



UNITED STATES MARINE CORPS  
MARINE CORPS INSTALLATIONS EAST-MARINE CORPS BASE  
PSC BOX 20005  
CAMP LEJEUNE NC 28542-0005

MCIEAST-MCB CAMLEJO 5104.1C

G-4/SAFE

MAR 06 2023

MARINE CORPS INSTALLATIONS EAST-MARINE CORPS BASE CAMP LEJEUNE ORDER  
5104.1C

From: Commanding General  
To: Distribution List

Subj: CAMP LEJEUNE RADIATION SAFETY PROGRAM

Ref: (a) MCO 5100.29C, Vol 7  
(b) Title 10  
(c) Title 40  
(d) Title 49  
(e) NAVSEA S0410-AA-RAD-010 Rev 2, Radiological Affairs  
Support Program Manual  
(f) NAVMED P-5055 Ch 1, "Radiation Health Protection Manual",  
February 3, 2011  
(g) Nuclear Regulatory Commission (NRC) Regulatory Guide 8.13,  
"Instruction Concerning Prenatal Radiation Exposure"

Encl: (1) Radiation Safety Program Guidance  
(2) Standard Operating and Emergency Procedures for the X-ray  
Fluorescence (XRF) Analyzer XL 600

1. Situation. As directed by guidance in references (a) through (g), this Order provides policy and assigns responsibility for administering the Installation Radiation Safety Program (IRSP). This Order delineates and enacts the program elements necessary to assure compliance with the references, the Department of the Navy's Nuclear Regulatory Commission (NRC) Master Materials License, and specific Naval Radioactive Materials Permits (NRMP) issued to Marine Corps commands.

2. Cancellation. MCIEAST-MCB CAMLEJO 5104.1B.

3. Mission

a. Marine Corps Installations East-Marine Corps Base Camp Lejeune (MCIEAST-MCB CAMLEJ) shall develop policy and implement Standard Operating Procedures (SOP) to comply with reference (a) that will minimize risk of injury to personnel and to the general public; implement control measures that will prevent contamination of personnel and facilities and the loss of ionizing radiation sources and devices aboard the Installation.

DISTRIBUTION STATEMENT A: Approved for public release; distribution is unlimited.

b. Summary of Revision. This Order has been revised to update the references. This Order should be reviewed in its entirety as required by reference (a).

4. Execution

a. Commander's Intent and Concept of Operation

(1) Commander's Intent

(a) To protect military and civilian personnel from the harmful effects of ionizing radiation. All exposures to ionizing radiation will be kept As Low As Reasonably Achievable (ALARA) per references (a) through (g).

(b) To implement a comprehensive IRSP consistent with references (a) through (g).

(c) To enhance unit and individual readiness by maintaining an effective IRSP per reference (a).

(2) Concept of Operations. This Order provides guidance for the safe use, handling, transportation, storage and disposal of all Radioactive Material (RAM). All RAM and sources shall be considered hazardous. Any use, possession, storage, transfer, or disposal activities, which involve such items is prohibited until appropriate safety precautions have been established. No personnel shall be permitted to participate in any of the above activities until appropriately trained and the provisions of this Order have been met.

b. Tasks. Commanding Generals/Officers (CGs/COs)/Officers-In-Charge (OICs) shall:

(1) Comply with the intent and content of this Order, and all references.

(2) Provide sufficient documentation to demonstrate compliance.

(3) Ensure that local SOPs for radiation safety are developed and followed.

(4) Coordinate all aspects of the RSP with the Installation Radiation Safety Manager (IRSM).

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5. Administration and Logistics

a. Administration

(1) COs having cognizance of RAM, x-ray machines, and personnel who, in the performance of their duties, may come in contact with ionizing radiation will appoint, in writing, Radiation Safety Officers (RSO), Radiation Safety Managers (RSM), and Radiation Protection Assistants (RPA) as needed to ensure compliance with the references.

(2) Director of Safety (DOS). The DOS shall maintain overall cognizance of the IRSP.

(3) Installation Radiation Safety Officer (IRSM). The IRSM will ensure this Order is current.

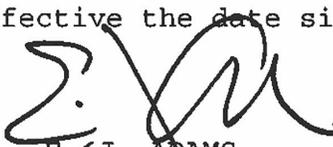
(4) This Order will supplement existing Navy/Marine Corps regulations, Marine Corps orders and instructions, and other pertinent statutory documents and publications to manage an efficient and compliant radiological controls program.

b. Logistics. For the purpose of this Order, sources of ionizing radiation are defined as RAM in commodities and equipment or radiation-producing equipment.

6. Command and Signal

a. Command. This Order applies to all personnel aboard Marine Corps Base Camp Lejeune who procure, transport, use, repair and store or who are responsible for the training of personnel who perform these functions.

b. Signal. This Order is effective the date signed.



E. J. ADAMS  
Chief of Staff

DISTRIBUTION: A/C (plus H&S Bn and WTBn)

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## Reports Required

<u>REPORT TITLE</u>	<u>REPORT CONTROL SYMBOL</u>	<u>PARAGRAPH</u>
I. Marine Corps Logistics Command Radiological Audit Checklist	MC-5104.1	10c pg 1-13
II. Radiological Affairs Support Program Deficiency Report	MC-5104.2	12 pg 1-15
III. Radiological Incident Reporting	MC-5104.3	13 pg 1-16
IV. United States Marine Corps RAM Movement Form/Report	MC-5104.5	2 pg 3-1
V. Low-Level Radiation Waste Disposal-Command Request/Inventory	MC-5104.4	2b pg 4-1

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RECORD OF CHANGES

Log completed change action as indicated.

Change Number	Date of Change	Date Entered	Signature of Person Incorporated Change

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## Chapter 1

Radiation Safety Program (RSP) Elements

1. Purpose. The RSP is designed to prevent the unnecessary exposure of personnel to ionizing radiation, to include contamination of equipment; to identify the requirements for compliance with NRC licenses and specific NRMPs; and to establish procedures for meeting those requirements. Procedures include provisions for storage, use, possession, transportation and disposal of RAM and training required for personnel involved in any of those activities. All personnel under MCIEAST-MCB CAMLEJ are required to understand their respective roles and duties when the handling and working with radioactive isotopes.

2. Background

a. Safety standards for ionizing radiation from RAM and other radiation sources are derived from a variety of Federal regulations. The NRC has primary responsibility for regulating RAM and it grants permission to receive, possess, distribute, use, transport, transfer, and dispose of RAM under special conditions established in individual licenses.

b. Naval Radiation Safety Committee (NRSC). The NRSC has administrative control of all RAM used in the Navy and Marine Corps except for nuclear propulsion, nuclear weapons, and certain components of nuclear weapons delivery systems. The NRSC issues NRMPs to exercise control.

c. Naval Sea Systems Command Detachment Radiological Affairs Support Office (NAVSEA DET RASO). The Commander, NAVSEA DET RASO, Yorktown, VA, provides guidance and has delegated authority, in coordination with the Senior Marine Corps Health Physicist, to control the Marine Corps RSP. This includes all aspects of radiation safety and control of radiation from licensable and non-licensable RAM, including radioactive waste, but excluding radioactive sources used for medical treatment or diagnosis, radioactivity associated with naval nuclear propulsion, and nuclear weapons. The NAVSEA DET RASO also oversees NRMPs issued to Navy and Marine Corps units by the NRSC to ensure compliance with NRC's licenses of RAM.

d. Senior Marine Corps Health Physicist (Commandant of the Marine Corps (SD)). Provides guidance and oversight for compliance with NRMPs issued to Marine Corps Commands by the NRC and applicable RSP orders and directives and is a member of the NRSC.

e. Command Radiation Safety Manager (CRSM). The individual appointed in writing at the Major Subordinate Command (MSC) level that is tasked and provides oversight for coordinating the RSP for sources of ionizing radiation under the control of that MSC.

