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MARINE CORPS ORDER 5104.3A

From: Commandant of the Marine Corps
To: Distribution List

Subj: MARINE CORPS RADIATION SAFETY PROGRAM

Ref: (a) MCO 5100.29, Marine Corps Safety Program
(b) 10 CFR, Energy (NOTAL)
(c) 49 CFR, Transportation (NOTAL)
(d) S0420-AA-RAD-010, NAVSEA Radiological Affairs Support Program Manual
(e) OPNAVINST 6470.3, Naval Radiation Safety Committee
(f) NAVMED P-5055, Radiation Health Protection Manual
(g) SECNAVINST 5100.10H, Department of the Navy Policy for Safety, Mishap Prevention, Occupational Health and Fire Protection Programs
(h) OPNAVINST 5100.8G, Navy Occupational Safety and Health Program
(i) SI 6665-15/1, Control Procedures for Specific Equipment, PCN 164 970000 00
(j) NRC Guide 8.13 (NOTAL)
(k) NRC Guide 8.29 (NOTAL)
(l) BUMEDINST 6470,10A, Initial Management of Irradiated or Radioactively Contaminated Personnel
(m) MCO P4030.19G, Preparing Hazardous Materials for Military Air Shipments
(n) OPNAVINST 3100.6G, Special Incident Reporting (OPREP-3, NAVY BLUE and Unit SitRep) Procedures
(o) NAVSUPINST 3400.5C, Procedures for Requisitioning, Storing and Handling of U.S. Nuclear Regulatory Commission Licensed Items Installed on Aircraft
(p) MIL-STD-129, Standard Practice for Military Marking
(q) MCO 4400.105D, Materiel Management for Radioactive Items in the Department of Defense (DOD)
(r) MCO P4400.150E, Consumer-Level Supply Policy Manual

Encl: (1) Radiological Controls (RADCON) Program Information
(2) Contact and Notification Information
(3) Glossary of Terms
(4) Acronyms and Abbreviations
(5) Reports Required

DISTRIBUTION STATEMENT C: Distribution authorized to U.S. Government agencies and their contractors: Administrative or Operational use, July 2002. Other requests for this document will be referred to CMC (SD).

Reports Required: See enclosure (5).

1. Situation. As directed by guidance in references (a) through (r), this Order provides the policy, assigns responsibility, and presents requirements for the administration of the Marine Corps Radiological Controls (RADCON) Program as a component of the Marine Corps Safety Program implemented by reference (a). This Order delineates and enacts the program elements necessary to assure compliance with references (a), (b), (c), and (d), the Department of the Navy's NRC Master Materials License, and specific Naval Radioactive Materials Permits (NRMPs) issued to Marine Corps commands.

2. Cancellation. MCO 5104.3.

3. Mission. This Order establishes a formal RADCON Program within the Marine Corps structure to minimize the risk of injury to personnel and the general public, contamination of personnel and facilities, and loss of control of sources of ionizing radiation. This Order applies to all Marine Corps commands or installations procuring, possessing, using, or responsible for training users of sources of ionizing radiation. For the purpose of this Order, sources of ionizing radiation are defined as radioactive materials in commodities and equipment or radiation-producing equipment. It does not apply to the use of any fixed or portable medical x-ray equipment used by health service personnel in support of Marine Corps operations.

4. Execution

a. Commander's Intent and Concept of Operations

(1) Commander's Intent

(a) Enhance unit and individual readiness by maintaining an effective RADCON Program in coordination with the Chief of Naval Operations (CNO) and in compliance with pertinent regulations.

(b) Control sources of ionizing radiation to minimize personnel exposures to a level as low as reasonably achievable (ALARA) and to prevent contamination of personnel, equipment, and facilities.

(c) Provide guidance and requirements for implementing references (b) through (r), for sources of ionizing radiation used in the Marine Corps.

(2) Concept of Operations

(a) Per reference (g), the Secretary of the Navy assigned to the CNO the responsibility to establish and manage the Navy Safety and Occupational Safety and Health Program, including the promulgation of appropriate directives, in coordination with the Commandant of the Marine Corps (CMC) for those matters that affect the U.S. Marine Corps.

(b) Under provisions of reference (b), the Nuclear Regulatory Commission (NRC) issued a Master Materials License to the Department of the Navy to control the receipt, acquisition, possession, use, and transfer of NRC-licensed radioactive material at Navy and Marine Corps activities. Reference (e) established the Naval Radiation Safety Committee (NRSC) to provide control of all radioactive material used in the Navy and Marine Corps; except for nuclear propulsion reactors and associated radioactivity, nuclear weapons, and certain components of weapons delivery systems. NRMPs are used to maintain this control.

(c) Per reference (h), CNO described and assigned to the Commander, Naval Sea Systems Command (COMNAVSEASYSYSCOM) specific program responsibilities pertaining to ionizing radiation. The Radiological Affairs Support Program (RASP) is the vehicle used by COMNAVSEASYSYSCOM to discharge his/her responsibility for RADCON. The RASP is the responsibility of NAVSEASYSYSCOM (SEA-04N) and includes all aspects of radiation safety with respect to the design, construction, and control of radiation from x-ray devices, accelerators, and radiographic units and from both licensed and non-licensed radioactive materials; including radioactive waste in the Navy and Marine Corps. NAVSEASYSYSCOM(SEA-04N) is the technical manager of the RASP and acts authoritatively on behalf of CNO for all matters under the auspices of the RASP throughout the Navy and Marine Corps.

(d) The Chief, Bureau of Medicine and Surgery (BUMED) is responsible for the Radiation Health Program that serves the Navy and Marine Corps. The Radiation Health Program includes the areas of medical examinations, radiation protection standards, exposure records, and personnel dosimetry. Successful radiation protection programs include Radiation Health and RADCON elements.

(e) Naval Sea Systems Command Detachment, Radiological Affairs Support Office (NAVSEADDET RASO) serves as

technical support center to NAVSEASYS COM (SEA-04N) and the NRSC. NAVSEADET RASO also provides guidance to Navy and Marine Corps in the following areas:

1. RASP. NAVSEADET RASO is the technical support center for the RASP that includes industrial and operational ionizing radiation safety, excluding medical and the Naval Nuclear Propulsion Program (NNPP).

2. NRMP Program. NAVSEADET RASO, as the technical support center, manages the Navy's NRC Master Materials License for control of non-medical licensed radioactive material throughout the Navy and Marine Corps.

3. Navy Installation Restoration Program and Navy Base Realignment and Closure Program. NAVSEADET RASO provides radiological expertise on environmental issues at Navy and Marine Corps facilities managed by the Naval Facilities Engineering Command (NAVFACENGCOM) and its engineering field divisions.

4. Naval Low-Level Radioactive Waste (LLRW) Program. NAVSEADET RASO manages the Navy's LLRW Program that covers all LLRW generated by the Navy, Marine Corps, and Coast Guard, excluding the NNPP. The program also provides contractual support for both command-specific and NAVFACENGCOM-managed radiological contamination and remediation projects at Navy and Marine Corps commands. The program is an integral part of the DOD LLRW Program managed by the U.S. Army.

5. Radiation Safety Training. NAVSEADET RASO provides initial qualification training to prospective radiation safety officers (RSOs) and assistant radiation safety officers (ARSOs).

(f) To accomplish RASP responsibilities in the Marine Corps, the CMC shall maintain an effective and unified Marine Corps RADCON Program in coordination with COMNAVSEASYS COM and appoint a member to the NRSC. The member shall be knowledgeable in the Marine Corps RADCON Program and shall function as liaison and central point of contact for radiological affairs within the Marine Corps.

(g) At the discretion of the CMC, a Marine Corps command shall serve as the lead agent to manage NRMPs for radioactive commodities. These radioactive commodities are distributed and used worldwide throughout the Corps. The lead

agent shall serve as the technical manager of the commodity NRMPs and must act authoritatively on behalf of the CMC for all matters under the auspices of the commodity NRMPs throughout the Marine Corps. Noncompliance with commodity NRMP requirements could adversely affect Marine Corps-wide readiness and safety.

(h) Individual Marine Corps commands can submit applications for NRMPs to use NRC-licensed material or sources of ionizing radiation in a local radiation protection program. These applications are submitted to NAVSEADDET RASO for review and processing. When an NRMP is issued, the command must comply with its locally developed operating procedures, NRMP requirements, and applicable Federal regulations. Non-compliance with NRMP requirements may adversely affect the command's readiness and safety.

b. Subordinate Element Missions

(1) Director, Safety Division (CMC (SD)). Appoint a qualified Naval Officer (Radiation Health Specialist) to serve as the Marine Corps Health Physics Programs Manager at the CMC (SD). This program manager shall:

(a) Serve as a member of the NRSC and function as the liaison and central point of contact for radiological affairs within the Marine Corps.

(b) Take appropriate actions to ensure compliance with this Order, NRMPs issued to Marine Corps commands, and references (b) through (r).

(c) Assist Marine Corps organizations in support of the Marine Corps RADCON Program.

(2) Commanding General, Marine Corps Combat Development Command

(a) Ensure subordinate commands adhere to the requirements of this Order.

(b) Ensure the assignment of command RSOs and/or radiation protection assistants (RPAs), as required, to oversee NRMP compliance at subordinate activities, including the various Marine Corps Training and Education Command schools and facilities, that possess, store, and use radioactive commodities.

(c) Coordinate the review of the training information for radiation safety and hazards awareness with the Logistics Radiation Safety Officer (LRSO) and/or CMC (SD). This coordination ensures compliance with regulatory and other applicable requirements.

(d) Incorporate radiation safety and hazards awareness information in the programs of instruction for each military occupational specialty school related to the procurement, receipt, storage, shipment, issue, transportation, use, and maintenance of commodities containing radioactive materials.

(3) Commander, Marine Corps Materiel Command (COMMARCORMATCOM). Serve as the lead agent for the management of NRMPs for commodities containing radioactive materials in the Marine Corps, and act authoritatively on behalf of the CMC for all matters under the auspices of the commodity NRMPs and RADCON Program throughout the Marine Corps.

(a) Establish the Marine Corps RADCON Office to manage the radioactive commodity NRMPs issued to COMMARCORMATCOM.

(b) Appoint a Logistics Radiation Safety Officer (LRSO) and Assistant Logistics Radiation Safety Officer (ALRSO) to manage NRMPs issued for radioactive commodities in the Marine Corps and to oversee Marine Corps-wide compliance.

(c) Assign appropriate authority, responsibility, and funding to the RADCON Office to ensure satisfactory resources and staffing are available to maintain compliance with applicable NRMPs and this Order.

(d) Assign the LRSO the authority to immediately halt operations governed by the RADCON Program that the LRSO considers significantly unsafe, and to report directly to the COMMARCORMATCOM and the local commander those circumstances or conditions that adversely affect compliance with commodity NRMPs.

(e) Inform the CMC of circumstances or conditions that are detrimental to Marine Corps readiness.

(f) Coordinate the Inter-Service Support Agreement with the Defense Logistics Agency for radioactive material storage and distribution requirements.

(g) Provide advance notice of shipments of radioactive commodities controlled by COMMARCORLOGBASES or NRC licenses.

(h) Provide disposition instructions for radioactive commodities controlled by COMMARCORLOGBASES or NRC licenses.

(i) Oversee the movement of radioactive commodities controlled by COMMARCORLOGBASES or NRC licenses.

(j) Direct required inventories and reconciliation efforts for NRMP commodities.

(k) Provide guidance via appropriate supply instructions, technical instructions, and technical manuals.

(4) Commander, Marine Corps Systems Command

(a) Coordinate the development, procurement, acquisition, testing, evaluation, and distribution of systems involving radioactive sources, or equipment containing radioactive material, with the LRSO and/or the CMC (SD). This coordination ensures compliance with new or established NRMPs or NRC licenses.

(b) Coordinate the procurement of any generally-licensed or license-exempt radioactive devices with the LRSO and/or the CMC (SD).

(c) Assign, in writing, a command radiation safety officer (CRSO) and/or radiation protection assistant (RPA), as required, to oversee NRMP compliance prior to receipt, use, handling, and storing commodities or equipment that contain radioactive material or produce ionizing radiation.

(d) Incorporate Marine Corps radiation safety requirements in the research, development, testing, and evaluation phases for an end item or system component that contains radioactive material or is a source of ionizing radiation. Make appropriate allowance for specific licensing and disposition requirements when planning life-cycle management of new systems.

(e) Coordinate with the LRSO and/or the CMC (SD) on the promulgation of documents for radioactive commodities to ensure the availability of training, maintenance, and pertinent regulatory information.

(5) Commander, U.S. Marine Corps Forces Atlantic; Commander, Marine Corps Bases Atlantic; Commander, U.S. Marine Corps Forces Pacific; and, Commander, Marine Corps Bases Pacific

(a) Ensure that subordinate commands adhere to the requirements of this Order.

(b) Publish procedures implementing formal radiation safety programs per the requirements of this Order and commensurate with RADCON Program operations. Table 1 provides a checklist of typical RADCON Program elements.

(c) Ensure that installations provide centralized LLRW storage sites, when practical, to reduce the risk for spread of contamination, and provide a single-site location for staging the collected LLRW and loading of vehicles contracted to deliver LLRW to the burial facility, identified by the DOD LLRW Executive Agent.

c. Coordinating Instructions. Submit all recommendations for revisions of this Order to the CMC (SD) via the appropriate chain of command.

(1) Applicable commands and HQMC elements shall comply with this Order.

(2) Commanders shall assure that their radiation safety programs reflect command support and fulfill the requirements of licenses, NRMPs, and applicable host-country and Federal regulations.

(3) Enclosure (1) provides guidance for establishing and maintaining radiation-health and RADCON Program elements. Enclosure (2) provides contact and notification information. Enclosure (3) provides a glossary of terms. Enclosure (4) provides a listing of acronyms and abbreviations. Enclosure (5) lists the reports that commands and installations might be required to prepare.

(4) LRSO. In the Marine Corps, a qualified individual serves on the staff of MATCOM as the Marine Corps LRSO. As such, this individual is named on all NRMPs issued to MATCOM for radioactive commodities and devices that are distributed for use throughout the entire Marine Corps, and controlled and managed centrally by the Marine Corps RADCON Office at MATCOM, Albany, Georgia.

This individual has responsibility for accountability and management of radioactive commodities, and to oversee their use throughout the Marine Corps. The LRSO shall:

(a) Direct and manage the staff and overall activities of the RADCON Office, and carry out the responsibilities of that office per the requirements of this Order and NRMPs issued to MATCOM.

(b) Develop RADCON procedures for training, receipt, storage, inventory, handling, wipe and leak testing, packaging, shipping, transferring, performing emergency actions, and reporting of incidents related to the possession and use of radioactive commodities. Promulgate complete and comprehensive technical instructions that contain these procedures; as well as techniques, requirements, and guidance necessary for the control and management of applicable radioactive materials to assure strict compliance with references (b), (c), (d); and with the policies set forth in this Order.

(c) Maintain centralized inventories of all licensed or permitted commodities used in the Marine Corps, and ensure Marine Corps-wide required inventories are conducted and reconciled in accordance with NRMP requirements. When semi-annual inventories are required, the first physical inventory and inventory reconciliation requirement will include the annual leak tests (wipe tests) for NRMP commodities; and the second inventory requirement will include only the physical inventory and inventory reconciliation. See Glossary of Terms, enclosure (3), for definitions of "Inventory or Physical Inventory Report" and "Report of Physical Inventory and Reconciliation."

(d) Maintain the disposal inventories and manifests of LLRW associated with radioactive commodities.

(e) Ensure all licensed radioactive commodities are leak tested, as required, and maintain accountability of leak test records for NRMP compliance.

(f) Conduct audits in accordance with NRMP requirements to ensure commodities are being handled in accordance with NRMP conditions.

(g) Direct corrective actions, to the extent required, to address or resolve discrepancies found during audits.

(h) Provide advice to Marine Corps commands on radiation safety matters.

(i) Serve as the primary point of contact for the reporting of incidents involving applicable radioactive commodities per the requirements of references (b), (c) and (d), NRMPs, and this Order. This includes generally-licensed commodities, exempt quantities, and other radioactive materials not otherwise specifically permitted for use in the Marine Corps.

