point below 100°F (37.8°C). Any mixture having components with flash points of 100°F (37.8°C) or higher which make up a total of 99% or more of the total volume of the mixture is considered to be a combustible liquid.

FLASH POINT

The lowest temperature at which a sufficient amount of vapor is given off to form an ignitable mixture.

GAS FREE ENGINEER (GFE)

The holder of a valid certificate issued by the Navy GFE Certification Board in accordance with the requirements of SECNAVINST 5100.16 (Series) establishing the holder as a person qualified to ensure that confined and poorly ventilated enclosed space operations incident to construction, overhaul, repair, lay-up, or shipbreaking of naval vessels are undertaken with safety.

HAZARDOUS ATMOSPHERE

An atmosphere which, by reason of being explosive, flammable, toxic, oxidizing, irritant, corrosive or otherwise harmful, is capable of causing serious injury, death or property damage.

HAZARDOUS SUBSTANCE

A substance which, by reason of being explosive, flammable, toxic, oxidizing, irritant, corrosive or otherwise harmful, is capable of causing serious injury, death or property damage.

HOT WORK

For the purpose of Maritime Confined Space Program, the term hot work includes all flameheating, welding, torch cutting, brazing, carbon arc gouging and any work which produces heat, by any means, of 400°F (204°C) or more, and, in the presence of flammables or flammable atmospheres, other ignition sources such as spark or arc producing tools or equipment, static discharges, friction, impact, open flames or embers, non-explosion-proof lights, fixtures, motors or equipment.

IMMEDIATELY DANGEROUS TO LIFE OR HEALTH (IDLH)

Atmospheres or conditions that may reasonably be expected to become "immediately dangerous to life or health" due to the presence of flammable or explosive vapors at, or in excess of, 10% of the LEL, oxygen content less than 19.5% or greater than 22%, toxic agents which exceed a level from which a person could escape within 30 minutes without impairing symptoms or irreversible health effects or any combination thereof.

INCIDENT

An reportable mishap in accordance with OPNAVINST 5102.1 (Series) and OPNAVINST 5100.23 (Series), Chapter 14, occurring in any Maritime Confined Space Program process covered by the requirements of this manual. This includes any fatality, injury, or material (property) damage related to the Maritime Confined Space Program.

INERTING

A process whereby an inert or non-flammable gas is introduced into an atmosphere to such a degree that the flammable vapor-oxygen content of the atmosphere is reduced to a level which will not burn or explode.

INITIAL CERTIFICATION

The certificate issued by Maritime Confined Space Program personnel as a result of initial testing.

INITIAL TESTING

Testing conducted on a confined or poorly ventilated enclosed space when the space is first opened after a period of closure or service. This includes the first tests conducted upon a fuel tank that has been in-service and must be taken out-of-service for repair.

INTRINSICALLY SAFE

An item or piece of equipment which, by design, does not have, or is not capable of, producing sufficient levels of energy to cause ignition. MSHA Mine Safety and Health Administration.

MARITIME OPERATIONS

Work that involves shipbuilding, ship repair, shipbreaking and related employment. Related employment means any employment performed as an incident to or in conjunction with ship repairing, shipbuilding or ship-breaking work, including, but not restricted to, inspection, testing, and employment as a watchman.

NAVAL MARITIME FACILITIES

Those facilities where maritime operations are performed on or in naval vessels or vessel sections. Vessels include all naval ships, watercraft, barges, floating cranes, derricks, and floating dry docks. Naval maritime facilities include naval shipyards, ship repair facilities (SRFs), TRIDENT refit facilities (TRFs), regional maintenance centers (RMCs), regional repair centers (RRCs), and other Navy commands whose primary mission involves maritime operations (as defined in this Appendix).

NAVY COMPETENT PERSON

An individual, qualified in accordance with paragraph 2-4 .

PERIODIC TESTING

Testing conducted during the course of an operation at intervals greater than 15 minutes.

OCCUPATIONAL EXPOSURE LIMIT (OEL)

Chemical contaminants that include:

1989 OSHA permissible exposure limits (PELs) found in 29 CFR 1915.1000 Tables Z.-1, Z-2 and Z-3

Substance specific regulations issued by OSHA under section 6(b) of the Occupational Safety and Health Act of 1970

Navy developed standards. Where there is no OSHA PEL or Navy developed standard, the American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit value (TLV) shall be used as the Navy OEL. When the OEL is based on a limit derived from the OSHA Z-1, Z-2. or Z-3 Tables, reports of data shall include the ACGIH TLV as additional guidance.

PERMISSIBLE EXPOSURE LIMIT (PEL)

As defined in OPNAVINST 5100.23 (Series), the maximum permissible concentration of a toxic chemical or exposure level of a harmful physical agent (normally averaged over an 8-hour period) to which an employee may be exposed.

POORLY VENTILATED ENCLOSED SPACE

An enclosed space which because of a lack of air exchange/filtration and/or the introduction or presence of toxic, flammable or combustible materials can easily be or become hazardous to personnel entering or working in the space.