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f. Command Radiation Safety Officer (CRSO). The individual who provides oversight for NRMPs or x-ray radiography RSPs. The command may not have more than one CRSO.

g. RPA. A unit-level, collateral duty radiation safety professional, appointed to assist the RSO or IRSM in the administration of command RSPs. Commands may have one or more RPAs.

h. Responsible Officer (RO). Any unit personnel having oversight of RAM or having custody of a licensed or permitted radioactive commodities.

3. Policy. To protect military and civilian personnel from the harmful effects of ionizing radiation, such that all exposures to ionizing radiation will be kept ALARA. This is accomplished through a comprehensive RSP which is consistent with applicable standards.

#### 4. Responsibilities

a. Installation Radiation Safety Manager (IRSM). The IRSM is the individual appointed in writing by the installation Commanding General, Commander, or Commanding Officer who is responsible for coordinating the IRSP and Installation Radiological Controls (RADCON) Program. The IRSM has oversight over all radiation programs aboard the Installation to include tenant commands that maintain radioactive commodities on the Installation. The IRSM is staffed within the Installation Safety Department. The IRSM will:

(1) Recommend the appointment of Assistant Installation Radiation Safety Managers (AIRSM) to the Director of Safety in sufficient numbers to administer the RADCON Program and provide appropriate training to each AIRSM. In the temporary absence of the IRSM from the Installation, the AIRSM will fulfill the IRSM duties.

(2) Coordinate and direct the action of the AIRSMs in the administration of the RADCON Program.

(3) Maintain inventory reports of NRMP, radioactive commodities or sources under the Installation's control as required by reference (e). Installation inventory reports will be reconciled with the previous inventory to account for changes or discrepancies. The inventory report will include this reconciliation (statement of changes, losses, additions, or updates). Submit Installation physical inventory and inventory reconciliation reports to the Marine Corps Logistic Command (MARCORLOGCOM) Radiation Safety Officer (LRSO) per the appropriate NRMP requirements as required by reference (e).

(4) Maintain decommissioning files containing copies of inventory reports, areas of use, facility surveys and reports of radiation incidents and accidents.

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(5) Perform required leak/wipe tests on the Installation NRMP radioactive commodities or sources, per the procedures in the applicable NRMP and forward the leak test packages to the Radiological Controls Office (LAB), Marine Corps Logistics Command (MARCORLOGCOM) (P503) 814 Radford Blvd Suite 20227 Albany, Georgia (GA) 37104-0227 via mail.

(6) Manage the Installation's Low-Level Radioactive Waste (LLRW)/Unwanted Radioactive Waste (URW) Program. Dispose of LLRW/URW through the Navy LLRW Program. Coordinate the disposal of LLRW/URW with the NAVSEA DET RASO and provide copies of the manifests to the RADCON Office, MARCORLOGCOM, Albany, GA

(7) Oversee the shipment and transportation of sources of ionizing radiation onto and off the Installation.

(8) All RSMs shall successfully complete RSM-R training endorsed by Commandant of the Marine Corps (CMC) Safety Division (SD) within three months of assuming duties as RSM.

b. AIRSM. Provide assistance and perform the duties in the absence of the IRSM.

c. CRSO

(1) Successfully complete the applicable RSO Course(s) provided by the NAVSEA DET RASO prior to assuming duties.

(2) Sign NRMP amendments when applicable.

(3) Be appointed in writing by the CG/CO, Commander, OIC, or designee with specific by direction authority as authorized in reference (e) and document in writing their acceptance of the responsibilities and position of CRSO.

(4) Have independent authority to stop operations associated with their NRMP or x-ray program that they consider unsafe.

(5) To fulfill their duties and responsibilities as outlined in their specific NRMP and all radiation safety directives/local SOPs to ensure that RAM and/or sources of ionizing radiation are used in a safe manner.

(6) Have direct, unimpeded access to the CG, Commander, or CO for all matters concerning radiation safety.

(7) Recommend to the CG, Commander, or CO to assign an Assistant Radiation Safety Officer (ARSO) with the same training and qualifications as the RSO.

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(8) Ensure that a radiation safety review, audit, and inspection program is implemented, and results are forwarded to the CG, Commander, or CO via the chain of command and that program deficiencies are corrected expeditiously.

(9) Conduct internal audits and inspections as follows:

(a) Quarterly: Radiological Controls Procedures and Practices (observation of operations when possible); NRMP compliance; and transportation of RAM shall be inspected.

(b) Semi-annually: Radiation medical examination (pre-placement, pre-examinations, and terminations); occupational radiation exposure and personnel dosimeter records and logs, required records and reports; receipt, transfer, and disposal of RAM; and corrective actions for discrepancies identified during previous audits or inspections (if applicable) in accordance with references (a) and (f).

(c) Annually: RSP training; ALARA Compliance; emergency plans and exercises; inventories of equipment containing radiation sources shall be audited and an overall review of the RSP shall be submitted to the CG or the CO.

(10) The RSO or ARSO shall provide an annual Commander's brief to the CG, Commander, or CO on the status of the radiation safety program for which they are responsible. This briefing shall include the general topics listed in reference (a), Sections 2.8.2.3 items a. through i., all inspections or assessments since the last Commander's brief, and any NRMP actions or correspondence. A copy of the completed brief, signed by the CO, and a copy of the Annual Program Review, shall be forwarded to CMC (SD) for review.

(11) Ensure strict compliance with all applicable regulations, instructions, and orders that are relevant to the RSP, to include any specific conditions associated with an NRMP.

(12) The IRSM/RSO and, when applicable the AIRSM/ARSO, shall attend an annual RSO conference provided by the NAVSEA DET RASO to maintain proficiency in radiation safety practices and to remain current with guiding regulations. If this requirement cannot be met, the IRSM/RSO and AIRSM/ARSO shall successfully complete the RSO course again within the five year period after initial completion.

(13) Perform or coordinate radiation surveys/leak tests/wipe test as required to ensure compliance with the references and NRMPs.

(14) Conduct radiation awareness safety training. Training will be conducted and evaluated annually or more frequently as required.

(15) Promptly report to the CO and the NAVSEA DET RASO any violation of specific NRMPs, naval directives, or Federal

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requirements; and any mishap, significant incident, personnel injury, suspected overexposure, spread of contamination, or internal deposition involving RAM sources.

d. Responsible Officer (RO). Any unit having custody of licensed or permitted radioactive commodities must assign a RO. The RO shall receive radiation safety training that is commensurate with one's duties and responsibilities. The RO shall:

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

(2) Complete all documentation and ensure reporting requirements are fulfilled.

e. RPA

(1) All RPAs shall successfully complete a radiation safety training program provided by the RSO or RSM within three months of assuming duties as RPA.

(2) All RPAs shall maintain an inventory of RAMs within the unit.

(3) All RPAs will report any loss, damaged, or radiological incident or exposure immediately to their respective commands and to the IRSM/IRSO.

f. Installation Fire Chief. The Fire Chief will ensure that the department is capable of supporting emergency response actions in the event of a radiological incident. The Fire Chief shall:

(1) Appoint an RPA in writing to administer the RADCON Program for the department and provide appropriate training.

(2) Ensure Fire and Emergency Services personnel designated as emergency response personnel receive annual training on radiation safety and radiological emergency response hazards.

(3) Maintain a copy of inventories provided by the IRSO to identify the locations of RAMs stored aboard the Installation.

(4) Notify the IRSO of all radiological emergencies, accidents, and incidents.

(5) Ensure compliance with this Order and all applicable regulations regarding RAMs.

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g. Installation Provost Marshal (PM). The PM will ensure that the Provost Marshal's Office (PMO) is capable of supporting emergency response actions in the event of a radiological incident. The PM shall:

(1) Appoint in writing an RPA to administer the RADCON Program for the PMO and provide appropriate training.