(j) Coordinate with the Commander, Marine Corps Systems Command, and the Commander, Marine Corps Combat Development Command, on the promulgation of documents for radioactive commodities to ensure the availability of training, maintenance, and pertinent regulatory information.

(k) Conduct administrative actions required for application, amendment, and renewal of NRMPs associated with new and fielded radioactive commodities.

(l) Conduct and consolidate annual reviews of the adequacy of content and implementation of radiation safety programs in the Marine Corps. Program improvement information gained from the reviews shall be distributed to the Marine Corps radiation safety community, by means and priority appropriate to the material.

(m) Assist in coordinating the procurement of radioactive commodities by Marine Corps commands to ensure adequacy of permit coverage and establishment of RADCON.

(5) Installation Radiation Safety Officer (IRSO). The IRSO, or base RSO (BRSO), is the individual, appointed in writing, at the installation, base, air station, logistics base, combat center, or other fixed activity, who is responsible for coordinating the RADCON Program for sources of radiation under the control of that installation. The IRSO shall:

(a) Develop and implement the installation radiation safety order, and publish and distribute applicable installation messages; bulletins; or notices, as required.

(b) Recommend the appointment of Assistant IRSO and RPAs to the installation commander in sufficient numbers to administer the RADCON Program at the installation, and provide appropriate training to each RPA. RPA is defined in paragraph

4c(7). In the temporary absence of the IRSO from the installation, the Assistant IRSO or RPA shall be appointed to fulfill the IRSO's duties.

(c) Coordinate and direct the actions of the installation or base RPAs in the administration of the RADCON Program.

(d) If the IRSO maintains NRMP radioactive commodities or sources, inventory reports of these installation assets are required. Installation inventory reports shall be reconciled with the previous inventory to account for changes or discrepancies. The inventory report shall include this reconciliation (statement of changes, losses, additions, or updates). Submit installation physical inventory and inventory reconciliation reports to the LRSO, in accordance with the appropriate NRMP requirement. Maintain copies of installation and tenant activity inventory reports of licensed sources of ionizing radiation. Decommissioning files shall contain copies of inventory reports (Report Control Symbol EXEMPT), areas of use, facility surveys (Report Control Symbol EXEMPT), and reports of radiation incidents and accidents (Report Control Symbol EXEMPT). See Glossary of Terms, enclosure (3), for definitions of "Inventory or Physical Inventory Report" and "Report of Physical Inventory and Reconciliation."

(e) If the IRSO maintains NRMP radioactive commodities or sources, perform required leak tests (wipe tests) in accordance with the procedures in the applicable NRMPs, and forward the leak test packages to the LRSO via certified mail.

(f) Dispose of LLRW through the Navy LLRW Program. Coordinate the disposal of LLRW with NAVSEADDET RASO and provide a copy of the manifest to the LRSO.

(g) Ensure proper handling and control of radioactive materials; including receipt, storage, shipping, and disposal operations at installation activities and tenant commands.

(h) Maintain liaison with tenant command RSOs and RPAs.

(i) Establish and implement a training program for RPAs and all installation personnel who are involved in the receipt, maintenance, handling, packaging, transferring, and shipping of radioactive commodities.

(j) Provide lists of inventories and storage locations of radioactive materials and commodities to installation fire department, custodian, and emergency response personnel. Also, provide periodic training to these organizations on emergency response procedures involving radiation sources.

(k) Coordinate the procurement of any generally-licensed or license-exempt radioactive devices with the LRSO and/or CMC (SD).

(l) Establish local procedures and maintain close liaison with the Defense Reutilization and Marketing Offices (DRMO) and other base organizations to prevent the unauthorized transfer or delivery of any radioactive materials to the DRMO.

(m) Conduct and document annual reviews of the adequacy of the content and implementation of the RADCON Program, as delineated in the installation order and reference (d), and report results to the LRSO.

(n) Maintain liaison with the Navy Radiation Health Officer, assigned to the supporting Naval medical facility, and coordinate the Radiation Health Program and the RADCON Program in accordance with references (d) and (f).

(6) Command Radiation Safety Officer (CRSO). Appointed in writing, the CRSO is the designated individual at the Marine Expeditionary Forces (MEF) or Major Subordinate Command (MSC) level tasked with direct oversight of radiation safety practices and procedures. Whenever possible, assignment of the CRSO shall be from the command safety office. The CRSO shall:

(a) Develop and implement the command RADCON Program procedures, and publish and distribute applicable command messages; bulletins; or notices, as required.

(b) Serve as the primary point of contact for RADCON Program issues that arise within any subordinate command.

(c) Recommend the appointment of Assistant CRSOs (ACRSOs) and RPAs in sufficient numbers to administer the RADCON Program for the command and subordinate units, and provide appropriate training. In the temporary absence of the CRSO from the command, the Assistant IRSO or RPA shall be appointed to fulfill the CRSO's duties.

(d) Coordinate and direct the actions of the command RPAs in the administration of the command RADCON Program.

(e) If the CRSO maintains NRMP radioactive commodities or sources, a consolidated inventory of these command assets is required. Command inventory reports shall be reconciled with the previous inventory to account for changes or discrepancies. The inventory report shall include this reconciliation (statement of changes, losses, and additions or updates). Submit command physical inventory and inventory reconciliation reports to the LRSO in accordance with the appropriate NRMP requirement. Maintain copies of command and subordinate-activity inventory/reconciliation reports of licensed sources of ionizing radiation. See Glossary of Terms, enclosure (3), for definitions of "Inventory or Physical Inventory Report" and "Report of Physical Inventory and Reconciliation."

(f) If the CRSO maintains NRMP radioactive commodities or sources, oversee required leak tests (wipe tests) in accordance with the procedures in the applicable NRMPs, and forward the leak test packages to the LRSO via certified mail.

(g) Ensure disposition instructions provided by the item inventory manager and LRSO are followed, and coordinate the disposition and storage of LLRW with the IRSO managing the installation LLRW Program and with NAVSEADET RASO.

(h) Maintain liaison with all IRSOs that provide support to any and all subordinate units within the command.

(i) Establish and implement a training program for command RPAs and for those command personnel who are involved in the receipt, maintenance, handling, packaging, transferring, transporting, and shipping of radioactive commodities.

(j) Maintain liaison with RSOs within the command that have been appointed oversight of specific NRMPs or radiation safety programs (RADIAC calibration laboratory, x-ray radiography, etc.).

(k) Advise the IRSO on the locations of stored or in-use radioactive materials, by providing the IRSO with copies of each reconciled inventory report that was forwarded to the LRSO.

(l) Coordinate the procurement of any generally-licensed or license-exempt radioactive devices with the LRSO and/or CMC (SD).

(m) Conduct annual reviews or audits of the adequacy of the content and implementation of RADCON programs as delineated in local orders. The results of these reviews shall be reported to the host IRSO (if applicable) and the LRSO by 30 November of each year.

(7) RPA. The commander shall appoint each RPA based upon the recommendation of the RSO. The RPA is a critical member of the command, and is appointed to assist the CRSO or IRSO in administration of the command or installation RADCON Program. It is essential to consider RPA appointments at crucial locations, having custody of licensed or permitted radioactive commodities. Such areas may include areas of use, maintenance, transportation, storage, and facilities involved with packaging, receipt, and shipment of radioactive commodities.

(8) Responsible Officer (RO). In accordance with reference (r), the responsible unit having custody of the licensed or permitted radioactive commodities must assign an RO. The RO shall receive radiation-safety training that is commensurate with one's duties and responsibilities. The RO shall:

(a) Perform or ensure the conduct of RADCON Program requirements for the receipt, handling, storing, physical inventory, packaging, and shipping of licensed sources of ionizing radiation.

(b) Perform or ensure that documentation and reporting requirements are fulfilled. Section 1 of enclosure (1) provides a generic RADCON Program from which an RO can develop a local RADCON Program that is commensurate with operations.

5. Administration and Logistics

a. Modifications to Policy. Commanders in overseas areas may modify certain policies and procedures when dictated by host-nation relationships. Submit modifications or changes to this Order for approval by the Safety Division (CMC (SD)) prior to issuance. Submit modifications to policies affecting specific NRMPs to the permit holder for approval.

b. Local RADCON Program. A local (tenant, command, or installation) RADCON Program should have written standard operating procedures. The following checklist can be used to model a local RADCON Program, and to provide the framework for a local inspection and program review checklist.

Element Number	Radiological Controls Program Elements	Applicable Section in Enclosure (1)
1	Accident and incident (lost/missing/damaged) reporting requirements; report immediately to the LRSO.	1.8
2	Contact and notification information and telephone numbers.	See Enclosure (2)
3	Contamination control.	1.5.6
4	Decommissioning records.	1.5.12
5	Disposal of radioactive materials/waste.	4.5.7
6	Inventory and reconciliation reports (for NRMP commodities; dates may vary with other sources; provide copies to IRSO or CRSO). See Glossary of Terms, enclosure (3), for definitions of "Inventory or Physical Inventory Report" and "Report of Physical Inventory and Reconciliation."	1.5.2
7	Labeling, storage, posting, and control of areas.	1.5.4
8	Leak test procedures and results (for NRMP commodities; dates may vary with other sources; provide copies to IRSO or CRSO).	1.5.9
9	Procedures for shipment, receipt, and opening of packages.	1.5.3
10	Radiation emergency procedures and points of contact.	1.7 and 4.7
11	Radiation health and personnel dosimetry, if applicable.	1.1
12	Radiation protection surveys.	1.5.5
13	Records and reports (includes RSO assignment letter).	1.5.10
14	Training and training records.	1.2.2, 1.2.3
15	Transportation of radioactive material.	1.6

Table 1.--Checklist of Radiological Controls Program Elements.

6. Command and Signal

- a. Signal. This Order is effective the date signed.
- b. Command. This Marine Corps Order is applicable to the Marine Corps Total Force.



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General, U. S. Marine Corps
Assistant Commandant
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SECTION 1. GENERIC RADIOLOGICAL CONTROLS (RADCON) PROGRAM

1.1. RADIATION HEALTH PROGRAM

1.1.1. Introduction. The Radiation Health Program is an essential element of any Marine Corps radiation protection effort and includes the areas of medical examinations, radiation protection standards, exposure records, and personnel dosimetry.

The Chief, Bureau of Medicine and Surgery (BUMED) has issued NAVMED P-5055 (Radiation Health Protection Manual) as the governing document for Navy and Marine Corps Radiation Health Programs. The Radiation Health Program for any given shore command or organization is administered by the supporting BUMED activity (i.e., Navy hospital, clinic, etc.). However, it is essential for a Radiation Safety Officer (RSO) to have access to pertinent information contained in the Radiation Health Program, such as records of exposure to ionizing radiation, results of radiation medical examinations, records of special exams and bioassays, and situational reports on personnel exposure to ionizing radiation. If needed, consult with the health physicist assigned at CMC (SD) for guidance in collecting and assessing bioassay samples.

1.1.2. Radiation Protection Standards. The standards for protection of personnel from ionizing radiation associated with the Radiological Affairs Support Program (RASP) are based on radiation exposure limits and internal deposition limits of chapter 4 of NAVMED P-5055. In addition, the Navy and Marine Corps have adopted the philosophy of maintaining individual and collective exposures "As Low As Reasonably Achievable" (ALARA). To assist commands in keeping exposures ALARA, the RASP has adopted a maximum administrative control level of 0.5 rem (500 mrem) per calendar year. This control is administrative in nature and applies to radiation workers. The administrative control level shall not be exceeded by any individual without prior written approval of that individual's commanding officer per the RSO's recommendations.

1.1.3. Medical Examinations. Chapter 2 of NAVMED P-5055 requires that all personnel who are being considered for routine assignment to duties or occupations requiring exposure to ionizing radiation (for example, workers and supervisors involving x-ray radiography) shall be given a medical examination prior to assignment or transfer to those duties. Personnel who are not routinely exposed to ionizing radiation as

a result of their normal duties or occupation, and are not likely to exceed 0.5 rem per year, are not required to have pre-placement medical examinations. NAVMED P-5055 provides requirements for preplacement and subsequent medical examinations. Preplacement and subsequent medical examinations shall be provided to the following:

- a. All x-ray radiographers and radiographer assistants.
- b. All personnel whose duties may require entry into a high radiation area (100 mrem or higher in 1 hour).
- c. All personnel required by conditions of individual Naval Radioactive Materials Permits (NRMPs).
- d. All personnel who routinely work with unsealed radium sources containing greater than 0.1 microcuries of radium or with sealed sources of radioactive material greater than the exempt quantity limits specified in Schedule B of 10 CFR 30.
- e. All personnel deemed necessary by the commanding officer.

1.1.4. Personnel Dosimetry. Personnel dosimetry provides the means for monitoring and documenting the exposure of radiation workers, evaluating and enhancing ALARA concepts, and ensuring that authorized control levels and limits are not exceeded. It also provides the means for surveillance of individual radiation safety practices and valuable information on exposure trends. For the information received from personnel dosimetry devices to be accurate; procedures for handling, storing, and wearing the various devices must be followed.

1.1.5. Exposure Records. When applicable, personnel exposure records shall be maintained in accordance with chapter 5 of NAVMED P-5055.

1.1.6. Radiation Exposure Control for the Unborn Child

- a. All reasonable efforts shall be made to keep ionizing radiation exposure to the unborn child to the very lowest practical level.
- b. Once the individual informs the command of her pregnancy, the command shall take action to limit the exposure to the unborn child to less than 0.5 rem (500 mrem) during the

entire period of pregnancy. In addition, any exposure received after the declaration of pregnancy shall not exceed 50 mrem per month.

c. Female personnel and their supervisors shall be trained on the biological risks to the embryo and fetus from radiation in accordance with the NAVSEA RASP Manual (S0420-AA-RAD-010).

1.2. TRAINING

1.2.1. General Information. Commanding officers of Navy and Marine Corps activities have the responsibility to ensure that occupationally exposed personnel under their jurisdiction maintain exposure to ionizing radiation ALARA. A part of the ALARA philosophy is the assurance that each person has received radiation safety training commensurate with his or her potential for occupational exposure to ionizing radiation. There are at least three reasons for radiation safety training. First, the development of worker awareness of radiation safety procedures permits the performance of tasks with greater efficiency and confidence. Second, when individuals are aware that there is some risk associated with their exposure, they can become active participants in the decision to accept and, where possible, to reduce the risk as part of their job. Third, the number and seriousness of accidents and incidents can be reduced through training.

1.2.2. Formal RSO Training Courses. NAVSEA RASP Manual (S0420-AA-RAD-010) and applicable NRMPs list the formal training requirements for RASP RSOs, Assistant Radiation Safety Officers (ARSOs), and x-ray radiographers. The 80-hour RSO Course (S-4J 0016) offered at NAVSEADET RASO or an approved course of training is required for all RSOs and ARSOs. In addition, commands conducting x-ray radiography shall provide each x-ray radiographer with at least 6 hours of annual refresher training and a written examination.

1.2.3. Training Requirements. NAVSEA RASP Manual (S0420-AA-RAD-010) and applicable NRMPs list training requirements for radiation workers, limited radiation workers, occupationally exposed females and their supervisors, emergency personnel, and other organizational personnel. Training requirements for Radiation Protection Assistants (RPAs) and handlers and users of

radioactive devices are listed in applicable NRMPs. Training requirements include:

1.2.3.1. Radiation Workers

a. Initial Training for Radiation Workers. Each radiation worker shall, prior to performing any radiation duties, successfully complete radiation safety training including the following topics as a minimum. The individual attaining a minimum score of 70 percent on a written examination shall demonstrate successful completion of this training. Commands with numerous radioactive devices or radiation producing machines should expand the scope and duration of their initial training accordingly. Initial training shall be conducted by the RSO or a designated representative and shall be documented. This initial training shall include:

(1) Operating, maintenance, handling, and accountability procedures for devices or radioactive sources in use (including command specific operating procedures).

(2) Radiation exposure limits and control levels.

(3) Specific RADIAC survey instrument requirements and operating procedures.

(4) Facility or site survey requirements and procedures (if applicable to duties).

(5) Specific personnel dosimetry requirements.

(6) Biological effects and risks associated with exposure to ionizing radiation.