PRESSING-UP

The process of filling a space with a liquid to exclude flammable vapor-air mixture from the space.

RETESTING/RECERTIFYING

The process of retesting, re-evaluating and recertifying a confined or poorly ventilated enclosed space under the same procedure required for initial testing and certification when the duration of the certificate expires or conditions occur that alter the initial conditions found and/or conditions specified.

SHIPBOARD (SURFACE AFLOAT) GAS FREE ENGINEER

A uniformed service member (Chief Petty or above), designated in writing that has satisfactorily completed the formal gas free engineering (afloat) training course specified in S9086-CH-STM-030/CH-074V3 (Series).

SUBMARINE (SUBSURFACE AFLOAT) GAS FREE ENGINEER

A uniformed service member (Medical Department Representative), designated in writing that has satisfactorily completed the formal Naval Undersea Medical Institute (NUMI) Nuclear Submarine Medical Course specified in S9086-CH-STM-030/CH-074V3 (Series).

THRESHOLD LIMIT VALUE-CEILING (TLV-C)

The concentration of a substance above which personnel should not be exposed, even instantaneously, as established by the American Conference of Governmental Industrial Hygienists (ACGIH).

THRESHOLD LIMIT VALUE-TIME WEIGHTED AVERAGE (TLV-TWA)

A value established by the American Conference of Governmental Industrial Hygienists (ACGIH) expressed in parts per million (ppm) or milligrams per cubic meter (mg/m³) to which nearly all workers may be exposed, on a time weighted average (TWA) basis, for a normal 8-hour workday and 40-hour workweek without adverse effect.

TOXICITY

A relative property of a material or substance referring to a harmful effect on some biological mechanism and the conditions under which this effect occurs.

TOXIC SUBSTANCE

A material or substance capable of producing a harmful effect on some biological mechanism.

UPDATING OR MAINTAINING CERTIFICATES

The process of conducting tests, inspections and/or evaluations of conditions within a confined or poorly ventilated enclosed space and certifying that conditions found have not changed significantly and are acceptable under the provisions specified by the initial certificate.

APPENDIX B**REFERENCE DOCUMENTS**

1. "Gas Free Engineering (Afloat)," Naval Ships Technical Manual (NSTM) Chapter 074, Volume 3.
2. "Navy Safety and Occupational-Health Manual," OPNAVINST 5100.23 (Series).
3. "Industrial Ventilation." American Conference of Governmental Industrial Hygienists (ACGIH).
4. "TLVs Threshold Limit Values for Chemical Substances and Physical Agents, and Biological Exposure Indices," (Latest Issue), American Conference of Governmental Industrial Hygienists (ACGIH).
5. "Military Handbook, Cargo Tank Cleaning," MIL-HDBK-291 (SH).
6. "Working in Confined Spaces, Criteria for a Recommended Standard," NIOSH Publication No. 60-106.
7. "National Electric Code," NFPA-70, (Latest Issue), National Fire Protection Association (NFPA).
8. "Safety and Health Regulations for Maritime Employment," 29 CFR 1915.
9. "Safety and Health Regulations for Construction," 29 CFR 1926.
10. "Occupational Safety and Health Standards (General Industry)," 29 CFR 1910.
11. "Basic Program Elements for Federal Employee Occupational Safety and Health Programs," 29 CFR 1960.
12. "Ammunition and Explosives Ashore," OP-5, Volume 1.
13. "Ammunition Afloat," OP-4, Volume 1.
14. "Compressed Air for Breathing Purposes." Federal Specification BB-A-1034a.
15. "Compressed Air for Human Respiration," Pamphlet G-7. Compressed Gas Association, Inc.
16. "Commodity Specification for Air," Pamphlet G-7.1, Compressed Gas Association, Inc.
17. "Control of Gas Hazards on Vessels," NFPA-306, National Fire Protection Association.
18. "Gas-Free Engineer Certification/Recertification Process," SECNAVINST 5100.16 (Series).
19. "Pocket Guide to Chemical Hazards," NIOSH Publication No. 94-116.
20. "Cleaning Petroleum Storage Tanks," NAVFAC Guide Specification 13219A.
21. "Navy and Marine Corps Mishap and Safety Investigation, Reporting, and Record Keeping Manual". OPNAVINST 5102.1 (Series)

APPENDIX C**Technical Manual Deficiency/Evaluation Report (TMDER)****NOTE**

Ships, training activities, supply points, depots, Naval Shipyards and Supervisors of Shipbuilding are requested to arrange for the maximum practical use and evaluation of NAVSEA technical manuals. All errors, omissions, discrepancies and suggestions for improvement to NAVSEA technical manuals shall be forwarded to:

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on NAVSEA/SPAWAR Technical Manual Deficiency/Evaluation Report (TMDER), NAVSEA form 4160/1. To facilitate such reporting, print, complete and mail NAVSEA form 4160/1 below or submit TMDERS at web site:

<https://nsdsa2.phdnswc.navy.mil/tmder/tmder.asp?lvl=1>

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