(2) Provide physical security in the event of a radiological incident.

(3) Notify the IRSM/IRSO of all radiological emergencies, accidents, and incidents.

(4) Ensure compliance with this Order and all applicable regulations regarding RAMs.

h. Radiation Workers/Limited Radiation Workers. Radiation workers or limited radiation workers are individuals who operate, maintain, store, inventory, ship or receive equipment with RAMs. Radiation workers/limited radiation workers shall:

(1) Obey posted, verbal, and written command RASP operating procedures and instructions.

(2) Not handle RAM unless they have received and have documented the required training appropriate to the operations they are to perform.

(3) Wear dosimeters (e.g., thermoluminescent dosimeters, pocket dosimeters) when required by reference (a), NRMPS or NRC licenses.

(4) Promptly report to their supervisor and/or RPA any incident, personnel injury, suspected over exposure, contamination and any suspicious or questionable occurrence involving ionizing radiation sources.

5. Contractors and Other Non-Department of Defense (DoD) Agencies. Contractors and other non-DoD agencies shall implement their own RSP that meets all pertinent radiation protection standards. The following provisions apply to contractors performing work aboard the Installation:

a. Directorates responsible for issuing contracts and/or having control of contractor oversight involving RSP-type work must be authorized by NAVSEA 09R. A formal request signed by the CO shall be submitted to NAVSEA 09R via the NAVSEA DET RASO.

b. The contractor shall have an RSO to ensure compliance with RSP requirements and protection of contractor personnel.

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c. Marine Corps personnel shall not perform radiation services for contractor personnel as performance of such functions may involve assumption of liability.

d. Where Marine Corps and contractor personnel work together in areas where RAM or ionizing radiation may be present, the contractor shall provide a separate radiation survey for their personnel. The contractor shall be informed of Marine Corps survey findings, location of RAM and radiation areas, and local controls used. However, the contracting officer or Resident Officer-in-Charge of Construction shall also inform the contractor that they retain legal obligation for the safety of contractor personnel.

e. The contractor will provide the IRSM with an inventory of all radioactive sources and commodities that will be brought aboard the Installation and shall assure that transportation of all RAM is in compliance with all pertinent regulations. The contractor must receive an authorization letter prior to bringing any isotope aboard the Installation from the IRSO. A sample letter is provided as Appendix B to this Order.

#### 6. Nuclear Regulatory Commission (NRC)

a. The NRC has the primary responsibility for regulating RAM. It grants permission to receive, possess, distribute, use, transport, transfer, and dispose of RAM under special conditions established in individual licenses.

b. 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 RAM. The Naval Radiation Safety Committee (NRSC) was established to oversee the NRMP program and to control the use of licensed material. The NRSC issues NRMPs to individual commands that have the authorization to use NRC regulated material as well as naturally occurring and accelerator produced materials. The NRSC, through NAVSEA DET RASO, maintains oversight of all RAM licenses for Marine Corps commands issued by the NRC.

c. All conditions and requirements contained in permits and licenses issued must be met by commands possessing, storing, using, and disposing of RAM and using machines that produce ionizing radiation.

d. Should conflicting instructions or regulations exist between this Order, local orders/instructions, or Federal regulations, the more stringent requirement shall prevail. An exception to this requirement may be taken where the tenant unit represents a separate department of the Federal Government.

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## 7. General Requirements

a. Each unit RSO/RPA must maintain an updated inventory of RAM located in the work area. The inventory will include:

- (1) Item Nomenclature
- (2) National Stock Number (NSN)
- (3) Radioactive Source Identification Number
- (4) Radioisotope
- (5) Chemical and Physical Form
- (6) Activity (in curies) and Date Determined
- (7) Location
- (8) Custodian Name

b. Each operation involving RAM must have an SOP specifically tailored for the operation being conducted. At a minimum, the SOP will include:

- (1) The purpose and objective of the SOP
- (2) Applicability
- (3) Responsibilities
- (4) Procurement
- (5) Storage
- (6) Inventory
- (7) Surveillance
- (8) References

c. Safety Procedures (including specifics for use and handling). Safety procedures in the SOP will include:

- (1) Specific Purpose
- (2) Philosophy
- (3) Safety Rules
- (4) Instructions to Personnel

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- (5) Radiation Protection Standards
- (6) Surveys
- (7) Caution Signs
- (8) Labels and Signals
- (9) Radiological Procedures and Reporting

d. A radiation emergency can occur where RAM or radiation producing equipment is used, stored, or transported. Emergency plans are included in the NRMP application. Emergency plans include:

- (1) Identified procedures constituting an emergency
- (2) Priority list of individuals, departments, and regulatory officials to be notified: IRSM, RADCON, NAVSEA DET RASO
- (3) Steps to control radiological exposure
- (4) Actions necessary to abate the radiation hazard

e. Emergency plans shall be reviewed annually, updated if necessary, and tested via drills/exercises under realistic conditions. The XRF Analyzer Emergency plan is in enclosure (2).

f. Per reference (b), each licensee shall post current copies of the Federal regulations contained in parts 19 and 20, operating procedures applicable to licensed activities, any notice of violation involving radiological working conditions, proposed imposition of civil penalty, or other actions by the NRC. If posting of a document is not practical, a notice may be posted which describes the document and states where it may be examined.

g. The NRC Form 3, Notice to Employees, must be posted in all areas where RAM is used or stored. The required form can be acquired from the cognizant RSO or IRSM.

## 8. Medical Requirements

a. Per reference (e), all personnel who are being considered for routine assignments to duties or occupations which require exposure to ionizing radiation shall be given a medical examination prior to assignment or transfer to those duties.

b. 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 Roentgen Equivalent Man (rem), a unit used to measure radiation exposure, per year are not required to have pre-placement medical examinations.

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c. Pre-placement and subsequent medical examinations shall be provided to all x-ray and gamma radiographers and radiographers' assistants.

d. Pregnant persons must inform their respective chain-of-command and sign a Radiation Exposure Control for the Unborn Child form, Figure 1-1, and a Declaration of Pregnancy form, Figure 1-2.

(1) The individual is responsible to inform their supervisor of the pregnancy.

(2) After notification, the individual must then complete a Declaration of Pregnancy stating the estimated date of pregnancy. Management will maintain a copy in the individual's personnel file. The purpose of the Declaration of Pregnancy statement is to ensure that a pregnant person's occupational exposure to radiation does not exceed 0.5 rem during the entire pregnancy.

#### 9. RSP Surveillance

a. The supervisor responsible for operations subject to RSP controls shall conduct and document a surveillance of operations at least quarterly. Each type of RSP operation at a command (e.g., industrial radiography, x-ray analyzer usage, RAM shipping) shall have a separate surveillance performed quarterly if operations are conducted. Surveillances should include observation of work in progress.

b. The CRSO shall review the findings of supervisor surveillances.

c. The RSO shall conduct and document surveillances of RSP operations at least quarterly.

d. Deficiencies or improvement noted during surveillances shall be documented on a RSP Deficiency Report (RDR) per Section 2.11 of reference (e).

e. All RSP surveillance records shall be maintained per section 2.26.6 of reference (e).

#### 10. RSP Audit

a. The purpose of the audit program is to improve RSP safety, reduce RSP program violations, and prevent mishaps and near misses from occurring. The audit program shall encompass compliance and performance-based reviews. This includes periodic observation of actual RSP operations and activities.

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b. When deficiencies are found, the subordinate command/organization will be responsible for correcting them. For deficiencies of a systemic or repetitive nature, subordinate commands shall perform a causal analysis, document the corrective actions taken for all findings, and forward a copy of the documentation to the IRSM.

c. The CRSO or Assistant Command Radiation Safety Officer (ACRSO) shall conduct a radiation protection audit at least every six months if the command has a NRMP or machine sources of radiation. Annual audits shall be conducted at commands possessing only generally licensed or exempt radioactive material. Audits shall verify that:

(1) Procedures, and the NRMP if applicable, are being properly maintained and are current.