(7) Types and sources of ionizing radiation contributing to personnel exposure (alpha, beta, gamma, x-ray, neutron, and internal or external exposure).

(8) Specific procedures for using time, distance, and shielding to maintain individual exposures ALARA.

(9) Responsibility of individuals.

(10) Emergency procedures.

b. Periodic Training. Each radiation worker shall receive annual refresher training covering the following topics, at a minimum:

(1) Command radiation safety operating and emergency procedures.

(2) Use of RADIAC survey instruments.

(3) Personnel dosimetry.

(4) Results of internal audits and inspections.

(5) Command conducted radiation survey results and personnel exposure trends.

1.2.3.2. Limited Radiation Workers and RPAs.

Radiation safety training for limited radiation workers and RPAs should be specific to the areas and hazards that the individual could reasonably encounter.

a. Initial Training. The duration of the initial training for limited workers and RPAs shall be locally determined, conducted by the RSO or a designate representative, and documented. Each shall receive initial training on the following topics, at a minimum:

(1) Sources of radiation in areas they may frequent.

(2) Potential hazards associated with radiation sources in areas they may enter.

(3) Use and meaning of radiation warning signs and barriers.

(4) Procedures to avoid and reduce exposures.

(5) Personnel dosimetry requirements.

b. Periodic Training. Each limited radiation worker shall annually receive documented training covering the scope of the initial training requirement.

Periodic training shall be conducted by the RSO or a designated representative and shall be documented.

1.2.3.3. Occupationally Exposed Females and Their Supervisors. Exposure of a female worker to ionizing radiation may also involve exposure of an embryo or fetus. RASP commands should provide training to occupationally exposed females and their supervisors regarding the nature of the potential risk to the embryo or fetus from the female's occupational exposure. Instruction concerning prenatal exposure to the unborn child shall also be given to personnel who supervise female workers authorized to receive occupational exposure, because such personnel affect the amount of radiation exposure a female worker receives. Instruction concerning prenatal exposure to the unborn child shall be given during initial and annual training. All female personnel receiving instruction, in accordance with NAVSEA RASP Manual and Nuclear Regulatory Guide 8.13, shall sign and date the following statement prior to being issued dosimetry equipment.

"The recommendations of the National Council on Radiation Protection and Measurements to limit radiation exposure to the unborn child to the very lowest practicable level, not to exceed 0.5 rem during the entire period of pregnancy, have been explained to me."

The signed statements shall be kept with training record. The training shall be conducted by the RSO or a designated representative and shall be documented.

1.2.3.4. Emergency Personnel. Firefighting, security, medical, and other personnel who, in response to an emergency situation, may be required to enter areas where they could be exposed to ionizing radiation sources or devices, should receive initial and periodic training on how to protect themselves from the hazards involved. However, emergency personnel should understand the relative priority of radiological controls versus other safety considerations. Firefighters, for example, should be trained that when fighting a fire that involves radioactivity, the fire is, in most cases, more of a threat to life and property than radiation exposure, and that radiological controls shall not be instituted that significantly impair the firefighting effectiveness.

a. Initial Training. The initial training for emergency personnel shall be conducted by the RSO or a designated representative, and shall be documented. All

emergency personnel who could be exposed to ionizing radiation during the performance of their emergency response duties shall receive training on the following topics, at a minimum:

(1) Sources of radiation in areas where they may be required to respond.

(2) Potential hazards associated with radiation sources in areas where they may be required to respond.

(3) Relative priority of RADCON versus other safety considerations during an emergency.

(4) Procedures to avoid or reduce exposures in emergency response actions.

(5) Procedures to avoid or reduce potential radioactive contamination in emergency response situations.

(6) Personnel radiation safety requirements (i.e., protective clothing, stay times, dosimetry, etc.) for personnel entering radiation areas under emergency conditions.

(7) Familiarization with the physical layout of facilities.

(8) Persons to contact to provide RADCON support during or after an emergency.

b. Periodic Training. Persons classified as "emergency personnel" shall receive annual training covering the scope of the initial training requirements. Additional training shall be provided whenever there is a significant increase in the radiation exposure potential due to additional or different sources of ionizing radiation. Periodic training shall be conducted by the RSO or a designated representative and shall be documented.

1.2.3.5. Other Organizational Personnel and Visitors. Those personnel who work in or frequent areas adjacent to radiation areas or radioactive materials storage areas, while not actually being involved in the RADCON Program, may develop concerns about radiation because they often see radiation warning signs. To allay concerns and enhance

awareness, it is incumbent upon the command to provide these personnel with a briefing.

a. Initial Training. Those personnel who routinely work in or frequent areas adjacent to radiation areas and radioactive material storage areas shall receive an initial briefing on the need to heed radiation warning signs and boundary markers. These personnel shall be informed of the nature of potential radiation exposures and that the majority of their exposures come from natural background, man-made enhancements to background, and medical exposures (with the latter comprising the most significant portion). The briefing should include an explanation of what is done to protect them from radiation exposure. All personnel should be encouraged to contact the RSO if they have additional questions regarding radiation exposure in their work areas.

b. Periodic Training. Because of the sensitive nature of the subject of potential radiation exposures, the RSO shall repeat the initial briefing as frequently as necessary to allay concerns.

1.2.4. Required Training Records. Failure to document required training is considered to be evidence of failure to conduct required training and will be so noted in internal audits and compliance inspections.

a. Initial Radiation Safety Training

(1) Records of initial radiation safety training for radiation workers are a permanent record and shall normally be maintained in the individual's service record for military and official personnel folder for civilian employees.

(2) For other categories of personnel, records of initial training shall be maintained in organizational training records for as long as the individual is assigned to the organization.

(3) Records of initial training shall be course completion certificates or signed memorandums stating successful completion of specified initial training and copies of tests and test scores of personnel. The RSO or individual conducting the training shall sign memoranda of completion.

b. Periodic Radiation Safety Training

(1) The RSO or activity training office shall maintain records of periodic radiation safety training for all categories of personnel for a period of 3 years.

(2) Records of periodic training may be kept in any format. At a minimum, the record shall identify the date of training, subject matter covered, length of training, person(s) conducting the training, and attendees.

1.3. NRMP AND NUCLEAR REGULATORY COMMISSION (NRC) LICENSED MATERIAL

1.3.1. General Information. Under provisions of 10 CFR, the NRC has issued a Master Materials License to the Department of the Navy to control the receipt, acquisition, possession, use, and transfer of NRC-licensed radioactive material. OPNAVINST 6470.3 established the Naval Radiation Safety Committee (NRSC) to implement the NRMP system and assigned responsibilities to control the use of NRC-licensed radioactive material and naturally-occurring and accelerator-produced radioactive materials.

1.3.2. Generally-Licensed Items. The NRC established general licenses in 10 CFR 31, 40.22, 40.25, and 70.19 for items or products manufactured and distributed in accordance with a specific license issued by the NRC or an agreement state. Byproduct materials covered by a general license are normally identified in the manufacturer's instructions or on a caution label attached to the product. Commands can only transfer generally-licensed items to a person holding an NRC or agreement state license, or an NRMP which authorizes receipt of the item. Generally-licensed items are subject to the pertinent RADCON provisions of this Order. These provisions include proper training, inventories, storage, disposal, shipping, packaging, and transporting.

1.3.3. Exempt Items. 10 CFR 30.11 through 30.19 identifies items that are exempt from the requirements of 10 CFR 30 when the items are manufactured and distributed in accordance with a specific license issued by the NRC. The letter "E" identifies exempt items after the manufacturer's license number that is normally printed on a caution label on the device or in the manufacturer's instructions. The 10 CFR 40.13 identifies source material items that are exempt from licensing. Exempt items are still subject to the pertinent RADCON provisions of

this Order. These provisions include proper training, inventories, storage, disposal, shipping, packaging, and transporting.

1.3.4. NRMP Requirements. All Navy and Marine Corps commands that receive, possess, use, store, transfer, or dispose of radioactive material which is not exempted by NAVSEA RASP Manual or covered by an NRC license or an NRMP shall obtain an NRMP. NAVSEA RASP Manual provides the requirements and criteria for initial issue, renewal, and amendments of NRMPs.

1.3.5. Exemptions Requiring No NRMP. Consult with the RADCON Office to determine whether an NRMP is required for radioactive materials contained in a device or product prior to receiving the device or product.

1.3.6. Termination of Activities Authorized by an NRMP. NAVSEA RASP Manual provides the requirements for termination of all activities authorized by an NRMP.

1.3.7. Unauthorized Possession or Use of Radioactive Material

a. The following constitutes unauthorized possession or use of radioactive material:

(1) Receipt or possession of radioactive material not authorized by an NRMP when required to obtain one under NAVSEA RASP Manual or specific direction of the NRSC.

(2) Possession of quantities of radioactive materials exceeding limits authorized in an NRMP.

(3) Receipt or use of radioactive material in equipment, devices, or storage containers not approved for use, when required, by an NRMP.

(4) Use of radioactive material by an individual who is not qualified in accordance with conditions of an NRMP.

b. When unauthorized possession or use of radioactive material is determined, the command shall:

(1) Immediately withdraw the radioactive material or excess quantities from use and place in secure storage.

(2) Obtain guidance from the Logistics Radiation Safety Officer (LRSO) prior to transferring the radioactive materials or excess quantities.

(3) Investigate the unauthorized possession or radioactive material, review procedures, and initiate necessary corrective action to prevent recurrence.

(4) Report by letter via RADCON chain of command to NAVSEADET RASO and LRSO, within 30 days after discovery of the unauthorized possession, describing circumstances and corrective actions taken.

1.4. REPORTING OF EQUIPMENT DEFECTS AND NONCOMPLIANCE FOR NRC LICENSED MATERIAL

1.4.1. Reporting Guidance. The 10 CFR 21 establishes procedures and requirements for reporting of defects and noncompliance.

1.4.2. Reporting Procedures. NAVSEA RASP Manual provides the procedures and requirements for commands to report defects and noncompliance.

1.5. GENERAL RADIOLOGICAL CONTROLS PROCEDURES

1.5.1. Administrative Control of Occupational Exposure

a. At least annually, a formal review shall be conducted to identify operations with high exposures and to recommend procedures for reduction of exposure.

b. All exposures above levels anticipated for the jobs and any exposure exceeding an authorized administrative control level shall be investigated and documented by the RSO.

1.5.2. Procurement, Inventory, and Notification of Persons for Radiation Sources

a. Approval by the RSO, or LRSO if applicable, is required prior to the procurement of radioactive material that contains radioactivity equal to or greater than the quantities listed in table 1.5 (excerpt of NAVSEA RASP Manual) of this enclosure, or contains a specific activity greater than 0.002 microcuries per gram. Approval by the RSO is required prior to procurement of machines that produce ionizing radiation (for example, x-ray machines) that are inherently accessible in the

design or intended uses of the devices. Supply procedures shall be established to assure RSO/LRSO approval of the procurement of any item containing radioactive material or any radiation producing machines.

RADIOACTIVE MATERIAL		MICROCURIES
Barium-133	Ba-133	10
Cadmium-109	Cd-109	10
Carbon-14	C-14	100
Cesium-137	Cs-137	10
Cobalt-60	Co-60	1
Hydrogen-3	H-3, Tritium	1,000
Nickel-63	Ni-63	10
Promethium-147	Pm-147	10
Strontium-90	Sr-90	0.01

Table 1.5.--Exempt Quantities of Radioactive Materials
(Source: Excerpt of NAVSEA RASP Manual (S0420-AA-RAD-010)).

b. The RSO shall maintain an inventory of all radioactive materials authorized by NRMPs, all non-exempt radioactive commodities, and all x-ray equipment subject to the RASP.

(1) For radioactive material, the inventory shall list a source identification number, equipment and source serial numbers, radioisotope, chemical and physical forms, activity, date of activity determination, location, and custodian.

(2) For x-ray radiation producing machines subject to the RASP, the inventory shall list machine description, model, serial number, maximum energy (peak tube potential, kVp) and filament current (milli-amperes, mA) or radiation output, location, and the custodian.

c. Inventories of radioactive commodities and inventory reconciliation efforts shall be conducted at least semi-annually or according to NRMP or NRC-licensed requirements. Reconciled inventory reports, which include equipment losses and gains, shall be consolidated at the MEF or MSC level and reported to the inventory manager in accordance with the conditions of the appropriate NRMP.

d. Security and fire departments shall be provided with the following:

(1) A listing of permanent locations of radioactive material (at least annually and when locations permanently change).

(2) A listing of locations of radioactive material where radiation exposure, contamination, or airborne radioactivity may be produced as a result of fire.

(3) Advance notifications of locations of temporary high-radiation areas not under direct supervision of an authorized individual (i.e., overnight calibrations).

1.5.3. Shipment, Receipt, and Opening of Packages

a. Monitoring for external radiation and contamination on external surfaces of packages received or packaged for shipment shall be carried out near the receiving or packaging point.

b. Each command expecting receipt of a package containing radioactive materials shall comply with the requirements of 10 CFR 20.1906 for notification, pickup, and monitoring. Alternatively, commands shall comply with NRMPs that provide approved shipping and receipt instructions for certain commodities and radioactive materials.

c. Written procedures shall be established for monitoring and safely opening packages which are received. Consideration shall be given to the type of package being opened and the chemical and physical forms of the contents. General procedures that are provided in commodity NRMPs should be included in local procedures if the command receives, ships, or transports licensed or permitted commodities.

1.5.4. Labeling, Storage, Posting, and Control of Areas

a. Store radioactive materials in secure areas in accordance with 10 CFR 20.1801 and 20.1802, or according to conditions of the appropriate NRMP. Quantities of radioactive material (greater than table 1.5 quantities) shall be stored in a restricted area. Access shall be limited to the RSO and designated individuals. Radioactive material shall not be stored in office spaces, food storage areas, or berthing areas.

b. Containers of radioactive material shall be labeled in accordance with 10 CFR 20.1904.

c. Exemptions to labeling containers are found in 10 CFR 20.1904.

d. Each container containing greater than table 1.5 exempt quantities of radioactive material shall be labeled in accordance with the requirements of 10 CFR 20.1904.

e. Except as otherwise authorized by 10 CFR (Energy) or an authorized representative of a regulatory agency, labels and symbols shall use the conventional radiation colors (black, magenta, or purple on a yellow background). The symbol prescribed is the conventional three-laded design. The crosshatched area shall be black, purple, or magenta, and the background shall be yellow.

f. In addition to the contents of signs and labels described in this section, information may be provided on or near such signs and labels that may be appropriate in aiding individuals to minimize exposure to radiation or radioactive material.

g. Consult 10 CFR 20.1902, NAVSEA RASP Manual, and host-nation agreements for information regarding the posting and control of radioactive-materials storage areas, radiation areas, high-radiation areas, radioactive contaminated areas, and other restricted areas. Consult 10 CFR 20.1903 for exceptions to posting requirements. Consult with the LRSO for clarifications about posting requirements.

h. Prior to removal or disposal of empty, uncontaminated containers to unrestricted areas, remove or deface the RAM label, or otherwise clearly indicate that the container no longer contains radioactive material.

1.5.5. Radiation Protection Surveys

a. A radiation survey shall be conducted:

(1) Before a new facility is put into routine operation. These records shall be maintained indefinitely in the installation's or command's RADCON decommissioning file.

(2) After any significant changes in condition from the initial radiation protection survey which could adversely affect radiation safety (facility modification,

increase in operating parameters (energy, workload, occupancy, etc.)). These records shall also be maintained indefinitely in the installation's or command's RADCON decommissioning file.

(3) Every 2 years, unless otherwise specified in a specific NRMP or an NRC license condition.

b. Required radiation protection surveys cited above shall be conducted by the RSO, ARSO, or trained RPA, and, if applicable, submitted to NAVSEADET RASO via the LRSO for evaluation and approval.

c. Surveys and inspections shall be made as necessary to comply with specific requirements of NAVSEA RASP Manual and to evaluate the extent of radiation hazards.

d. Safety devices in permanent facilities (lights, audible signals, warning signs, interlocks, etc.) shall be examined by personnel who are knowledgeable in their design, operation, and maintenance at least every 6 months; unless otherwise specified in NAVSEA RASP Manual. Records of the results of semi-annual safety device examinations and inspections shall be maintained for 3 years.