(2) Appropriate radiological surveys are being conducted and reviewed in a timely manner.

(3) Required radiation medical examinations are properly conducted at required interval.

(4) Records of occupational radiation exposure are accurate and complete.

(5) Exposure information is provided to workers.

(6) NRMP commitments are maintained by reconciling physical inventories, leak test records, and other items prescribed by the NRMP.

(7) Required records and reports are properly maintained and issued in a timely manner.

(8) RAM transportation, shipping, receipt, transfer, and disposal records are properly maintained.

(9) RSP related training is properly conducted and documented.

(10) RSPDRs are being utilized and properly maintained.

d. Audits shall be documented, command reviewed, and maintained per Section 2.26.6 of reference (e).

#### 11. Annual Radiation Safety Program Review (ARSPR)

a. The purpose of the ARSPR is to evaluate command compliance with Federal regulations, adherence to applicable Navy and Marine Corps directives, NRMP conditions, and management oversight of the RSP. The CRSO shall conduct the ARSPR. The requirement to conduct an ARSPR shall be included in each command RSP instruction.

b. The ARSPR shall include, as applicable:

(1) A review of the exposure control processes that are in place to ensure doses are maintained ALARA.

(2) A review of operating and emergency procedures to ensure compliance with governing regulations and that they are current. Include a list of any discrepancies found in the operating and emergency procedures.

(3) A review of RSP operations with the highest personnel doses to identify opportunities to reduce these exposures.

(4) A review of personnel exposure records that includes the individuals with the five highest annual radiation doses, those individuals with annual doses above 100 millirem (mrem) (one millisievert (msv), and the cumulative radiation dose total for all radiation workers.

(5) A review of all RSP related training.

(6) A demonstration of compliance with dose limits for individual members of the public.

(7) The results of the annual RDR trend report conducted by the RSO as required by reference (a).

(8) A review of all incident and critique reports associated corrective actions, and the effectiveness of those corrective actions.

(9) Summary of RSP operation surveillances and results. A review of audit findings, responses, and audit effectiveness.

c. Deficiencies and program improvement items discovered during the Annual Program Review (APR) and not previously identified shall be entered into the RDR program per Section 2.11 of reference (e).

d. ARSPRs shall be documented and maintained per Section 2.26.7 of reference (d).

## 12. Radiation Safety Program Deficiency Report (RSPDR) Program

a. The purpose of the RSPDR program at the command level is to identify and correct RSP deficiencies and abnormal conditions. RSPDRs are also used to document and track the completion of RSP improvements. Self-identification and correction of lower order deficiencies or abnormal conditions is an effective method to identify trends and address program weaknesses before they develop into violations.

b. Subordinate commands shall establish a RSPDR program or use an existing system that meets the requirements of Section 2.11.2 of reference (e).

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c. The level of effort required for the RSPDR program should correspond to the complexity and scope of the RSP at the command.

d. RSPDR Requirements

(1) Document all deficiencies, abnormal conditions, and improvement items associated with the command's RSP.

(2) Supervisors ensure the actions taken to correct the deficiencies and abnormal conditions are appropriate and documented.

(3) CRSO or ACRSO shall review each RSP deficiency or abnormal condition and corrective action.

(4) The RSO shall review RSPDRs and perform a trend analysis as part of the annual or semiannual audit.

(5) Each RSPDR is assigned a level of significance as defined in Section 2.11.1 of reference (e).

(6) The RSPDR documentation shall include the problem; date of discovery; serial number (two-digit year and sequential number); name and contact information for the person discovering the problem; immediate corrective action(s) taken, apparent cause for deficiencies, if known; supervisory review and comment, and CRSO or ACRSO review and comment. A sample form may be obtained from the NAVSEA DET RASO.

(7) Maintain a log that records, at a minimum, the RSPDR serial number, date, short problem description, and date RSPDR reviewed and closed out by the CRSO or ACRSO.

13. Radiological Incident Reporting

a. A radiological incident can occur where RAM or radiation producing equipment are used, stored, or transported. The magnitude of the incident and the severity of consequences will determine the level of response.

b. Per reference (e), the following conditions, situations and occurrences shall be considered as radiological incidents:

(1) External radiation exposure in excess of the limits of reference (e).

(2) External radiation exposure in excess of the Alternate Concentration Limits (ACL) in reference (e).

(3) Personnel contamination above the levels of reference (e).

(4) Exposure of personnel to airborne radioactivity above 10 percent of the derived airborne concentrations of Appendix B of reference (b) 20 without respiratory protection.

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(5) A mishap resulting in the inhalation or ingestion of a measurable quantity of RAM.

(6) Unauthorized or accidental entry of personnel into a high radiation area or unauthorized or accidental entry into a radiation area and the person or persons receives an estimated unmonitored exposure of greater than two mrem.

(7) Entry into a high radiation area without the required dosimeter and exposure of one mrem or more.

(8) Spills of RAM outside controlled areas.

(9) Theft or loss of RAM or machines that produce ionizing radiation.

(10) Release of RAM into the environment above the effluent limits of Appendix B of reference (b) 20.

(11) Receipt of packages with contamination or radiation levels in excess of reference (b) 71, limits.

(12) Leaking sealed radioactive source.

(13) 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, have domestic or international implications, or pose a threat to public health or welfare.

(14) Unauthorized disposal of RAM.

c. Each command shall, upon discovery of the event, immediately report to the NAVSEA DET RASO, IRSM, and the chain-of-command any event listed in paragraph 13b above.

d. Initial notification to the NAVSEA DET RASO shall be made by telephone at (757) 887-4692. If after normal work hours, contact the emergency number provided on the NAVSEA DET RASO's after-hours voice message.

e. An initial follow-up written report shall be made within 10 days with updated reports to be determined by the NAVSEA DET RASO as outlined in reference (e). The written report shall include:

(1) A description of the operation, date, time, and individual(s) involved.

(2) Exposures of individuals to radiation, circumstances under which the exposures occurred, and the possible total effective dose equivalent to persons in unrestricted areas.

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(3) A determination of the cause(s), immediate actions taken, long-term corrective actions planned to prevent recurrence, and the Plan of Actions and Milestones.

(4) An assessment of the radiological significance of the event.

(5) Signature of the CG, Commander, CO, or OIC.

14. Leak/Wipe Test Procedures and Results

a. A Leak/Wipe Test is a sample wipe test taken from the device to determine if a sealed source or instrument has lost its integrity by allowing leakage of RAM through holes or cracks. Tests are normally performed using a filter paper or absorbent material to wipe the source or instrument, the paper or matter is then evaluated to determine the presence of radioactive contamination, which indicates a leakage.

b. The difference between a Leak Test and Wipe Test is that a Leak Test is performed to determine the integrity of a sealed source, and a Wipe Test is used to determine if contamination is present during a survey or an incident.

c. Proper Leak/Wipe Test procedures are essential to ensure for valid test results and to protect personnel from exposure to radiation.

d. When submitting a Leak/Wipe Test, submit a request letter to RADCON Office (LAB) MARCORLOGCOM along with the sample. The letter will provide contact information, the suspected isotope(s), a list of the samples submitted by sample serial number, and any additional information that would be pertinent to the testing.

e. Equipment containing RAM in most cases will have procedures outlined in the equipment manuals, material license or NRMP on how to conduct the Leak/Wipe Tests.

15. Leak Test Requirements. Leak tests are required at scheduled intervals or when a suspected leakage has occurred. Leak testing requirements are as follows:

a. Sealed sources containing more than 100 micro curies of beta-gamma emitting material or more than 10 microcuries of alpha emitting materials will be tested for leakage or contamination at intervals not to exceed six months, except in the following cases:

(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.