1.5.6. Contamination Control

a. Eating, drinking, chewing, or smoking shall not be allowed in contaminated areas or areas where unsealed sources are used or stored.

b. Storage of food in radioactive material storage or contaminated areas shall not be allowed.

c. Eating, drinking, chewing, or smoking while wearing potentially contaminated clothing shall not be allowed.

d. Pipetting radioactive liquids by mouth shall not be allowed.

e. Radioactive liquids and powders shall be carried in their containers and within another secondary non-breakable container.

f. Separate sink and drain systems shall be used in rooms or facilities where liquid radioactive material may leak, spill, or be disposed of.

g. A caution label shall be affixed to all containers actually containing or contaminated with radioactive material.

h. Chemical fume hoods used to contain radioactive material in excess of table 1.5 quantities shall be equipped with a high-efficiency particulate filter and shall be marked with a "Caution-Radioactive Material" sign or label.

i. The average velocity through the face of a chemical fume hood used to contain radioactive material shall be at least 100 linear feet per minute.

j. Protective clothing shall be removed or monitored for contamination before an individual leaves a contaminated area.

k. Individuals leaving a contaminated area shall be monitored for contamination using an AN/PDR-56 (or equivalent) with small probe for alpha activity, and an IM-247 APD series RADIAC with DT-304 probe (or equivalent) for beta-gamma activity, or an AN/VDR-2 (or equivalent) for beta-gamma activity, as applicable. When a contact reading indicates detectable contamination, the affected areas shall be decontaminated in accordance with approved procedures or those provided in BUMEDINST 6470.10A.

l. Tools and equipment used in a contaminated area shall be routinely monitored and decontaminated as necessary before release to unrestricted areas.

m. Clothing and items released for unrestricted use shall meet the contamination limits provided by the LRSO or NAVSEADET RASO.

n. Any injury sustained in a contaminated area shall be reported to the RSO and evaluated by medical personnel.

o. Contamination control shall not take priority over medical treatment of injuries sustained in a contaminated area.

1.5.7. Control of Airborne Radioactivity

a. The design of ventilation systems associated with enclosures or areas having potential gaseous airborne radioactive material released, shall be operated and controlled

to ensure effluent releases at the boundary of the unrestricted area do not exceed the values specified in column 1 of table II of appendix B, 10 CFR 20.

b. Workers shall be monitored for occupational intake of radioactive material and an assessment made of the committed effective dose equivalent when they are likely to receive, in 1 year, an intake in excess of 10 percent of the applicable annual limit on intake (ALI) in columns 1 and 2 of table II of appendix B, 10 CFR 20.

c. No individual in a restricted area shall be exposed to airborne radioactivity concentrations that exceed the limits provided in 10 CFR 20.1201.

1.5.8. Protective Clothing and Respiratory Protection

a. Protective gloves and clothing shall be worn by personnel who work with unsealed radioactive material in a readily dispersible form (gas, liquid, or powder), or who otherwise work in a radioactively contaminated area.

b. Respiratory protection equipment used pursuant to 10 CFR 20.1702 and to limit the intake of radioactive material shall meet the requirements of 10 CFR 20.1703.

1.5.9. Leak Testing of Sealed Radiation Sources

a. Sealed sources containing more than 100 microcuries of beta-gamma emitting material or more than 10 microcuries of alpha emitting materials shall be tested for leakage or contamination at intervals not to exceed 6 months, except as specified below. Any source received by the command that is not accompanied by a certificate indicating that a test was performed within 6 months prior to the transfer shall not be put into use until tested.

(1) Hydrogen-3, other gaseous-form radioactive isotopes, and radioactive isotopes with half-lives less than 30 days are exempt from the periodic leak test requirement.

EXCEPTION: Perform leak testing of sources prior to echelon 4 and 5 repairs that replace vials and when a suspected leakage has occurred.

(2) Leak test intervals exceeding 6 months are allowed if approved in a specific or general NRC license or an NRMP. Except for commodities stored at the Defense Logistics

Agency, annual leak tests are required for NBC commodities containing radioactive materials (e.g., chemical agent monitors, detectors, etc.).

(3) Any source in storage and not being used is exempt from the periodic leak test requirement. When the source is removed from storage, it shall be leak tested prior to use or transfer.

b. The test sample(s) shall be taken from the source or adjacent surface(s) where contamination is expected to accumulate.

c. The leak test shall be capable of measuring 0.005 microcuries of radioactivity.

d. If 0.005 microcuries or more of removable contamination is measured on the test sample(s), the actions below shall be accomplished:

(1) The source shall be removed from service, decontaminated, repaired, or transferred for disposal. The source may be returned to the manufacturer when so stated on the label on the device, or when incorporated into the specific license governing it.

(2) A complete investigation of the source and extent of contamination shall be conducted.

(3) Comply with notification requirements of NAVSEA RASP Manual, applicable NRMP, or an NRC license.

e. Leak test records shall be maintained in units of microcuries or disintegrations per minute (dpm).

1.5.10. Records and Reports

a. Radiation protection program records shall include the following:

(1) Radiation protection surveys.

(2) Radiation safety audits and inspections.

(3) Radiation medical examinations, if applicable, and as required by NAVMED P-5055.

(4) All occupational radiation exposure and personnel dosimetry records.

(5) Medical records generated during the period of a radiation worker's employment.

(6) Radiation instrumentation maintenance and calibration records.

(7) Pocket dosimeter logs.

(8) Inspections of safety devices.

(9) Sealed source leak test results.

(10) Records of receipt, transfer, and inventory of radioactive material. Include results of inventory reconciliation efforts.

(11) Utilization logs for radioactive sources.

(12) Utilization logs of x-ray machines.

(13) Training and qualification records of personnel using radiation sources.

(14) Records and reports required by an NRMP.

(15) Reports and records of overexposure, accidents, and significant events.

(16) Records of information important to the decommissioning of a facility, as required by 10 CFR 30.35(g).

b. All medical records and personnel dosimetry records shall be maintained in accordance with NAVMED P-5055.

c. At a minimum, survey records shall contain:

(1) Identification of the radiation source(s) and location.

(2) Dose levels and contamination levels, as applicable.

(3) Airborne radioactivity level, if applicable.

- (4) Date and time of survey.
- (5) Instrument(s) used by type and serial number.
- (6) Calibration date of each instrument used.
- (7) Name of surveyor.
- (8) Date of review by and signature of RSO.

d. Inspections shall be documented so that radiological discrepancies and corrective actions taken are recorded, and a final review and statement of adequacy of corrective actions taken are recorded. The RSO and a more senior individual in the chain of command shall sign a final review and statement of adequacy of corrective action.

e. Records shall be retained:

(1) As specified in 10 CFR 20 (subpart L), 30.51, 40.61 and 70.51(b) for receipt, transfer, inventory, and disposal of NRC-licensed material.

(2) Indefinitely for surveys conducted to establish occupational exposure in the absence of personnel dosimetry.

(3) Indefinitely according to 10 CFR 30.35(g) to decommission facilities for unrestricted use.

(4) For at least a minimum of 3 years after termination of operations, or until the next inspection by NAVSEADET RASO; unless a longer period is specified in the NRMP, applicable section of 10 CFR, or other Marine Corps directive.

(5) For at least 3 years if not otherwise specified in Federal regulations, NAVSEA RASP Manual, or other directive.

1.5.11. Internal Audits and Inspections

a. The command RSO shall establish a formal internal audit and inspection plan that evaluates compliance with Federal and Navy regulations, NRMP conditions, and the provisions of NAVSEA RASP Manual.

b. Documented internal audits shall be conducted by the RSO or ARSO at least every 6 months unless otherwise specified in NAVSEA RASP Manual, an NRMP, or Federal regulations.

c. The internal audit and inspection plan shall include, at a minimum, evaluation of the following applicable subject areas for operations involving RADCON Program ionizing radiation sources. The audit and inspection frequency is every 6 months unless stated otherwise.

(1) Radiation medical examinations (pre-placement, re-examination, and termination, as required by NAVMED P-5055).

(2) Occupational radiation exposure and personnel dosimetry records and logs; e.g., TLD (thermoluminescent dosimeter), and pocket dosimeter.

(3) RADCON Program related training - annually.

(4) Radiological control procedures and practices - quarterly.

(5) NRMP compliance - quarterly.

(6) Receipt, transfer, and disposal of radioactive material.

(7) Required records and reports.

(8) Transportation - quarterly.

(9) Corrective actions for discrepancies identified during previous audits or inspections.

1.5.12. Decommissioning of Facilities. Prior to release of facilities used for handling, maintenance, or storage of radioactive materials or commodities for unrestricted use, the NRMP holder shall contact NAVSEADET RASO. NAVSEADET RASO will work with the command to develop and implement complete work plans to address any potential residual contamination and allow for the appropriate level of release of the facility. Commands should provide NAVSEADET RASO the following information, at a minimum:

a. Complete description of the facilities and the history of use.

b. List of radioactive materials or commodities stored or used.

c. Previous surveys and general procedures used in the facilities.

d. Reports of any accidents or incidents that may have occurred involving radioactive material.

e. Release of the facilities (for example, abandonment or reuse) is not authorized without written approval from NAVSEADET RASO.

1.6. TRANSPORTATION OF RADIOACTIVE MATERIAL. Regulations governing the transportation of hazardous material are designed to prevent undue exposures and injury to the general public during transport. For this reason, most regulations govern the design and construction of the transportation package or container. The proper packaging, labeling, and other tasks associated with the transportation of radioactive materials are complex and dependent on form, quantity, and isotope of the radioactive materials to be transported. Regulations concerning the shipment of radioactive materials are provided in 49 CFR 170-199 and 10 CFR 71. Consult with NAVSEA RASP Manual, applicable supply instructions, logistics or supply personnel, or the RADCON Office for guidance when preparing to transport radioactive materials. NAVSEA RASP Manual provides general transportation requirements. Several of those general requirements are provided in this section.

a. Prior to performing any transportation operation, each activity shall consult the appropriate section of NAVSEA RASP Manual and the current edition of 49 CFR and 10 CFR 71.

b. Each command is responsible for ensuring personnel assigned duties to perform transportation requirements receive instructions regarding the applicable sections of 49 CFR 172 subpart H and 173.1(b).

c. Department of Transportation (DOT) regulations shall apply to the movement of radioactive material outside the boundaries of an activity.

d. Transportation on military aircraft must comply with requirements of the International Civil Aviation Organization (ICAO).

e. The RSO is responsible for ensuring that all packages offered for transportation, or transported by the activity, conform to all applicable requirements of the NRMP, NRC license, NAVSEA RASP Manual, 10 CFR, and 49 CFR.

f. The supply officer and responsible officer for each activity are responsible for ensuring that all radioactive material that has been properly packaged and certified is expeditiously transported to the receiving organization.

g. A record of transfer of radioactive material shall be maintained for at least 3 years from the date the material is accepted by the carrier. At a minimum, the record shall contain the following:

(1) Verification that the receiving activity is licensed or authorized by an NRMP or an NRC license to receive the material.

(2) A copy of documentation identifying the radioactive material.

(3) For sealed sources, a copy of the current leak test certificate and a list of serial numbers for sources being transferred.

(4) A copy of the bill of lading or manifest for the shipment.

(5) A copy of the acknowledgement of receipt of the material.

1.7. RADIATION EMERGENCIES

1.7.1. Discussion. A radiation emergency can occur where radioactive materials or radiation producing equipment are used, stored, or transported. Depending upon the magnitude of events and severity of consequences, the radiation emergency can be categorized as a radiation accident or incident.

1.7.2. Requirements

a. The RSO shall prepare for the possibility of a radiation emergency by developing, testing, and maintaining a radiation emergency response plan.

b. The following conditions, situations, and occurrences shall be considered, as appropriate, in developing emergency plans:

- (1) Real or suspected personnel overexposure.
- (2) Personnel contamination.
- (3) Unauthorized or accidental entry of personnel into a controlled area.
- (4) Spills of radioactive material.
- (5) Theft or loss of radioactive material or machines that produce ionizing radiation.
- (6) Unplanned release of radioactive material in the environment.
- (7) Receipt of packages with excessive contamination or radiation levels.
- (8) Failure of safety devices to function properly, such as interlocks not terminating exposure.
- (9) Failure of exposure or radioactive device components to function properly.
- (10) Discharges or spills of material or fluids that might be considered pollutants which endanger critical water areas, have the potential to generate public concern, become the focus of enforcement action, or pose a threat to public health or welfare.
- (11) Events involving radioactive material or radiation exposure which do not present a hazard to life, health, or property; but which are of such nature as to warrant immediate notification of cognizant higher command.
- (12) Incineration of radioactive materials.
- (13) Violations of operating procedures required by the NRMP or an NRC license.

c. Procedures shall identify conditions constituting an emergency, list by priority individuals and departments to be notified (primary and alternates) during duty

hours and off-duty hours, radiological exposure control, and actions to be taken to include responsibility for notifications.

d. Emergency plans for radioactive-material incidents and accidents shall be included in NRMP applications submitted to NAVSEADET RASO.

e. Emergency plans shall be reviewed and updated at least annually.

f. An exercise of the emergency response plan shall be conducted at least annually under realistic conditions.

1.8. REPORTING OF RADIATION ACCIDENTS AND INCIDENTS.

Situations involving NRMP or NRC-license controlled radioactive material shall require immediate voice or message notifications. Notifications of NRMP-controlled radioactive materials shall use OPREP-3 NAVY BLUE procedures specified in OPNAVINST 3100.6C. Situations involving command-held NRMP radioactive materials require that the command make notifications using the OPREP-3 NAVY BLUE process. Situations involving radioactive-commodity NRMPs shall be reported immediately to the RADCON Office. The RADCON Office must make appropriate OPREP-3 NAVY BLUE notifications for situations involving radioactive commodity NRMPs. Situations involving radioactive materials controlled by the Army must be reported immediately to the appropriate Army office. Contact the RADCON Office for assistance in determining reporting conditions and requirements. Enclosure (2) of this Order provides telephone numbers for key points of contact.

1.9. EXTERNAL AUDITS AND INSPECTIONS

1.9.1. Notice of RASP Inspections. As required by OPNAV Instructions 6470.3 and 5100.18A, NAVSEADET RASO audits and inspects all RASP radiation safety programs to determine compliance with Federal and Navy regulations, the provisions of NAVSEA RASP Manual, and the requirements of any applicable NRMP. In addition, as required by NRMP conditions and this Order, the USMC RADCON Office will audit and inspect RADCON Programs to ensure compliance with NRMP and regulatory requirements. An inspection may be announced or unannounced. Commands will normally be notified prior to an inspection. It should be noted that under the conditions of the NRC Master Materials License issued to the Navy, the NRC reserved the right to conduct inspections of the Navy program, including Marine Corps commands with an NRMP and/or radioactive commodities, at times and places

the NRC considers appropriate. Requirements and conditions are provided in the following paragraphs:

a. The command to be inspected is responsible for coordination of announced inspections. Written acknowledgement and the name and telephone number of a designated command representative shall be provided upon receipt of inspection notification. Inspection coordination includes scheduling a pre-inspection briefing with the commanding officer, officer in charge, or designated representative, and obtaining access authorizations or badges. If applicable, the command shall ensure that local radiation health personnel are informed.

b. During the in-briefing, the inspector shall be provided a detailed listing, to include building numbers or site locations of all RADCON Program operations, an accurate inventory of RADCON Program ionizing radiation sources, and, where applicable, the license or an NRMP number which authorizes the operation.

c. The command shall make available to the inspector any records; logs; or other documents necessary to demonstrate compliance with applicable Federal; Army; and Navy regulations; NAVSEA RASP Manual; and the NRMP, and shall be prepared to demonstrate the safe use of ionizing radiation in applicable areas of operation.

d. The command RADCON Program RSO or ARSO shall accompany the inspector throughout the inspection. If the RSO or ARSO cannot be available, a knowledgeable replacement shall be designated.

e. When hosting inspectors from the NRC, commands authorized to use radioactive materials under the authority of a NRC license or NRMP shall cooperate fully with NRC compliance inspectors, to include making available any records, logs, or other documents necessary to demonstrate compliance with Federal regulations and license and/or NRMP conditions.