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This exception does not apply when fourth maintenance is performed to replace vials when a suspected leakage has occurred. In this case, a Wipe Test is completed prior to performing the maintenance.

(2) Leak Test intervals exceeding six months are allowed if approved in a specific or general NRC license or an NRMP.

(3) When the source is removed from storage, it will be leak tested prior to use or transfer.

(4) Any source received by the command that requires a Leak Test and is not accompanied by a certificate indicating that a test was performed within six months prior to the transfer will not be put into use until tested.

b. The test sample(s) will be taken from the source or adjacent surface(s) where contamination is expected to accumulate. Specific sampling locations and procedures will be used when instructions are provided in the license, permit, published instructions or equipment manuals.

c. The Leak Test will 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 will be taken:

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

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

e. Leak Test records should be maintained with the equipment record jackets and will be retained for a minimum of three years.

f. Leak Test results will be maintained in units of microcuries or disintegrations per minute (dpm).

g. Leak Tests will be submitted to the following address unless otherwise directed in the license or NRMP:

COMMANDING GENERAL  
RADIOLOGICAL CONTROLS OFFICE (LAB)  
MARINE CORPS LOGISTICS COMMAND (P503)  
814 RADFORD BLVD SUITE 20227  
ALBANY, GA 37104-0227

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RADIATION EXPOSURE CONTROL FOR THE EMBRYO/FETUS

RADIATION SAFETY TRAINING

Subject: RADIATION EXPOSURE CONTROL FOR THE EMBRYO/FETUS

Purpose: The purpose of the subject training is to ensure that pregnant employees subject to hazards are aware of the radiation hazards to an embryo/fetus.

- References:
- (a) MCO 5100.29C
  - (b) NAVSEA S0410-AA-RAD-010 Rev 2
  - (c) U.S. NRC Regulatory Guide 8.13

1. The National Council on Radiation Protection and Measurement (NCRP) concerning limits for exposure to ionizing radiation recommends a total dose equivalent limit, excluding medical exposure, of 0.5 rem (roentgen equivalent man; a unit of measuring absorbed doses of radiation) for the embryo-fetus. Once a pregnancy becomes known, exposure of the embryo/fetus will be no greater than 0.5 rems in any month.
2. The radiation exposure control level for personnel physically capable of bearing children shall not exceed 0.5 rem per year.
3. All reasonable effort will be made to keep ionizing radiation exposure to the unborn child to the very lowest practical level.
4. Per references (a) through (c), personnel physically capable of bearing children subject to ionizing radiation hazards are to be informed of such hazards by reviewing reference (c) and acknowledging the following statement.

\* I understand the recommendations of the NCRP to limit radiation exposure to the embryo/fetus to the lowest practical level, not to exceed 0.5 rems for the entire time of the pregnancy. I recognize that protection of the embryo/fetus is a joint responsibility of the employer and employee. I agree that it is my responsibility to promptly notify the Radiation Safety Officer/Alternate should I become pregnant.

Signature \_\_\_\_\_ Date of Training \_\_\_\_\_

Printed Name \_\_\_\_\_ Instructor \_\_\_\_\_

5. A copy of this acknowledgment will be filed in the individuals training jacket.

Figure 1-1.--Radiation Exposure Control for the Embryo/Fetus

**DECLARATION OF PREGNANCY**

To: \_\_\_\_\_

In accordance with the Nuclear Regulatory Commission's (NRC) regulation at 10 CFR 20.1208. "Dose to an embryo/fetus." I am declaring that I am pregnant. I believe I became pregnant \_\_\_\_\_ (mm/dd/yyyy)

I understand the radiation dose to my embryo/fetus during my entire pregnancy will not be allowed to exceed 0.5 rem (5 millisievert) (unless that dose has already been exceeded between the time of conception and submitting this letter). I have been provided a copy of or access to the NRC Regulatory Guide 8.13. "Instruction concerning prenatal radiation exposure." I understand that I may need to change my job or job responsibilities during my pregnancy to meet the lower dose limit.

Signature \_\_\_\_\_

Printed name \_\_\_\_\_

Date \_\_\_\_\_

MCIEAST-MCB CAMLEJ/Safety/5104.1B (8/20) PREVIOUS EDITIONS ARE OBSOLETE

Figure 1-2.--Declaration of Pregnancy

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## Chapter 2

Radiation Safety Training Requirements1. Purpose

a. Develop worker awareness of RSP that permits the performance of tasks with greater efficiency and confidence. 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, reduce the risk as part of their job.

b. The number and seriousness of accidents and incidents can be reduced through training.

2. Responsibility. All Commanders, COs, and OICs have the responsibility to ensure that occupationally exposed personnel under their jurisdiction who work with RAMs must keep exposure to ionizing radiation in accordance with the ALARA principles. A part of ALARA is the assurance that each person has received radiation safety training commensurate with their potential for occupational exposure to ionizing radiation. All training must be documented.

3. Training Requirements

a. Prior to assuming the duties of RSO or RSM, the prospective appointee shall successfully complete initial qualification training at the NAVSEA DET RASO or an approved RSM course provided by MARCORLOGCOM. Courses offered and required by NAVSEA DET RASO can be found in reference (e), Section II. Additionally, RSOs and RSMs shall attend Radiation Affairs Support Program (RASP) training provided by the USMC Senior Health Officer (SHO). All RPAs shall be trained annually by the responsible RSO/RSM.

b. Each military gamma radiographer and radiographer's assistant shall successfully complete the Radiographic Operator Course (A-701-0032) at Service Schools Command, San Diego, CA.

c. Civilian radiographers shall successfully complete the radiation safety training specified in their individual application for a NRMP to conduct gamma radiography.

d. All gamma radiographers will receive formal training on local command operating and emergency procedures and annual refresher training in radiation safety procedures and regulations specified and described in their individual application for a NRMP to conduct gamma radiography.

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e. Initial training for x-ray radiographers shall consist of the successful completion of one of the courses specified in reference (e), Section 11.8.4.

f. Annual refresher training including the topics listed in reference (d), Section 11.8.3.2.b. shall be provided by the command.

g. Completion of refresher training shall be documented via a written exam on which students must attain a score of 80 percent or better.

h. Additional training shall be conducted each time there is a substantial change in equipment or operating procedures.

i. Quarterly training shall be conducted by the RSO, a designated representative, or both.

j. Radiation workers are personnel who are occupationally exposed to ionizing radiation. They work in controlled areas and are required to have a physical examination. Initial training for radiation workers consists of a minimum of eight hours covering the subjects in reference (e), Section 2.8.4.3, with a final written examination (must attain a score of 80 percent or better).

k. Annual refresher training will be conducted consisting of topics listed in reference (e), Section 2.8.4.5.

l. Initial/Annual refresher training will be conducted by the RSO, RSM, or designated representative.

m. Non-radiation workers are personnel who are not exposed to ionizing on a routine basis and do not require a physical exam (i.e., emergency response personnel, firefighters, medical personnel, etc.) Their sporadic exposure is not monitored. Non-radiation workers will receive initial and annual refresher training on the topics listed in reference (e), Section 2.8.6.3. Training will be conducted by the RSO or designated representative. The RSO will determine the duration.

n. Prior to being issued dosimetry equipment, all personnel authorized to receive radiation exposure shall be given specific instruction about radiation hazards including prenatal exposure risks to a developing embryo or fetus. All reasonable efforts shall be made to keep ionizing radiation exposure to unborn children to the very lowest practical level. The radiation exposure control level for personnel physically capable of bearing children shall not be extended beyond 0.5 rem per year whenever the "Declaration of Pregnancy" in Appendix A of reference (f) has been signed. This declaration shall be kept in the individual's training record and a copy provided to the responsible RSO. Instruction concerning prenatal exposure to unborn children shall also be given to personnel who supervise female workers authorized for radiation exposure. The amount of radiation exposure a pregnant female worker receives shall be limited in accordance with

regulations. Instruction concerning prenatal exposure to the unborn child shall be given by the responsible RSO or designated representative during initial and annual training. Reference (g) shall be available, and a copy given to individuals receiving the training. No examinations are required as part of the training, however, the training shall be documented.

o. Other organization personnel who routinely work in or frequent areas adjacent to radiation areas and RAM storage areas shall receive awareness training per reference (e), Section 2.8.7.4. Training shall:

(1) Be commensurate with the size and complexity of the command's RSP.

(2) Be provided through a self-study presentation. A written examination is not required to demonstrate successful completion.

(3) Be documented and maintained per reference (e), Section 2.26.5.

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## Chapter 3

Transportation of Radioactive Material

1. General. Transportation of RAM must comply with military, NRC, and Department of Transportation (DOT) regulations. The shipper of record is ultimately responsible for compliance. Personnel assigned duties related to transportation of RAM must be appropriately trained per reference (c). Movement of RAM must be in a government owned vehicle.

2. RAM Movement Form

a. The MARCORLOGCOM RADCON RAM Movement Form will be used to maintain an accurate record of change in location or custody of RAM, sources, commodities, or items containing RAM. This form will be completed whenever transfers or changes of custody of items involving ionizing radiation take place. One copy will be retained by the unit transferring the item, one copy will be given to the receiving unit, one copy will be given to the appropriate supply activity, and one copy will be sent to the responsible IRSM.

b. A record of transfer of RAM will be maintained for at least three years from the date the material is accepted by the carrier. At a minimum, the record will contain the following:

(1) Verification the receiving activity is licensed or authorized by a NRMP or 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.

3. Disposition

a. In accordance with USMC SHO, and/or RASO as applicable, all disposition instructions for excess, defective, or serviceable radioactive items will be requested via email, message, or formal letter from the responsible unit owning the RAM. The quantity, NSN, serial number, condition codes, applicable NRC license or NRMP numbers, and any other identifying or amplifying information must be provided in the correspondence.

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b. When applicable, information copies of disposition instructions should be sent to the LRSO at Marine Corps Logistics Base, Albany, GA, who will initiate tracer actions on shipments not received within 120 days. Copies of disposition instructions for local transfers should be kept by the IRSM along with a RAM Movement Form. This will serve as a record of transfer.

#### 4. Defense Logistics Agency (DLA) Distribution

a. The RSO of DLA Distribution shall be consulted to determine, based on the form and quantity of the material, the type of labeling and packaging required in accordance with DOT shipping regulations, 173.422 of reference (d), with individual packaging data sheets, or with special packaging instructions.

b. RAM, to be shipped by commercial carrier, shall be taken to DLA Distribution for shipping. The RSO of DLA Distribution or a qualified representative will inspect and apply required shipping labels and certify the shipping package for the appropriate mode of transportation.

c. Unless otherwise specified by the RSO of DLA Distribution, intact Marine Corps radioactive commodities shall be shipped using the Proper Shipping Name: "Radioactive Material, Excepted Package-Instruments or Articles" under the provisions of DOT regulations, 173.422 of reference (d). Items under the cognizance of other services or commercial activities may require the use of other shipping names or procedures.

#### 5. Shipping and Carriage

a. RAM will not be transported in a privately-owned vehicle.

b. When transporting RAM on or off the Installation via government vehicle, compliance with applicable DOT regulations is still required even though the RAM or item is not being transported for "commerce" purposes.

c. All movement, transfer, or change of custody of RAM other than routine use or operation, on or off the Installation must be accompanied by a completed RAM Movement Form for documenting the disposition, transfer, movement, and storage of RAM.

d. Except for local transport aboard the Installation or removal of RAM from the LLRW by the contractor as designated by NAVSEA DET RASO, all RAM to be shipped off the Installation via commercial carrier will be taken to the DLA Distribution to ensure proper inspection, packaging, labeling, and certification.

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6. Receipt

a. Arrangements to receive a package containing RAM must be made when the carrier offers it for delivery or when notified of the arrival of the package at the carrier's terminal. Any unit receiving RAM must notify the IRSM of the RAM coming aboard the installation.

b. Packages known to contain RAM must be monitored for radioactive contamination and radiation levels no later than three hours after receipt. It is the responsibility of the receiving/owning unit to notify the IRSM of the RAM and to request a Leak Test/Wipe Test.

c. If an owning unit of a RAM has received or damaged any RAM or commodity which contains any RAM, the owning unit must immediately notify the IRSM who will conduct all required testing and further notifications. The testing procedures will determine if the external radiation levels exceed 200 mrem per hour at the surface, 10 mrem per hour at one meter from the surface, or two mrem per hour in any occupied positions of the vehicle.

d. A record of the required surveys must be maintained by the receiving/owning unit.

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## Chapter 4

Disposal of Radioactive Material1. Definitions. LLRW includes:

- a. Surplus, unwanted, or unserviceable devices that are identified as containing RAM.
- b. Commodities that are identified as containing RAM.
- c. Instruments or articles that are identified as containing RAM.
- d. RAM for which there is no longer a useful purpose or material contaminated with RAM to the extent that decontamination is economically unfeasible. The item manager will advise users if the item may be turned in for reconditioning rather than disposal.

2. Turn-In Procedures

- a. LLRW cannot be disposed of as ordinary waste or hazardous waste. Thus, under no circumstances will any RAM be turned in to DLA Disposition Services (DLA-DS).
- b. An inventory of LLRW for transfer and disposal must be forwarded to the IRSM as soon as the prospective waste is identified. A RAM Movement Form may be used as a temporary inventory to show possession of RAM for transfer purposes. RAM Movement Forms may be acquired from IRSM or at the RADCON website.

3. IRSM Responsibilities Involving Disposal of LLRW

- a. Upon notification by a unit that LLRW needs to be turned in for disposal, the responsible IRSM/AIRSM will arrange for the LLRW to be moved to the LLRW storage site where it will be secured until it can be picked up by a disposal contractor designated by the NAVSEA DET RASO. All RAM Movement Forms, RAM property receipts (DD 1348), and RAM disposition requests with disposition instructions will be completed by the CRSO/RPA who shall provide copies to all parties concerned including the IRSM/AIRSM.
- b. The IRSM/AIRSM will notify the appropriate point of contact at NAVSEA DET RASO who will arrange for LLRW to be picked up by a designated contractor that is licensed by the NRC to transport and dispose of RAM.
- c. When the LLRW is picked up for disposal by the designated contractor, the IRSM/AIRSM will assure copies of all documentation showing transfer of the LLRW are acquired and distributed to all parties concerned for recordkeeping purposes. These records shall be retained for audits and inspections involving the disposition of RAM and LLRW.

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## Chapter 5

General Emergency Guidelines1. Introduction

a. Each unit handling, storing, using, transporting, receiving, or disposing sources of ionizing radiation, RAM, or commodities containing RAM shall provide specific guidance as outlined in Chapter 1 and training as described in Chapter 2 of this Order.

b. The emergency guidelines in this chapter are general in nature. They will be used when an incident involving breakage or other exposure of personnel to RAM (or radioactivity produced from any source), is discovered by personnel whose positions are not covered by a radiation SOP.

2. Emergency Guidelines

a. In the case of an incident involving RAM, immediately dial 911 and inform the operator where you are located on the Installation. The senior person present shall take immediate steps to control the emergency and request assistance from the responsible RSO as required.

b. The initial objective of any incident response involving RAM is to regain control over the event and prevent further spread of any radioactive contamination produced.

c. Actions to save life, aid the injured, fight fires, or control further spread of damage take precedence over concerns for radiological contamination that may arise from fielded Marine Corps equipment.