1.9.2. Inspection Protocols and Reports. The RASP system for rating the command's overall radiation safety program consists of two categories, satisfactory and unsatisfactory. Satisfactory ratings will be given to those commands where no significant radiation safety program violations are found. A rating of unsatisfactory will be given when there is an actual or substantial risk of the loss of safety or security as a result of methods or operations. Loss of safety is considered

to have occurred if conditions exist where personnel overexposure could realistically occur. Loss of security is considered to have occurred if licensed radioactive material is not maintained in accordance with NAVSEA RASP Manual, the appropriate sections of 10 CFR, or the provisions of the applicable NRMP. In general, a loss of security occurs when non-exempt quantities of radioactive materials are not secured or not under the positive control of authorized personnel. Requirements and conditions are provided in the following paragraphs:

a. Commanding officers, or designated representatives, shall be in-briefed on the scope of the inspection. At the conclusion of the inspection, the commanding officers or designated representatives will be briefed on preliminary findings, severity levels, and a projected overall radiation safety program rating of satisfactory or unsatisfactory.

b. Findings during NAVSEADET RASO inspections are rated by 1 of 5 severity levels with severity level I being the most critical. Brief descriptions of severity levels are as follows:

(1) Severity level I reflects an actual loss of safety or security. An unsatisfactory rating will result and will include immediate suspension of NRMP authorizations.

(2) Severity level II violations are also the result of the loss of safety or security; however, circumstances mitigate it from being the most severe. An unsatisfactory rating will be assigned and immediate suspension of NRMP authorization will be recommended.

(3) Severity level III violations exist when there is a realistic potential for the loss of safety or security. An unsatisfactory rating is considered for severity level III violations.

(4) Severity level IV violations are those that have more than minor safety or environmental significance. An unsatisfactory rating may be considered for severity level IV violations that are similar to previously cited violations that have not been corrected.

(5) Severity level V violations have minor safety and environmental significance and will not necessitate an unsatisfactory rating.

c. Formal written inspection reports shall be routed via the appropriate chain of command with an advance copy to the inspected activity.

d. The command shall respond to the adverse findings in writing as instructed in the inspection report. Subsequent reports of corrective actions are required at 30-day intervals until all negative findings and discrepancies are corrected.

e. Programs that received an unsatisfactory rating as the result of a NAVSEADET RASO inspection shall be evaluated for potential operation stoppage by the NRSC. All unsatisfactory programs shall be re-inspected within 6 months.

1.10. CONTRACTOR USE OF NRC-LICENSED RADIOACTIVE MATERIAL OR MACHINE SOURCES OF IONIZING RADIATION ON MARINE CORPS PROPERTY

1.10.1. Obtaining Authorization. Prior to operation of prototype or developmental systems using radioactive material or machine sources of ionizing radiation on Marine Corps property, Marine Corps commands shall provide a copy of the operating procedures and complete information; including, when applicable, copies of contractor NRC or agreement state licenses regarding system process and operation to NAVSEADET RASO and the LRSO for review. NAVSEADET RASO shall appraise the command of any radiation safety shortcomings to be rectified prior to commencing operations. Marine Corps personnel shall not be used as operators under an NRC or agreement state license issued to a contractor.

1.10.2. Contract and Contractor Requirements. Marine Corps commands engaged in negotiating contracts shall include in the terms of the contract a clause requiring compliance with requirements of NRMPs and NAVSEA RASP Manual. When applicable, contractors shall be required to provide a copy of a NRC or agreement state license or certificate of registration. For agreement state licenses, the contractor shall be required to provide written notification to the NRC Regional Office required by 10 CFR 150.20.



SECTION 2. X-RAY RADIOGRAPHY

2.1. REQUIREMENTS AND RESPONSIBILITIES. Industrial x-ray radiography represents a potential for serious radiation exposure to x-ray radiography personnel and members of the general public in the vicinity of the x-ray radiography operations. Because of this potential for personal injury, it is incumbent upon each Marine Corps activity that conducts x-ray radiography to operate their programs in strict compliance with established safety rules and NAVSEA RASP Manual requirements. NAVSEA RASP Manual provides the minimum standards for industrial x-ray radiography radiation safety. The radiation safety requirements listed in section IV for x-ray radiography are the minimum that each Marine Corps activity must meet. Individual commands are encouraged to establish additional radiation safety requirements for their respective operations as dictated by local conditions.

2.2. PROGRAM ELEMENTS. Implement local procedures in accordance with guidance provided in NAVSEA RASP Manual to ensure the following program elements are implemented and maintained:

2.2.1. Survey Instruments and Personnel Dosimetry.

2.2.2. Radiation Safety Operating and Emergency Procedures.

2.2.3. Radiation Protection Inspections and Surveys.

2.2.4. Logs and Records.

2.2.5. Reporting Requirements and Procedures.

2.2.6. Facility Requirements.

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SECTION 3. RADIAC CALIBRATION PROGRAM

3.1. PURPOSE. To provide information for establishing RADIAC equipment allowances and for determining RADIAC calibration intervals.

3.2. BACKGROUND. RADIAC is an acronym derived from "Radioactivity Detection Indication and Computation", and is a

generic term applying to radiation detection instrumentation. RADIAC instruments are used to detect and monitor radiation levels. RADIAC equipment is also necessary for protective actions and recovery procedures as part of a command's disaster preparedness capabilities and combat operations on the nuclear battlefield.

3.3. FLEET MARINE FORCES RADIAC INSTRUMENTS; COMMANDER, MARINE CORPS SYSTEMS COMMAND (SSCNBC). COMMARCORSSYSCOM (SSCNBC) is the program office that procures RADIAC equipment for the Fleet Marine Force in support of combat operations. Marine Corps table of equipment allowances (TE) lists applicable RADIAC equipment.

3.4. REQUIREMENTS AND RESPONSIBILITIES. NAVSEA RASP Manual lists the responsibilities and requirements for the NRMP RSO and senior RADIAC calibration technician and RADIAC calibration laboratory supervisor at RADIAC calibration laboratories.

3.4.1. RADIAC Calibration Laboratory RSO Requirements. The RSO shall ensure that the following elements of the Radiation Safety Program are accomplished:

- a. Physical inventory checks, radiation surveys, and contamination surveys are performed and documented.
- b. Operating and emergency procedures are written and updated.
- c. Leak tests (or wipe tests) are performed by qualified personnel.
- d. All RADIAC repair personnel receive required initial and refresher radiation safety training.
- e. Applications for amendment or renewal of NRMPs are submitted when required by NAVSEA RASP Manual.
- f. All pertinent requirements and responsibilities of an RSO as specified in the NRMP and NAVSEA RASP Manual are accomplished.

3.4.2. RADIAC Calibration Laboratory Functions. The senior RADIAC calibration technician or RADIAC calibration

laboratory supervisor shall perform or ensure qualified personnel perform the following functions:

- a. Daily prior-to-use inspections of calibration sources and related equipment; such as, interlocks, warning lights, and audible alarms.
- b. Inventories and inspections of sources and equipment.
- c. Leak tests of calibration sources.
- d. Initial and refresher radiation safety training of RADIAC repair personnel.
- e. Physical inventory checks, radiation surveys, and contamination surveys of calibration sources and work areas.
- f. Contamination surveys of all incoming RADIAC instruments.
- g. Notify appropriate personnel; such as the RSO, security, fire department, and appropriate supervisors of any planned overnight or unattended calibration operation.

3.5. PROGRAM ELEMENTS. Implement local procedures in accordance with NRMP and guidance provided in NAVSEA RASP Manual to ensure the following program elements are implemented and maintained:

- 3.5.1. Training.
- 3.5.2. Radiation Surveys.
- 3.5.3. Source Inventory, Inspection, and Maintenance.
- 3.5.4. Receipt, Survey, and Decontamination of RADIAC.
- 3.5.5. Personnel Dosimetry.
- 3.5.6. Operating and Emergency Procedures.
- 3.5.7. Source Leak Tests.

3.6. RADIAC EQUIPMENT CALIBRATION, DISPOSITION, AND LEAK TESTING

3.6.1. Calibration Intervals by End Use. Calibrate RADIAC equipment at standard intervals depending on their end-use application.

a. When using a particular RADIAC instrument for more than one end-use application, the calibration interval for the appropriate shortest calibration cycle applies.

b. Units should avoid occurrence of calibration expiration during deployments. Extension of calibration dates for deployed units using RASP end-use RADIACs shall only be granted by NAVSEADET RASO via the RADCON Office. Deploying Marine Corps units using non-RASP end-use RADIACs can request that the RADIAC calibration facility adjust the calibration interval.

3.6.2. RADIAC Calibration Services

a. RADIAC calibration and repair services are available from the Marine Corps RADIAC calibration facilities at MCLB Albany, MCLB Barstow, and Third Force Service Support Group (FSSG) Maintenance Battalion.

b. RADIAC calibration and repair services are generally available from Navy RADIAC calibration facilities at no cost to Marine Corps commands, if the RADIAC equipment is part of a NAVSEA issued RASPSAFE or RASPXRAY RADIAC equipment allowance.

3.6.3. RADIAC Disposition and Leak Testing

a. Return RASPSAFE or RASPXRAY RADIAC instruments to the nearest Navy RADIAC calibration laboratory. Contact the RADCON Office for disposition instructions for other RADIAC instruments.

b. Ship RADIAC instruments containing radioactive check sources as radioactive material, limited quantity, under 49 CFR 173.424.

c. Perform leak test, if required, per local procedures, or consult with the RADCON Office.

d. Maintain documentation of all dispositions and the results of all leak tests.



SECTION 4. RADIOACTIVE COMMODITIES

4.1. COMMODITIES CONTAINING RADIOACTIVE MATERIAL

4.1.1. Definitions

a. Radioactive material is strictly defined as any material or combination of materials that spontaneously emits ionizing radiation.

b. A radioactive commodity is an item of Government property, containing radioactivity equal to or in excess of the quantities listed in 10 CFR 20, appendix C, or contains a specific activity greater than 0.002 microcuries per gram of radioactive materials, to which a national stock number (NSN) has been assigned.

c. Several components, devices, equipment, and commodities used in the Marine Corps contain one or more types of licensed, radioactive materials. Table 4.1 provides information on selected radioisotopes, their characteristics, and general precautions.

d. Generally, there are five types of NSN-numbered commodities (see Table 4.2) containing radioactivity stocked in the supply system: electronic devices (including electron tubes), luminescent (self-illuminating) devices, ionization devices, commodities containing natural sources, and analytical devices.

Radioisotope, Characteristics, And General Precautions	Examples of Commodities
<p><u>Depleted Uranium (DU)</u> consists primarily of 3 isotopes: U-238 (99.2%), U-235 (0.72%), and U-234 (0.006%). DU, a solid metal with a 4,500 million year half-life, undergoes a complex radiological decay scheme via daughter products that emit alpha, beta, and gamma radiation. Unless there is direct contact with the skin, external radiation exposure from DU is not a significant concern. Internal radiation exposure is of concern if DU particles have been ingested, inhaled, or otherwise taken into the body.</p>	<ul style="list-style-type: none"> • DU penetrators and ammunition • Armor • Aircraft counterweights
<p><u>Hydrogen-3 (Tritium or H-3)</u> decays by emitting very low-energy beta particles that have a radiological half-life of 12.3 years. Tritium gas, in combination with a phosphor and sealed in a tube, provide a radioluminescent source for reduced-light viewing of scales, vials, compasses or other indicators on military equipment. Exposure to tritium causes no external radiation hazard but might present an internal radiation exposure hazard depending upon the amount that enters the body through absorption, inhalation or ingestion. If internalized, the residence time in the body is short, with a biological half-life of 10 to 12 days.</p>	<ul style="list-style-type: none"> • Exit markers and signs • Lensatic compasses • Muzzle reference sensors • Fire control quadrants, alignment devices, telescopes, and sight mounts
<p><u>Nickel-63 (Ni-63)</u> has a half-life of 92 years and undergoes radioactive decay by emitting beta particles. Similar to tritium, it is difficult to detect because of its low-energy (weak) beta particles and no gamma-/x-ray emissions; Ni-63 does not present an external hazard; potential exists for internal contamination via inhaling or ingesting small particles that leak from the sealed sources. Leak or wipe tests are required to verify that the devices are intact and are not contaminated.</p>	<ul style="list-style-type: none"> • Chemical agent monitors (CAMs) • Automatic chemical agent detector alarms (ACADAs)
<p>Thorium-232 (Th-232) is a naturally-occurring radionuclide found in a number</p>	<ul style="list-style-type: none"> • Anti-reflective coating on

<p>of manufactured articles; such as, incandescent gas mantles, electron tubes, lamps, certain types of welding rods, optical coating on lenses, and magnesium-thorium and nickel-thorium alloys in aircraft/missile engine and structural components. Multi-layer anti-reflective optical coating on thermal imaging lenses for the Forward Looking Infrared System (FLIR) and on Night Vision Devices (NVD) use Th-232 Fluoride (ThF₄). Th-232 has a very long half-life of 14 billion years. Like uranium and radium, the radiological decay scheme is complex and involves emissions of gamma, alpha, and beta radiation. Internal and external exposure hazards are similar to that of DU. Periodically monitor industrial workplaces where overhaul of equipment containing thorium alloys may have inadvertently generated thorium contamination.</p>	<p>thermal imaging lenses</p> <ul style="list-style-type: none"> • Aircraft/missile components • Thoriated tungsten electrodes • Welding rods, lamps, mantles, and tubes
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Table 4.1.--Selected Radioisotopes, Characteristics, and General Precautions for Commodities.

Radionuclide and Sources	Half-life	Radiation Energy (MeV)			Means of Detection *
		Gamma	Beta	Alpha	
AMERICIUM-241 (Am-241) Ionization Devices and Alarms (Examples: smoke detectors)	432 yrs.	0.059	None	5.44 5.49	2, 4
CADMIUM-109 (Cd-109)	1.3 yrs.	0.088	None	None	3
CARBON-14 (C-14) Electronic Devices	5730 yrs.	None	0.156	None	Lab only
CESIUM-137 (Cs-137) Electronic Devices, Ionization Devices, and Electron Tubes (Ex: Moisture density gauges)	30.17 yrs.	0.662	0.512	None	1, 2, 3
COBALT-60 (Co-60) Electronic Devices, and Ionization Devices	5.27 yrs.	1.17 1.33	0.318	None	1, 2, 3
NICKEL-63 (Ni-63) Ionization Devices, Electronic Devices, and Electron Tubes (Ex: Chemical Agent Monitors)	100 yrs.	None	0.066	None	Lab only
POLONIUM-210 (Po-210) Ionization Devices (Ex: static eliminators)	138.38 days	0.803	None	5.30	1, 2, 3, 4
PROMETHIUM-147 (Pm-147) Luminescent Devices	2.62 yrs.	0.121	0.224	None	1, 2, 3
RADIUM-226 (Ra-226) Luminescent Devices **, Electron Tubes **, and Electronic Devices (Ex: radar equipment, analytical devices, ionization devices, and natural sources)	1600 yrs.	0.186	None	4.78	1, 2, 3, 4
STRONTIUM-90 (Sr-90) Luminescent Devices, ice detectors, IBIS, and Electron Tubes	29 yrs.	None	0.546	None	1, 2

TECHNETIUM-99 (Tc-99) Ionization Devices	2.13 $\times 10^5$ yrs.	0.090	0.293	None	1, 2
THORIUM-232 (Th-232) Ionization Devices, Welding Rods, and Electron Tubes	1.4 x 10^{10} yrs.	0.059	None	3.95 4.01	1, 2, 3, 4
TRITIUM (Hydrogen-3 or H-3) Luminescent Devices (Ex: Fire control devices)	12.3 yrs.	None	0.019	None	Lab only
URANIUM-238 (U-238) Naturally Occurring (Ex: firebricks, building materials, shielding materials, ceramics), Munitions, and Counter weights	4.468 $\times 10^9$ yrs.	0.496	None	4.15 4.196	1, 2, 3, 4
<p>* MEANS OF DETECTION:</p> <ol style="list-style-type: none"> 1. IM-247 Series (e.g., E-140N). 2. AN/PDR-27 or equivalent. 3. PRM-5N/SPA-3, GRM-595 or IM-253/DT-640 Scintillation Ratemeter Probe. 4. AN/PDR-56 or equivalent. <p>** Luminescent devices containing radium-226 are obsolete and should be purged from the system.</p>					

Table 4.2.--Radionuclides in NSN-numbered Commodities.