3. General Steps

a. In an effort to minimize personnel exposure from possible internal contamination, notify personnel in the immediate area to evacuate and activate the emergency alarm system.

b. In the case of tritium gas, vacate the immediate area and remain upwind for at least 30 minutes or until directed by the emergency personnel and/or cognizant IRSM to reenter.

c. In case of fire, stay upwind from any smoke at a minimum of 100 meters or more as directed by emergency personnel.

d. As soon as possible, notify the IRSM to ensure proper follow-up actions.

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4. Contamination Control

a. Devices with broken sources and any resulting debris should only be handled while wearing rubber or plastic gloves. Read the Safety Data Sheet for the source and wear all additional suggested Personal Protective Equipment (PPE) listed.

b. Eating, drinking, tobacco use, vaping or applying makeup is prohibited in areas where RAMs are stored, handled, or maintained.

c. Wash hands with a non-abrasive mild soap and water after handling equipment containing RAMs.

d. When equipment is damaged and/or suspected of being contaminated, immediately follow the procedures outlined in command/unit written emergency procedures. Minimally, you will double bag the item in plastic bags and notify your RPA or CRSO.

e. Based on radiological measurements and the circumstances of the incident, contamination of the immediate area and equipment should be considered a possibility. Until determined by the RSO and/or emergency personnel that radioactive contamination did not occur, or contamination levels have been reduced to allowable limits, potentially contaminated areas are not to be accessed by unauthorized personnel. Furthermore, equipment that may be contaminated shall not be returned to service until surveyed by persons trained and qualified for competently measuring and evaluating radioactive contamination.

f. RAMs will not be disposed of through DLA-DS Services or the landfill. Proper disposition instructions will be requested via the appropriate approving authority. Contact the RSO for questions concerning the proper disposition of RAMs.

5. Points of Contact

a. IRSM/AIRSM

Commanding General  
MCIEAST-MCB CAMLEJ  
AC/S G-4/Safety  
PSC Box 20005  
Camp Lejeune NC 28542-0005  
Telephone Number: DSN 751-5725  
Commercial Number: (910) 451-5725  
Facsimile: DSN 751-2798

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b. LRSO and USMC RADCON OFFICE

Commanding General  
Attn: Radiation Safety Officer  
814 Radford Boulevard  
Albany, GA 31704-0227  
Commercial Number: (229) 894-8258  
Message Address: CG MARCORLOGCOM ALBANY GA

c. NAVSEA DET RASO

Building 1971  
160 Main Road  
Yorktown, VA 23691-0260  
Telephone Number: DSN 953-4692  
Commercial Number: (757) 887-4692  
Message Address: NAVSEA DET RASO YORKTOWN VA//001//  
Website: <https://www.milsuite.mil/book/groups/navsea-det-raso>

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## Chapter 6

Storage of Radioactive Material

1. General Steps. All RAM, including radioactive commodities, requires special storage procedures. At a minimum, all storage areas containing RAM and the entrances to these areas shall be labeled with signs containing the radiation symbol (also known as the trefoil, Figure 6-1) and the words "Caution - Radioactive Material". Areas used for storage of RAM will be kept to a minimum to facilitate adequate control. Small radioactive sources containing more than one millicurie of activity shall be stored in locked areas or cabinets, access to which is limited to authorized individuals. All losses of control of RAM will be reported to the supervisor, CRSO, RPA, and IRSM as soon as they are noted. This includes temporary misplacement, loss, theft, or unauthorized access of storage areas.

a. RAM will not be stored in the same warehouse section with flammables, explosives, photosensitive items, food products, or other incompatible goods. Whenever feasible, RAM shall be stored in fire resistant containers to minimize contamination spread.

b. All RAM shall be stored so that they are protected from adverse weather or conditions which may deteriorate the packaging materials. Commodities that contain radioactive gases, tritium-containing devices, or radium shall be stored in ventilated structures. Eating, drinking, tobacco use, vaping, applying cosmetics, applying or removing contact lens, or storing consumables will not be permitted in RAM storage areas or areas where RAMs are serviced or repaired. Every unit owning RAMs must ensure signage is posted depicting these requirements.

c. Reasonable care shall be taken in packaging and storing contaminated items to prevent the spread of contamination to personnel or to other areas.

d. Personnel entering potentially contaminated storage areas shall wear appropriate PPE/anti-contamination clothing.

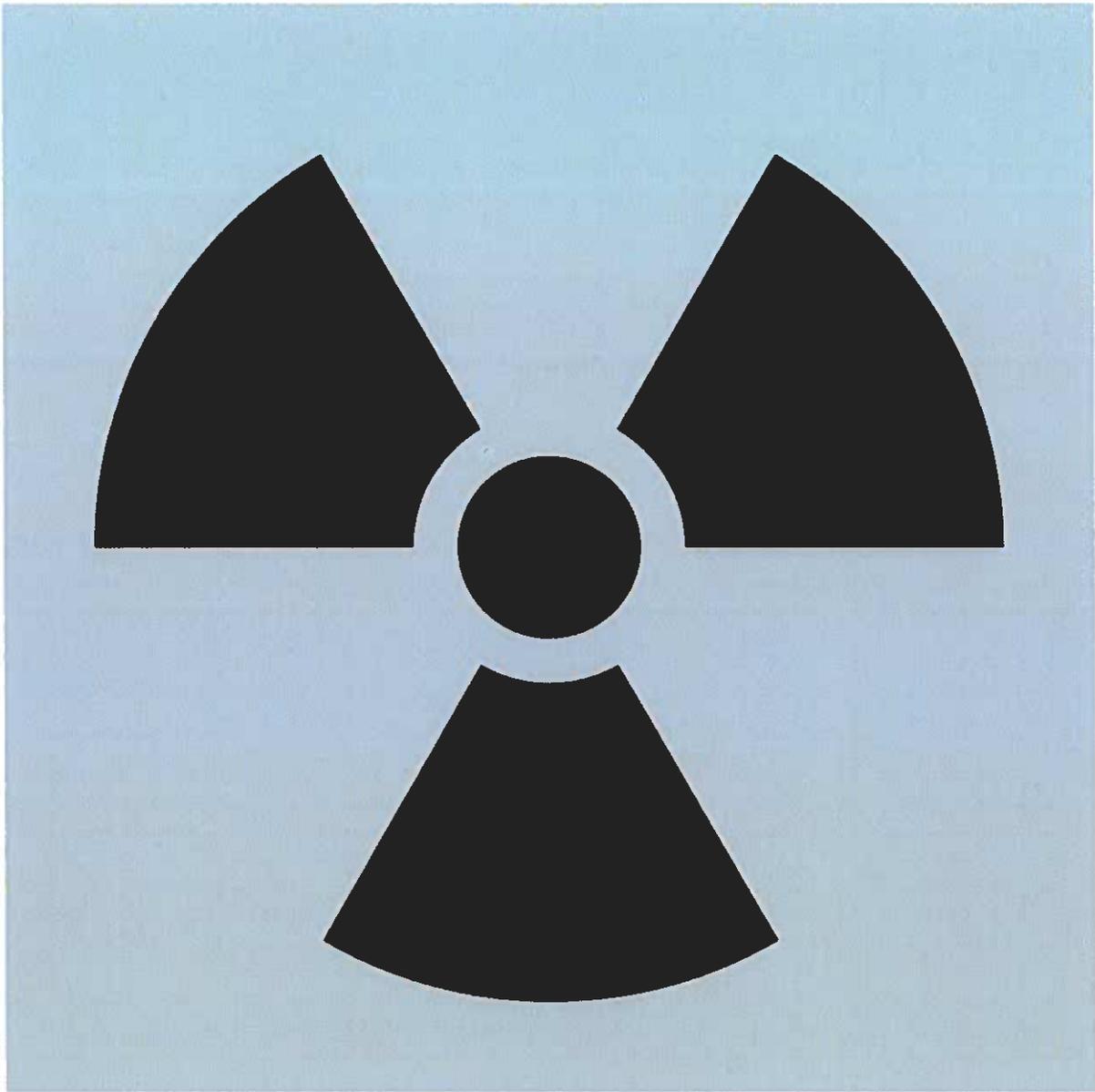


Figure 6-1. -- Trefoil

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## APPENDIX A

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.