4.1.2. Radium, Radon, and Miscellaneous Sources

a. Radium 226. Radium 226 is a naturally occurring radioisotope extensively used in a variety of applications and as a source for radioluminescent paint on gauges and dials aboard ships, aircraft, and other military equipment from World War I to the mid-1960's. Tritium and promethium have replaced radium as significantly less hazardous isotopes of choice for radioluminescent sources.

(1) Radium 226 has a half-life of 1,602 years. The radioactive decay of radium and its daughters emits a series of alpha, beta and gamma radiation. Some of the emitted beta particles and gamma rays have penetrating energies between 1.0

to 1.5 MeV and will be a source of external radiation exposure. Radium produces Radon-222 during its decay and this gas may be of concern if storing large quantities of unsealed radium sources in non-ventilated or closed spaces. Internal body contamination can occur from ingestion of radium particles from flaking of the radioluminescent paint.

(2) The extensive use of radium over many years, especially in electronic switches, knobs, markers and gauges, means it is economically and logistically difficult to replace all existing components containing radium. The goal of eliminating use of radium in the military is being pursued through the phase out of existing equipment, component replacements that do not contain radium, and radium procurement restrictions. Joint services guidance prohibits procurement of radium except in unusual cases. Marine Corps prohibits existing replacement-part inventories of radium containing components from issue or use if non-radium substitutes or replacement parts are available or obtainable. Submit requests to procure or use radium, or to use or issue radium containing components from inventories, to CMC (SD) after obtaining review endorsement by the LRSO.

(3) RSOs and/or RPAs should locate and dispose of unneeded or unnecessary items containing radium. These items are usually found in storage rooms and shelves in work spaces containing older equipment items. Gamma radiation from radium sources is easily detectable, even though the radium source no longer produces light due to damage of the luminous material by alpha particle bombardment. Thoroughly check old vehicles, aircraft, and equipment for removal of all radium containing gauges to prevent spread of radium contamination and risk to clean-up crews. Removal of radium devices from equipment items must be under the direction of an RSO because of the need for contamination measurements and control. Exercise extreme care when directly handling radium radioluminescent sources since the luminous paint, or the plastic and rubber material used as a base, may have become very brittle from molecular damage by alpha-particle bombardment.

b. Radon 222. The radioactive decay of Radium-226 produces Radon-222. Radon is an inert gas with a half-life of 3.8 days, and radon itself is of little significance. However, there are four short lived daughters of radon: polonium-218 with a 3.05 minute half-life, lead-214 with a 26.8 minute half-life, bismuth-214 with a 19.7 minute half-life and polonium-214 with a 0.15 millisecond half-life. These four

daughter products are chemically active particles, and attach themselves to dust particles, walls, furnishings, clothing; and, if inhaled, to the tissues of the lungs.

Air filters, or any dust collecting material placed in a constant flow of air, accumulate these daughter products. Relatively high radiation levels can accumulate at the surface of such filters and should not be a cause for alarm or an indication of abnormal conditions. On removing the filters from the air flow, the radioactivity quickly disappears due to the short half-lives of the radon daughters. This rapid decrease in radiation levels on a filter removed from a constant air flow path, is a positive indicator that the radiation levels were attributable to naturally occurring radon. Also, stagnant weather conditions can allow a build up in airborne radon levels that may show as increased readings on radiological air monitoring instruments.

c. Moisture-Density Meters. Portable moisture density gauges measure the density and moisture content of soils, soil-stone aggregate bases, cement and asphalt treated bases, and asphalt paving. Commonly used radioisotopes in these gauges are cesium-137 as a gamma source and americium-241:beryllium as a neutron source.

(1) Individual commands must obtain an NRMP as authorization for possession and use of these gauges. Primarily, these commands will be Navy Construction Battalions and Marine Corps Engineer Support Battalions.

(2) Authorization for these gauges include specific requirements for establishing a command radiation protection program and formal training of a designated RSO.

(3) Submit requests for issuance of an NRMP, for Marine Corps commands, for moisture density meters in accordance with NAVSEA RASP Manual, via the LRSO and CMC (SD).

d. Electron Tubes. Numerous types of electron tubes contain small amounts of various radioactive materials. Unless otherwise specified for a particular type of electron tube, the radioactive materials in these tube are usually licensed exempt under 10 CFR 30.15(a)(8). The following general precautions apply.

(1) Periodically survey storage rooms with large numbers of electron tubes containing radioactive material

with low level gamma survey meters. In some cases involving large quantities, it may be necessary to redistribute the tubes among different shelves or bins.

(2) Wear rubber or disposable plastic gloves when cleaning up the debris from broken tubes containing radioactive material. If suspecting skin contamination, wash hands with soap and water.

(3) With RSO concurrence, dispose of electron tubes containing exempt quantities of radioactive material as normal trash when replacing defective tubes during repair operations, as long as large numbers of tubes simultaneously in one location are not disposed of. If generating large collections of tubes for disposal at electronic maintenance activities, or if state or local jurisdictions prohibit disposal of any amount of radioactive material, then dispose of the tubes as radioactive waste. Refer to paragraph 4.5.7 of enclosure (1) for disposal procedures.

e. Historical Displays and War Trophies. Marine Corps museums and installations have received for display purposes, multiple military items of foreign and domestic origin. Many of these items contain radioactive devices or radioactive painted surfaces. Contact CMC (SD) for information on proper handling and disposal of these items.

4.2. RADIOACTIVE SOURCES IN AIRCRAFT

4.2.1. General Information. Various aircraft components may contain radioactive material. This section does not describe all the sources of radioactive materials installed on Marine Corps aircraft. Refer to the applicable supply, technical, NRMP, or regulatory guidance for the specific conditions that must be met. Conditions and guidance found in applicable NRMP or regulatory documents take precedence over guidance provided in this Order.

4.2.2. NRMP Coverage. NRMP Number 19-00019-T4NP, issued to the Naval Air Systems Command, Patuxent River, MD, 20670-1547, controls sealed-sources use on various aircraft components. Some of those sources include the following:

a. Drogue Markers for Nighttime In-Flight Refueling, NSN 1680-00-793-7994, 25 millicuries of krypton-85.

b. Drogue Markers for Nighttime In-Flight Refueling, NSN 1680-01-208-0417, 500 millicuries of tritium.

4.2.3. Generally-Licensed Devices. The following generally licensed devices may be found on Marine Corps aircraft:

a. External Wind Direction Indicators

NSN 6260-99-996-9563, 0.23 curies of tritium
NSN 6260-99-996-9568, 0.4 curies of tritium

b. Aircraft Exit Markers

NSN 1560-00-022-9002, 90 millicuries of tritium
NSN 9905-00-705-3765, 50 millicuries of tritium

c. Ice Detector Probes

NSN 1660-00-010-1421, 50 microcuries of strontium-90
NSN 1660-00-919-0419, 50 microcuries of strontium-90
NSN 1660-00-077-8473, 50 microcuries of strontium-90

4.2.4. In-Flight Blade Inspection System (IBIS)

a. The IBIS is installed on H-53 helicopter rotor blades to provide in-flight warning of low-blade gas pressure. A sealed source containing 500 microcuries of strontium-90 (Sr-90) remains in a shielded condition when blade pressure is normal and extracts from its shielded condition, only when losing blade pressure or pressing the manual test button. When in the unshielded position, detectors sense the increased radiation levels and activate a warning light in the cockpit.

b. The dose-rate level when the Sr-90 source is in the shielded position is approximately 0.8 mR/hr at 3 inches from the IBIS indicator. When the source is exposed in the unshielded position, the dose rates are approximately 150 mR/hr at 8 inches, 30 mR/hr at 18 inches and 7.5 mR/hr at 3 feet.

c. When rotor blades are damaged during aircraft mishaps, locate and secure any unshielded IBIS sources to reduce exposure to investigators and salvage crews, if possible.

d. The IBIS system is NRC generally-licensed. The IBIS technical manual contains user requirements for storing, shipping, installing, and testing the IBIS.

4.2.5. Leak Tests. With the exception of the IBIS, there are no leak test requirements for the above aircraft sources, except when damage has occurred or leakage is suspected.

4.3. DEPLETED URANIUM (DU): MUNITIONS, ARMOR, AND COUNTERWEIGHTS

4.3.1. Definition. DU is a heavy metal used as a ballast or counterweights in aircraft gyroscope assemblies, flight control surfaces, helicopter blade assemblies, elevator balance assemblies, aileron balance assemblies, etc., in aircraft, rockets, projectiles, and missiles; and as penetrators in certain ammunition. DU is natural uranium that has most of the uranium-235 and uranium-234 atoms removed. Physical properties that make DU metal useful in various applications are its high density and strength, ease and relatively low costs of fabrication, and its availability. Consult NAVSEA RASP Manual for discussions and requirements regarding the storage, handling, and use of DU in the Navy and Marine Corps.

4.3.2. Internal Contamination. The potential for internal contamination exists from handling severely damaged DU munitions, from debris from fires or explosions involving DU, from targets or firing ranges impacted with DU munitions, and from any cutting, sanding, or drilling of DU metal. When involved in fires, DU may oxidize and produce a downwind plume of DU oxide dusts, especially when accompanied by explosions.

4.3.3. DU Munitions. The NRMP Number 13-00164-L1NP, issued to Commanding Officer, Naval Weapons Support Center, Crane, IN and Army License SU-1380, control DU munitions used in the Marine Corps, which are listed below. The NRMP authorizes the possession, use, and deployment of the following Navy and Marine Corps DU munitions during armed conflicts only, while the Army License covers acquisition and storage alone. All Marine Corps commands that store or handle DU ammunition shall comply with all requirements contained in the NRMP and the NRC license.

<u>Cartridge Round</u>	<u>DODIC</u>	<u>DU/Round</u>
25 mm PGU-20/U API	A979	148 grams
25 mm PGU-20	A983	148 grams
105 mm APFSDS-T (DU) M774	C523	3364 grams
105 mm APFSDS-T (DU) M833	C524	3668 grams
120 mm APFSDS-T (DU) M829	C786	3945 grams
120 mm APFSDS-T (DU) M829A1	C380	4600 grams

(DODIC is the DOD identification code.)

a. NRMP Number 13-00164-L1NP authorizes:

(1) Long-term storage of DU munitions as war reserve material at DOD and host-nation facilities that also store Navy and Marine Corps conventional ammunition.

(2) Operational and temporary storage of DU munitions at bases and stations, maritime pre-positioning ships, naval vessels, and other DOD facilities in quantities sufficient to support Navy and Marine Corps operations.

b. NRMP Number 13-00164-L1NP does not authorize firing of DU munitions by Marine Corps commands or installations for training, testing, or any non-combatant use.

c. Store and handle DU munitions using procedures, equipment, and facilities appropriate for conventional munitions.

d. Do not dispose of unserviceable DU munitions by burning or detonating. Obtain disposition instructions from COMMARCORSYSCOM (PM AMMO, Ammunitions Program Manager). Personnel who handle damaged DU munitions should wear heavy gloves, wash their hands thoroughly afterwards with tepid water, and have any cuts in their skin sustained while handling DU munitions examined promptly by a medical officer.

e. DOT exemptions shall constitute exemption from transportation requirements of NAVSEA RASP Manual. Transport DU munitions as conventional ammunition.

4.3.4. DU Armor. NRC License Number SUB 1536 issued to Commander, U.S. Army Tank - Automotive and Armaments Command (TACOM) authorizes Army and Marine Corps possession and use of the DU material with transuranics and technitium-99 incorporated in the heavy armor of the Abrams M1 series tanks. This license restricts repair or replacement of DU armor only to Anniston Army Depot.

a. The DU armor is in all M1A2 tanks (NSN 2350-01-328-5964 LIN T13305) and in M1A1 tanks (NSN 2350-01-187-1095 LIN T13168) manufactured in mid-1988 and beyond. Turret serial numbers having "U" as a suffix identify M1 series tanks incorporating DU inside the heavy armor. A corrosion resistant cover, a stainless steel security container, and case of welded armor steel plating surround the DU armor components. The

actual design, manufacturing processes, and specific location of the M1 series armor DU component is classified.

b. When the hatch is closed, there is no measurable radiation exposure to the tank commander, loader, or gunner from intact DU armor when inside the tank. The maximum radiation levels on contact with any external surface will be less than 1.5 mrem/hour. With DU munitions onboard and the ammunition doors closed, exposure levels will be less than 0.03 mrem/hour. Radiation levels at the driver's head, without a helmet, can range from 0.09 to 0.16 mrem/hour when the hatch is open and the gun in the firing position, or when the gun is in the travel position and the bustle contains DU munitions.

c. There are no RADCON or radiation restrictions applied to M1A1 tanks containing DU armor, except for accidental situations that may expose the DU components. Paint stripping, sandblasting, or repainting of the armor plating covering the DU components is allowable, as long as there is no penetration of the encased DU components. Consult with TACOM representatives for directions.

4.3.5. DU Counterweights. DU counterweights are exempt from NRC licensing regulations per 10 CFR 40.13(c) (5). Conditions of this exemption prohibit any chemical, physical, or metallurgical treatment or processing of the counterweights, other than repair or restoration of any plating or other coverings. Installed DU counterweights in aircraft and missiles may be located without disassembly by using a sensitive RADIAC instrument to detect the low-energy gamma rays. Obtain specific authorization for disposing of or transferring DU counterweights from NAVSEADET RASO.

4.4. PROTECTION OF PERSONNEL HANDLING RADIOACTIVE COMMODITIES

4.4.1. Responsibility. Unit commanders, RSOs, supervisors, and individual radiation workers share responsibility for minimizing radiation exposure and controlling radioactive materials. This responsibility includes orientation and indoctrination of personnel who are subject to occupational exposure to ionizing radiation; promulgation and implementation of applicable directives and standard operating procedures; provision for personnel dosimetry, medical examinations, RADIAC instrumentation, and specialized equipment, when required; and the fostering of a work environment that encourages an emphasis on maintaining occupational radiation exposure ALARA.

4.4.2. Requirements

- a. All radiation workers and limited radiation workers shall be trained and records maintained in accordance with NAVSEA RASP Manual and/or an NRMP, an NRC license, or applicable regulatory requirements.
- b. Control procedures shall be developed for the protection of personnel handling radioactive commodities (e.g., shipment, inspection, storage, use, maintenance, and disposal operations).
- c. All activities whose personnel handle radioactive commodities shall prepare standard operating procedures. These procedures shall be tailored to the operation being performed and the type of commodities handled.
- d. Personnel exposure to ionizing radiation shall be maintained ALARA and shall conform to the requirements of NAVSEA RASP Manual.
- e. Removable, loose radioactive contamination in all areas shall not exceed the limits of NAVSEA RASP Manual.
- f. Written standard operating procedures that specify measures to minimize internal hazards from such operations as handling leaking sources, repairing broken radioactive commodities, working in contaminated areas or in airtight storage areas containing leaking gaseous sources, and responding to incidents or accidents shall be prepared.
- g. Smoking, eating, drinking, and chewing shall be prohibited in areas where radioactive materials are stored or handled.
- h. Storage of food, beverages, tobacco products and materials, cosmetics, and eating and drinking utensils shall be prohibited in areas where radioactive materials are stored or handled.

4.5. RADIOLOGICAL CONTROLS PRACTICES AND PROCEDURES

4.5.1. Administrative Controls. All activities handling, storing, stocking, or performing maintenance on radioactive commodities shall develop administrative controls to:

a. Assure safe handling, storage, and shipment of radioactive commodities.

b. Assure safe operation of repair and maintenance facilities handling radioactive components, where applicable.

c. Assure procedures are prepared for handling credible emergencies during receipt, storage, maintenance, and shipment.

d. Report defective radioactive commodities to the Material Inventory Control Point or the LRSO.

e. Comply with all applicable directives for the disposal of excess, surplus, and condemned radioactive commodities and/or radioactive waste.

f. Conduct a physical inventory of applicable radioactive commodities in accordance with an NRC license or NRMP requirements.

g. In conjunction with each physical inventory, ensure that a person other than the custodian conducts an audit of the general radioactive material accountability system. This audit (inventory reconciliation) shall include a comparison of the results of the previous inventory, after deletion of all items transferred or shipped from the organization and addition of all items received by the organization, with the current inventory results. This audit shall also include a visual search for any radioactive material that is not accounted for. Discrepancies shall be reported in writing to the commanding officer. All discrepancies shall be investigated and resolved. Complete audit reports together with reports of corrective action shall be reported to the LRSO and shall be retained for 3 years or until the next inspection from NAVSEADET RASO or the LRSO.

h. The supply and the stocking activity, where appropriate, shall establish a computer inventory program for radioactive commodities. The program shall be able to print out

all radioactive commodities in storage by NSN, hazard code, and name; and, if available, quantity, radioisotope, activity, location, and status. The RSO shall be able to obtain this printout upon request and distribute to emergency support elements as required.

i. All lost, missing, or stolen radioactive material shall be reported immediately to the LRSO. The LRSO shall make timely reports to the NAVSEADDET RASO and CMC (SD).

j. All radioactive commodities shall be marked with a label or sign containing the three-bladed radiation symbol and the words, "Caution - Radioactive Material", along with the isotope and activity, if known. MIL-STD 129 (Military Standard Marking for Shipment and Storage) applies.

4.5.2. Storage and Storage Areas

a. Radioactive materials and commodities shall be stored in locked areas with the number of keys and the individuals with access to the keys kept to a minimum.

b. All storage areas containing radioactive materials and commodities, and entrances to such areas, shall be labeled with signs containing the three-bladed radiation symbol and the words "Caution - Radioactive Materials". When appropriate, signs, either permanent or temporary, shall be securely fixed to barriers, walls, doors, fences, or ropes. Outdoor storage of M1 series tanks, howitzers, and other large equipment items containing radioactive materials is exempted from these labeling requirements.

c. Areas used for storage of radioactive commodities shall be kept to the minimum for adequate control.

d. Radioactive commodities shall not be stored in the same warehouse section with explosives, flammable materials, photosensitive items (e.g., photographic film), food products, or other incompatible commodities.

e. Radioactive materials shall be stored so that they are protected from adverse weather or conditions that may deteriorate the packaging materials.

f. Commodities that contain radioactive gases, tritium-containing devices, or radium shall be stored in ventilated structures.

g. Boundaries of the storage area shall be surveyed and checked whenever new packages are received to determine proper warning signs. Radiation levels at the boundary shall not exceed 0.5 mrem per hour.

h. "Caution Radiation Area" and "Caution High Radiation Area" signs shall be placed, when applicable, at each entrance and other locations surrounding such areas.

4.5.3. Fire Protection Practices. Proper selection of a fire resistant storage area for radioactive material will minimize release of radioactivity to the environment in the event of a fire. The following considerations and practices shall be observed when selecting storage areas for radioactive materials:

a. Whenever feasible, radioactive materials shall be stored in fire-resistant containers to minimize contamination spread.

b. Smoking, eating, drinking, and chewing shall not be permitted in radioactive material storage areas.

c. A current list of locations where radioactive materials are stored shall be available to personnel who might be called to fight a fire in such areas. This list should also identify unusual problems.

d. Semi-annual inspection of radioactive material storage areas shall be made to identify fire hazards by personnel trained in fire protection procedures. Deficiencies shall be promptly corrected.

4.5.4. Contamination Control. Contaminated items are often stored in one or multiple plastic bags which may break. Liquid, inadvertently left in a container may leak out, and condensation of moisture from the atmosphere, may drip on exposed, contaminated surfaces. Unless all contaminated surfaces of stored materials are appropriately wrapped or contained to prevent the spread of contamination, the entire storage location shall be considered potentially contaminated. When all contaminated surfaces are appropriately wrapped, personnel may walk through these areas without anti-contamination clothing. Anti-contamination clothing or equipment may include outer and/or protective devices or garments such as coveralls, gloves, face masks, face/body

shields, boots, shoe coverings, hoods, breathing devices, and other personal protective equipment.

a. Personnel in potentially contaminated storage areas, particularly if they handle contaminated materials, shall wear necessary anti-contamination clothing.

b. Reasonable care shall be taken in packaging and storing contaminated items to prevent the spread of contamination, and to ensure that entry to areas where such storage is permitted, does not result in the contamination of personnel or other areas.

4.5.5. Storage of Calibration and Test Sources.

Radioactive materials, particularly calibration and test sources, which contain more than 1 millicurie of radioactivity and can be easily stolen or mishandled because of their small size, require special precautions.

a. Small radioactive sources containing more than 1 millicurie of activity shall be stored in locked areas or cabinets, access to which is limited to authorized individuals.

b. Small RADIAC calibration or test sources shall be attached to encumbering devices, such as large rings, mounting boards, or storage boxes to the extent practical so as to not interfere with normal use of the source.

4.5.6. Radiation Surveys

a. Surveys of all areas where NRMP radioactive commodities are used or stored shall be performed at least every 6 months, and maintained for 3 years.

b. Radiation protection surveys shall document the following:

(1) Location and extent of any radioactive contamination and radiation levels, appropriateness of boundaries, signs, markings, and protective equipment and procedures.

(2) Corrective action(s) taken to correct observed deficiencies.

(3) Date of survey, model, serial number, and date of calibration of RADIAC or other instrument; and name and signature of surveyor.

c. Results of surveys shall be reported to operating supervisors with recommendations for corrective actions as necessary.

d. Closeout radiation surveys shall be made and documented for all storage, use, and maintenance locations when operations involving NRMP radioactive commodities have terminated. Contact the LRSO for guidance if residual contamination is found. When requested, surveys shall be forwarded to the LRSO, and shall be kept on file for 3 years.

4.5.7. Surplus Radioactive Commodities

a. Surplus radioactive commodities shall not be transferred to the Defense Reutilization and Marketing Office, but shall be retained until disposition instructions are received from the inventory control point.

b. Items that cannot be decontaminated or repaired shall be disposed of. Contact NAVSEADET RASO to coordinate the disposal of radioactive wastes.

c. Surplus items containing radioactive material shall be disposed of as radioactive waste when the inventory control point or owning activity determines that any other method of disposal is not in the best interest of the government.

d. All radioactive waste shall be disposed of through the Navy Low-Level Radioactive Waste Disposal Program managed by NAVSEADET RASO. Under no circumstance shall material marked as "radioactive" be disposed of as uncontrolled refuse for incineration or burial in unrestricted landfills.

4.6. RECEIPT AND SHIPMENT OF NRC-LICENSED MATERIALS. Refer to applicable local operating procedures, NRMP, Army NRC license, or other applicable guidance for specific requirements and procedures.

4.6.1. Receipt of Materials Not Meeting Excepted Package UN 2910 Requirements

a. To the maximum extent possible, all materials shall be received in a single location.

b. Only designated and qualified personnel shall receive or handle the material.

c. Supply activities that expect to receive packages containing more than type A quantities as listed in 49 CFR 173.435, shall make arrangements:

(1) to receive a package when it is offered for delivery by the carrier; or

(2) to be notified by the carrier when a package arrives at the carrier's terminal and to pick up the package as soon as possible after notification.

d. All packages containing radioactive material shall be surveyed as soon as possible after being received in an incoming shipment. When the package shows signs of damage (crushed, wet, or visible damage), the vehicle shall be monitored for contamination. The vehicle shall not be released until contamination is reduced to the level specified in 49 CFR 173.443.

e. Shipments shall be examined to determine if there is any leakage from contents or apparent damage. If damage or leakage is suspected, the RSO shall be notified immediately and the package shall not be moved or further handled, except as directed by the RSO.

f. Shipping documents shall be examined to insure that they are properly prepared in accordance with Navy, NRC, and DOT requirements.

g. Packages containing NRC-licensed radioactive material shall not be opened unless directed by the RSO as a result of package damage or discrepancy.

4.6.2. Receipt Surveys

a. Each package labeled as containing radioactive material and not exempt as specified below shall be monitored for removable external surface contamination within 3 hours if received during working hours, or not later than 3 hours from the beginning of the next working day if it is received after normal working hours.

(1) The following packages are exempt from surface contamination monitoring:

(a) Packages containing no more than 10 millicuries of radioactive material consisting solely of tritium, carbon-14, sulfur-35, or iodine-125.

(b) Packages containing only radioactive material as gases or in special form.

(c) Packages containing only radioactive materials in other than liquid form and not exceeding the type A (10 CFR) quantity limit.

(d) Packages containing only radionuclides with half-lives of less than 30 days and a total quantity of no more than 100 millicuries.

(2) If removable radioactive contamination exceeds 0.01 microcuries per 100 square centimeters of package surface, notify the RSO and LRSO immediately. Reporting requirements are provided in NAVSEA RASP Manual.

b. Each package of radioactive material containing more than type A quantities (except for packages in exclusive use vehicles) shall be monitored for radiation levels at the surface and 3 feet (one meter) from the package. The monitoring shall be conducted within 3 hours if received during normal working hours or within 18 hours if received after normal working hours. If the radiation level exceeds 200 mR/hour at the surface or 10 mR/hour at 3 feet, notify the RSO and LRSO immediately. Reporting requirements are provided in NAVSEA RASP Manual.

4.6.3. Shipment

a. The supply activity shall verify consignee authorization to receive the radioactive material. This is an NRC or state license for commercial firms or a NRMP for Navy and Marine Corps commands as required by 10 CFR 30.41.

b. Before shipment, the packages shall be inspected for damage, leakage, and radiation level and for proper classification, marking, labeling, shipping papers, and certification.

c. The supply activity shall formally notify the consignee or transportation officer by priority message or

equivalent method at least 24 hours prior to the expected arrival of the package at the consignee.

4.7. EMERGENCY ACTIONS AND PROCEDURES

4.7.1. General Information

a. The primary object of emergency actions shall be the protection of personnel from hazards to life and limb as during a fire or when high-level radiation sources are present. The secondary consideration should be the confinement of the contamination to the local area of the incident. If there is reason to believe that personnel may have been contaminated or overexposed, such persons shall be moved to an area where necessary decontamination and medical assistance can be furnished.

b. Prior plans shall be made in anticipation of radiological emergencies, in order to minimize exposure of personnel and spread of contamination. Such plans shall be written, coordinated, and rehearsed with all support organizations (fire, police, medical, maintenance, repair, damage control, and public personnel, as appropriate) and transport carriers to which the material is being tendered for transport. Such applicable procedures that are adopted shall be written and distributed to support organizations listed above, supervisors, and foremen.

c. Fire among or near radioactive commodities might produce airborne radioactivity. Personnel should avoid the smoke from such fires, unless they wear complete anti-contamination clothing and protective respiratory equipment.

d. When personnel are seriously injured, all considerations (except fire, explosion, or atmosphere dangerous to life) shall become secondary until urgent first aid is given, help for rescue (if necessary) is summoned and evacuation is completed.

e. As soon as the immediate emergency is under control, a detailed radiological survey shall be conducted of the affected area(s). Provided that the spread of contamination has been halted, priorities can be assigned to decontamination teams working in contaminated areas. An individual trained in radiological safety shall control those areas requiring control of exposure time. Assistance from outside source(s) shall be requested as needed.

4.7.2. General Emergency Procedures. The following emergency procedures shall be incorporated into written emergency operating procedures. Emergencies will generally be in the nature of spills, fires, or explosions, which could cause release, or dispersal of radioactive material over surfaces, in the air, soil, or water. In the case of emergency, the following procedures shall be followed:

a. Attempt to extinguish the fire if present and eliminate any significant radiation hazards (i.e., due to the presence of high-level radiation sources whose shielding has been compromised).

b. Stop the spill and evaluate for external radiation or contamination levels.

c. Warn all persons in the area of the emergency and evacuate the area immediately.

d. Isolate the area of the spill with cordons or physical barriers.

e. Minimize the spread of contamination and exposure of personnel to radiation and contamination.

f. Notify the fire, police, medical, and emergency personnel, if appropriate, indicating involvement of radioactive material.

g. Shut-off ventilation, heating, and air conditioning equipment if airborne contamination is present to prevent the spread of contamination. For incidents of broken tritium gas sources not involving fire, all personnel will vacate the area (or building, if appropriate) and move upwind for at least 30 minutes. If in a building, open windows and leave doors open, again, except in the case of a fire. The self-contained breathing apparatus worn by firefighters will provide short-term protection against inhalation of airborne radioactive contamination.

h. Notify the base or installation RSO (if applicable) and the LRSO. The LRSO shall notify NAVSEADET RASO and CMC (SD).

4.7.3. Contamination Control

a. Packages or devices with broken sources and any resulting debris should only be handled while wearing rubber or plastic gloves.

b. Devices with broken sources and any resulting debris should be doubly wrapped in two plastic bags and sealed with tape. Clearly label the package as containing a device contaminated with material. Retain all broken, or non-illuminating devices licensed by the Army, for disposal as radioactive waste.

c. Personnel who may have received contamination on bare skin should wash with a mild soap and plenty of tepid water. NAVMEDCOM Instruction 6470.10, available at Navy medical commands, offers useful technical guidance for handling radioactively contaminated personnel and monitoring procedures for various radioisotopes.

d. Contamination of the immediate area or on the major end item is possible based on the circumstances of the incident and on radiological measurements. Potentially contaminated areas are not to be open for normal access or potentially contaminated equipment returned to service until resolution by the RSO that radioactive contamination did not occur or reduction of contamination levels to below the allowable limits.

4.7.4. Radiological Measurements. Certain radiological measurements that are necessary to determine the absence, or the amount of radioactive contamination present, may be beyond the capabilities of the local command to perform. This is especially so in the case of radioactive tritium that, requires special liquid scintillation counting equipment that is available only at the Marine Corps Logistics Bases and Third Maintenance Battalion.

a. NBC warfare or radiological control organizations at nearby military bases, radiation safety personnel at Marine Corps Logistics Bases (MCLBs) Albany and Barstow, or from Navy Radiation Health Officers and health physicists assigned to major naval hospitals may provide technical assistance in radiological monitoring.

b. Marine Corps capabilities for analyzing wipe tests for radioactive contamination exist at the RADIAC

calibration facilities at MCLBs Albany and Barstow, and Third FSSG Maintenance Battalion. Direct liaison is authorized with the LRSO, CRSOs at MCLBs Albany and Barstow, and Third FSSG in arranging for wipe test materials and instructions for submitting wipe tests for analysis to determine contamination levels. Use of overnight or express mail allows for timely responses.

CONTACT AND NOTIFICATION INFORMATION

CONTACT INFORMATION

CNO
Chief of Naval Operations (N455)
Naval Radiation Safety Committee
Attn: Executive Secretary
2211 South Clark Place
Arlington, VA 22244-5108
Telephone Number: DSN 332-5365/2582
Commercial Number: (703) 602-5365/2582
Message Address: CNO WASHINGTON DC//N455//

COMNAVSEASYSKOM
Commander, Naval Sea Systems Command (SEA O4N)
1333 Isaac Hull Avenue SE
Washington Navy Yard, DC 20376-0001
Telephone Number: DSN 326-2414
Commercial Number: (202) 781-2414
Message Address: COMNAVSEASYSKOM WASHINGTON DC//O4N//

BUMED M3F7
Chief, Bureau of Medicine and Surgery
Attn: Radiation Health Branch
2300 E Street, NW
Washington, DC 20372-5300
Telephone Number: DSN 762-3447
Commercial Number: (202) 762-3447

NAVSEADET RASO
Officer-in-Charge, Naval Sea Systems Command Detachment
Radiological Affairs Support Office
NWS P.O. Drawer 260
Yorktown, VA 23691-0260
Telephone Number: DSN 953-4692
Commercial Number: (757) 887-4692
Message Address: NAVSEADET RASO YORKTOWN VA//001//

CMC (SD)
Commandant of the Marine Corps (SD)
Attn: Safety Division
2 Navy Annex
Washington, DC 20380-1775
Telephone Number: DSN 224-1202/3164/1077
Commercial Number: (703) 614-1202/3164/1077
Message Address: CMC WASHINGTON DC//SD//

LRSO and USMC RADCON OFFICE
Commander
Marine Corps Logistics Bases
Logistics Operations Suite 20330
Attn: Radiological Controls Office
814 Radford Boulevard
Albany, GA 31704-0330
Telephone Number: DSN 567-5511/5513
Commercial Number: (229) 639-5511/5513
Message Address: COMMARCORLOGBASES ALBANY GA//L10//

AMC
Headquarters, U. S. Army Materiel Command (AMC)
Attn: Mr. John Manfre
5001 Eisenhower Avenue
Alexandria, VA 22333-0001
Telephone Number: DSN 767-9340
Commercial Number: (703) 617-9340
Facsimile: DSN 767-9469

TACOM
U.S. Army Tank-Automotive and Armaments Command
Attn: Mr. Vernon E. Vondera, Safety Director
Rock Island, IL 61299-7630
Telephone Number: DSN 793-6499
Commercial Number: (309) 782-6499
Facsimile: DSN 793-6758

NOTIFICATION INFORMATION

- Users/Radiation Protection Assistants (RPAs) shall notify:
 - Command RSO (CRSO)/Installation RSO (IRSO) as applicable
 - Unit Commanding Officer

- CRSO shall notify:
 - Logistics RSO (LRSO)
 - Commanding General/Commanding Officer
 - IRSO as applicable

- IRSO shall notify:
 - LRSO
 - Commanding General/Commanding Officer

- LRSO shall notify:
 - NAVSEADET RASO
 - COMMARCORLOGBASES
 - CMC (SD)

- NAVSEADET RASO shall notify:
 - NAVSEASYSKOM (SEA 04N)
 - CNO (N455)
 - NRC

GLOSSARY OF TERMS

Absorbed Dose. The energy imparted to matter by ionizing radiation per unit mass of irradiated materials at the place of interest. The unit of absorbed dose is the rad. One rad equals 100 ergs per gram. The equivalent SI unit of dose is the Gray (Gy). One Gy equals 100 rads.

ALARA. Concept of controlling the possession, use, and transfer of radioactive material, or a radiation producing machine, in such a way that the total dose to the individual worker is kept as low as reasonably achievable (ALARA); considering the state of technology and the economics of improvement versus the benefits to public health and safety, and consistent with the purpose for which the activity is undertaken.

Authorized User. An individual that uses or operates a radiation source item, who has had the appropriate training, and is determined by the Radiation Safety Officer (RSO) to be qualified to work with radioactive material.

Calibration. The act of standardizing by determining the variation or deviation from a standard in order to ascertain the proper correction factors.

Centi. Numerical (metric) prefix meaning hundredth part of (1/100, 0.01, or 1×10^{-2}). Abbreviated as "c".

Command. Includes any Navy or Marine Corps facility or activity.

Contaminated Area. An area where radioactive contamination exists.

Contamination. The presence of radioactive material where it is not wanted.

Controlled Area. Any area in which radioactive materials or radiation producing devices are used or stored, and access is controlled for the protection of individuals from exposure to radiation.

Curie (Ci). A unit of radioactivity. One curie equals 3.7×10^{10} nuclear disintegrations per second (dps). The equivalent SI unit of radioactivity is the Becquerel (Bq). A Bq is equal to 1 dps. Therefore $1 \text{ Ci} = 3.7 \times 10^{10} \text{ Bq}$.

Dose. The total quantity of radiation absorbed per unit mass during a specific time period. For special purposes, it must be appropriately qualified. If not qualified, it refers to absorbed dose.

Dose Equivalent. A quantity used in radiation protection to express all radiations on a common scale for calculating the effective absorbed dose. The product of the absorbed dose in rads and certain modifying factors. The unit of dose equivalent is the rem. The equivalent SI unit of dose equivalent is the Sievert (Sv). One Sv equals 100 rem.

Dosimetry (Personnel Monitoring Device). Devices designed to be worn or carried by an individual for the purpose of detecting and measuring an individual's exposure to ionizing radiation.

Gray (Gy). The International System (SI) unit of absorbed dose. One Gy is equal to an absorbed dose of 1 Joule per kilogram (100 rad).

High Radiation Area. Any radiation area accessible to personnel where ionizing radiation levels exist such that individuals could receive a dose in excess of 100 mrem (1 mSv) in 1 hour.

Internal Audit and Inspection. A documented examination by a responsible person or management (i.e., RSO, assistant RSO, senior radiographer, supervisor, foreman, etc.) of the Radiation Safety Program, or any element thereof (training, posting, operations, procedures, records, etc.), to verify compliance with requirements and established procedures.

Internal Radiation. Radiation from a source within the body as a result of deposition of radionuclides in body tissues.

Inventory or Physical Inventory Report. A report that typically comprises the equipment model type, equipment serial number, drift tube/detector/source serial number, radioisotope, chemical and physical form, activity, date of activity, location or AAC or RUC, and custodian.

Ionizing Radiation. Electromagnetic (e.g., gamma or X rays) or particulate (e.g., alpha or beta) radiation capable of producing ion pairs in its passage through matter.

Isotope. Nuclides that have the same number of protons in their nuclei (the same atomic number) but different numbers of neutrons (different mass numbers).

Kilo. Numerical (metric) prefix meaning a thousand (1,000) times (1×10^3); abbreviated as "k".

Leak Test. A wipe test to determine if a sealed source or instrument has lost its integrity by allowing leakage of radioactive material through holes or cracks. The test is normally performed by wiping the source or instrument with filter paper or absorbent material, and evaluating the paper or material to determine the presence of radioactive contamination which indicates a leakage.

Licensed Material. Radioactive material that is received, possessed, used, or transferred under a general or specific license issued by the Nuclear Regulatory Commission (NRC).

Limited Radiation Worker. An individual who is assigned duties that may involve infrequent exposure to radiation and to radioactive material from licensed and unlicensed sources of ionizing radiation, whether in possession of the licensee or another person.

Mega. Numerical (metric) prefix meaning a million (1,000,000) times (1×10^6); abbreviated as "M".

Micro. Numerical (metric) prefix meaning one millionth part of ($1/1,000,000$, 0.000001, 1×10^{-6}). Abbreviated as Greek letter mu, "μ".

Milli. Numerical (metric) prefix meaning one thousandth part of ($1/1,000$, 0.001 or 1×10^{-3}). Abbreviated as "m".

Naval Radioactive Material Permit (NRMP). Authorization issued by the Naval Radiation Safety Committee in lieu of a specific license issued by the NRC.

Occupational Dose or Exposure. The exposure or dose received by an individual in a restricted area, or in the course of employment, in which the individual's assigned duties involve exposure to radiation and radioactive material from licensed and unlicensed sources of ionizing radiation; whether in possession of the licensee or another person. Occupational dose does not include dose received from background radiation, as a patient from medical practices, from voluntary participation in medical research programs, or as a member of the general public.

Quality Factor. A factor used for radiation protection purposes that accounts for differences in biological effectiveness between different radiations.

Rad. The unit of a radiation-absorbed dose equal to the absorption of energy in the amount of 100 ergs per gram in any material. For the purpose of this Order, 1 rad is considered to be the dose delivered by one roentgen of x-ray or gamma radiation. The term mrad refers to milli-rad or thousandth of a rad.

RADIAC. An acronym derived from "radioactivity detection indication and computation," a generic term applying to radiological instruments or equipment.

Radiation. For the purposes of this Order, any or all of the following ionizing radiations: alpha, beta, gamma or x-rays, neutrons, high-speed electrons, high-speed protons, and other atomic particles; but does not include sound or radio waves; or visible, infrared, or ultraviolet light.

Radiation Area. Area in which an individual could receive a radiation dose of 5 mrem or more in 1 hour, or 100 mrem or more in 5 consecutive days.

Radiation Incident. Unplanned loss of control of radioactive or machine sources, which results in overexposures or excessive levels, as defined in NAVSEA RASP Manual (S0420-AA-RAD-010).

Radiation Machine. Any device or equipment capable of generating ionizing radiation when the associated control panel area is operated, but excluding devices which produce radiation only by the use of radioactive materials.

Radiation Protection Survey. An evaluation of the radiation hazards incident to the production, use, release, disposal, or presence of radioactive material or other sources of radiation under a specific set of conditions; including a physical survey of the location of materials and equipment, and measurements of levels of radiation.

Radiation Safety Officer (RSO). A qualified individual, appointed by the commanding officer, who is responsible for those activities which assure adequate radiation protection.

Radiation Worker. An individual who is assigned duties that may involve frequent or routine exposure to radiation and to radioactive material from licensed and unlicensed sources of

ionizing radiation, whether in possession of the licensee or another person.

Radioactive Commodity. An item of Government property composed, in whole or part, of radioactive material; or any item that contains radioactivity equal to or in excess of limits established in 10 CFR 20, appendix C; or contains a specific activity greater than 0.002 microcuries per gram of radioactive material, and is license/NRMP exempt to the end user.

Radioactive Material. Any material or combination of materials that spontaneously emit ionizing radiation.

Radioactive Waste. Any radioactive material that meets all of the following conditions: material no longer needed or usable by the Navy or Marine Corps; materials that cannot be returned to the manufacturer; materials that require controlled disposal; and material that has been declared to be waste by an inventory control point.

Radiographer. Any individual who performs radiography or who, in attendance at the site, personally supervises radiographic operations; and who is responsible to the commanding officer for assuring compliance with the requirements of NAVSEA RASP Manual (S0420-AA-RAD-010).

Radiography. The examination of the structure of material by nondestructive methods utilizing radiation producing machines.

Radiological Accident. Loss of control of radiation or radioactive material which presents a hazard to life, health, or property; or which may result in any member of the general population exceeding exposure limits for ionizing radiation.

Rem. The unit of dose equivalent. The dose equivalent in rem is equal to the absorbed dose in rad, multiplied by the quality factor. The term mrem refers to millirem or thousandth of a rem.

Report of Physical Inventory and Reconciliation. This report typically includes: the inventory report, the total number of each item held under the NRMP or license for the current year, the total number of each item held under the NRMP or license during the previous inventory, total number of new items received since the previous inventory, total number of items disposed of since the previous inventory, and a statement summarizing the difference between the current inventory and the

previous inventory. For materials identified as lost, include copies of the reports which identified the material as lost.

Restricted Area. Any area access which is controlled by the command for purposes of protection of individuals from exposure to radiation or radioactive material.

Roentgen. The special unit of x-ray or gamma exposure. One roentgen produces 2.58×10^{-4} coulombs per kilogram of air.

Sealed Source. Any radioactive material that is encased in a capsule designed to prevent leakage or escape of radioactive material.

Sievert (Sv). The International System (SI) unit of any of the quantities expressed as dose equivalent. The dose equivalent in sieverts is equal to the absorbed dose in Gy multiplied by the quality factor (1 Sv = 100 rem).

Survey. See the definition for Radiation Protection Survey.

Unrestricted Area. Any area access which is not controlled by the command for purposes of protection of individuals from exposure to radiation or radioactive materials, and any area used for residential quarters.

ACRONYMS AND ABBREVIATIONS**ACRONYM OR
ABBREVIATION****DEFINITION****A**

AAC	Activity Address Code
ACADA	Automatic chemical agent detector assembly
ACRSO	Assistant Command Radiation Safety Officer
AIRSO	Assistant Installation Radiation Safety Officer
ALARA	As Low As Reasonably Achievable (see Glossary of Terms)
ALRSO	Assistant Logistics Radiation Safety Officer
AMMO	Ammunition
ARSO	Assistant Radiation Safety Officer

B

BRSO	Base Radiation Safety Officer
BUMED	Bureau of Medicine and Surgery
BUMEDINST	Bureau of Medicine and Surgery Instruction

C

CAD	Chemical agent detector
CAM	Chemical agent monitor
CBIRF	Chemical and Biological Incident Response Force
CFR	Code of Federal Regulations
CHBUMED	Chief, Bureau of Medicine and Surgery
Ci	Curie
cm ²	Square Centimeters
CMC	Commandant of the Marine Corps
CMC (SD)	Safety Division, Headquarters, U.S. Marine Corps
CNO	Chief of Naval Operations
COMMARCORLOGBASES	Commander, Marine Corps Logistics Bases
COMMARCORSYSCOM	Commander, Marine Corps Systems Command
COMNAVSEASYSYSCOM	Commander, Naval Sea Systems Command
CRSO	Command Radiation Safety Officer

D

DLA	Defense Logistics Agency
DOD	Department of Defense
DODIC	DOD Identification Code
DON	Department of the Navy
DOT	Department of Transportation
dpm	Disintegrations Per Minute
DRMO	Defense Reutilization and Marketing Office
DU	Depleted Uranium

E

F

FSSG	Force Service Support Group
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G

H

HAZMAT	Hazardous Materiel
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I

IBIS	In-Flight Blade Inspection System
IRSO	Installation Radiation Safety Officer
ISSA	Inter-Service Support Agreement

J

K

kVp	Maximum energy or peak x-ray tube potential during an exposure
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L

LLRW	Low-Level Radioactive Waste
LRSO	Logistics Radiation Safety Officer

M

mA	milli-ampere, filament current
MARCORLOGBASES	Marine Corps Logistics Bases
MAW	Marine Air Wing

MCLB	Marine Corps Logistics Base
MCO	Marine Corps Order
MEF	Marine Expeditionary Force
MEU	Marine Expeditionary Unit
MHG	MEF Headquarters Group
MIL-STD	Military Standard
MML	Master Materials License
mrad	milli-rad
mrem	milli-rem
mR/hr	milli-Roentgen per hour (exposure rate)
MSC	Major Subordinate Command
mSv	milli-Sievert

N

NARM	Naturally-Occurring and Accelerator-Produced Radioactive Materials
NAVAIRSYSCOM	Naval Air Systems Command
NAVMED P	Navy Medical Publication
NAVSEA	Naval Sea Systems Command
NAVSEADDET	Naval Sea Systems Command Detachment
NAVSEASYSYSCOM	Naval Sea Systems Command
NAVSUPINST	Naval Supply Systems Command Instruction
NAVSUP PUB	Naval Supply Systems Command Publication
NBC	Nuclear, Biological and Chemical
NNPP	Naval Nuclear Propulsion Program
NRC	U.S. Nuclear Regulatory Commission
NRMP	Naval Radioactive Materials Permit (see Glossary of Terms)
NRSC	Naval Radiation Safety Committee
NSN	National Stock Number

O

OPNAVINST	Operation Instruction
OPREP	Operations report

P

PM	Program Manager
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QR

RADCON	Radiological Controls
RADIAC	Radioactivity Detection Indication and

	Computation
RASO	Radiological Affairs Support Office
RASP	Radiological Affairs Support Program
RASPSAFE	Radiological Affairs Support Program, Radiation Safety
RASPXRAY	Radiological Affairs Support Program, X-Ray Radiography
RO	Responsible Officer
RPA	Radiation Protection Assistant
RSO	Radiation Safety Officer (see Glossary of Terms)
RU	Responsible Unit
RUC	Reporting Unit Code

S

SECNAV	Secretary of the Navy
SECNAVINST	Secretary of the Navy Instruction
SI	Supply Instruction

T

TACOM	U.S. Army Tank-Automotive and Armament Command
TE	(1)Table of Equipment Allowances
TLD	Thermoluminescent dosimeter

U

V

W

X

Y

Z

REPORTS REQUIRED

<u>REPORT TITLE</u>	<u>REPORT CONTROL SYMBOL</u>	<u>PARAGRAPH</u>
I. Inventory Reports	EXEMPT	5h(8), 5i(4), 5k(5), 5k(11); and encl. (1), par. 1.5.2c
II. Leak Tests	EXEMPT	5d(3), 5i(5), 5k(6); and encl. (1), par. 1.5.9(a)(2), 3.4.1c, 3.4.2c, and 3.5.7
III. Radiation Survey	EXEMPT	5h(8) and 5i(4); and encl. (1), par. 1.5.5b, 1.5.5c, 1.5.10(a)(1), 4.5.6a, 4.5.6c, and 4.5.6d
IV. NAVMED Situational and Annual Reports	EXEMPT	encl. (1), par. 1.1.1
V. Reports of Accidents and Incidents	EXEMPT	5h(8) and 5i(4)
VI. Reports of Corrective Action	EXEMPT	encl. (1), par. 1.9.2d and 4.5.1g
VII. Annual Reviews	EXEMPT	5d(12), 5i(12), and 5k(12)