As Low As Reasonably Achievable (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 who uses or operates a radiation source item, who has had the appropriate training, and who is determined by the RSO to be qualified to work with radioactive material.

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

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

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

Command Radiation Safety Officer (CRSO). The individual appointed in writing at the Marine Expeditionary Force or MSC level tasked with direct oversight of radiation safety practices and procedures.

Contaminated Area. An area where radioactive contamination exists.

Contamination. The presence of RAM where it is unwanted.

Controlled Area. Any area where RAMs or radiation producing devices are used or stored, and access is controlled to protect individuals from exposure to radiation.

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

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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. It is 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.

Dosimeter (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 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 where individuals could receive a dose in excess of 100 mrem (1 mSv) in one hour.

Installation Radiation Safety Officer (IRSO). The individual appointed in writing at the installation, base, air station, or other fixed activity responsible for coordinating the radiological controls program for sources of radiation under the control of that Installation.

Internal Audit and Inspection. A documented examination by a responsible person (i.e., RSO, assistant RSO, senior radiographer, supervisor, foreman, etc.) of the Radiation Safety Program or any element thereof (i.e., 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, 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).

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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 licenses and unlicensed sources of ionizing radiation, whether in possession of the licensee (personnel identified in the license) or another person (personnel not identified in the license).

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.

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, one 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 five mrem or more in one hour, or 100 mrem or more in five consecutive days.

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

Radiation Protection Assistant (RPA). Individual appointed in writing at the battalion, department, or unit level, responsible for assisting the IRSO or CRSO in administering the radiological controls program.

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.

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APPENDIX B

AUTHORIZATION FOR THE TRANSPORTATION AND USE OF RADIOACTIVE  
MATERIAL/RADIATION-PRODUCING MACHINES ABOARD MARINE CORPS  
INSTALLATIONS EAST-MARINE CORPS BASE CAMP LEJEUNE

(COMMAND LETTERHEAD)

5104  
G4/SAFE  
(DATE)

From: Commanding General, Marine Corps Installations East-Marine  
Corps Base Camp Lejeune  
To: (CONTRACTOR COMPANY NAME)  
Subj: AUTHORIZATION FOR THE TRANSPORTATION AND USE OF RADIOACTIVE  
MATERIAL/RADIATION-PRODUCING MACHINES ABOARD MARINE CORPS BASE  
CAMP LEJEUNE  
Ref: (a) MCIEAST-MCB CAMLEJO 5104.1C  
Encl: (1) U.S. NRC License (Number)  
(2) (Contractor Company Name) Radiation Standard Operating  
Procedure

1. Per the reference, you are authorized to transport and use the below listed radioactive material/radiation-producing machines about Marine Corps Base Camp Lejeune (MCIEAST-MCB CAMLEJ) from (DD MMMM YYYY) to (DD MMMM YYYY).

2. You will ensure that the use of any radioactive material/radiation-producing machines is conducted within the conditions of enclosures (1) and (2).

3. You will notify the Installation Radiation Safety Manager (IRSM) or Assistant IRSM (AIRSM) when the radioactive material/radiation-producing machines are transported aboard the installation. You will inform the IRSM/AIRSM informed of any changes to the information or conditions provided in enclosures (1) and (2). You will inform the IRSM/AIRSM when the radioactive material/radiation-producing machines are transported off of the installation.

4. You will ensure that the radioactive material/radiation-producing machines are properly secured during transport and accounted for at all times. You will ensure that the radioactive material/radiation-producing machines are maintained under constant surveillance while in use or properly secured to prevent unauthorized access

5. You will ensure that only authorized and properly trained personnel listed in enclosure (2) transport, handle, and/or operate the radioactive material/radiation-producing machines.

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Subj: AUTHORIZATION FOR THE TRANSPORTATION AND USE OF RADIOACTIVE MATERIAL/RADIATION-PRODUCING MACHINES ABOUT MARINE CORPS INSTALLATIONS EAST-MARINE CORPS BASE CAMP LEJEUNE

6. You will ensure that the manufacturer's transportation documents and this authorization letter with enclosures (1) and (2) accompany the radioactive material/radiation-producing machine during transportation aboard this installation. You will conduct transportation of radioactive material/radiation-producing machine in compliance with 40 CFR 170 through 179.

7. You will contact the Fire and Emergency Services Division by dialing 911 to report any emergency involving the radioactive material/radiation-producing machine. You will immediately notify the IRSM/AIRSM of all incidents and accidents including theft, loss, or damage involving radioactive material/radiation-producing machine.

8. The point of contact is (IRSM NAME, DESK TELEPHONE NUMBER, MOBILE TELEPHONE NUMBER) or (AIRSM NAME, DESK TELEPHONE NUMBER, MOBILE TELEPHONE NUMBER).

I. M. MARINE

Copy to:  
IRSM, Safety  
HQSPtBn, PMO  
HQSPtBn, FESD  
AC/S, G-4

MAR 0 6 2023

STANDARD OPERATING AND EMERGENCY PROCEDURE FOR THE  
X-ray Fluorescence (XRF) ANALYZER XL 600

Ref: (a) NAVSEA S0420-AA-RAD-10 Revision 2  
(b) KL2 Analyzer Users Guide version 8.0.1

1. Radiation Exposure:

a. The maximum potential radiation exposure rate for the Niton XL2 XRF Analyzer is less than 200 mrem per year.

b. The only anticipated exceptions to the 200 mrem maximum annual dose are:

(1) Routine and frequent analysis of plastic samples without use of a test stand, backscatter shield, or similar additional protective measures, or

(2) Improper use where a part of the Typical Radiation Doses Received (Source: NCRP 1987) Category Dose in mrem Dose in mSv.

c. Deep Dose/Whole Body 5 rem (50 mSv) 2.1 minutes, Shallow Dose / Extremities 50 rem (500 mSv) 0.95 minutes, Member of Public (i.e. untrained operator) 0.1 to 5 rem (1 to 50 mSv) 2.5 to 9.5 seconds.

2. Warnings:

a. Do not hold your analyzer near the measurement window during testing. Never point your analyzer at yourself or anyone else when the shutter is open.

b. Violating warnings may result in either injury to yourself or others, disciplinary action or damage to your analyzer and/or data.

c. Tampering with the 5,500 ppm (Lead high) lead-in-soil standard may cause exposure to lead dust. Keep all standards out of reach of children.

d. Do not tamper or bypass interlocks.

e. Never tamper with Test Standards. Test Standards must not be used unless they are completely intact.

f. Never point the Device with the primary beam path directed at yourself or anyone else.

3. Requirements:

a. Do not hold samples being analyzed.

b. The XRF can only be operated when a sample is in place except as recommended by the manufacturer when performing interlock checks.

Enclosure (2)

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c. All maintenance and repair other than exterior cleaning and routine maintenance consistent with manufacturer's recommendation must be performed by the manufacturer of the device.

d. The device must be returned to the manufacturer for maintenance and operability checks of interlocks.

e. Training: All XRF operators will have initial training and refresher training in accordance with reference (a) of this enclosure.

(1) Initial training shall be conducted by the manufacturer, per references (a) and (b).

(2) Initial training records shall be maintained for as long as the individual is assigned to the organization.

(3) Refresher training must be conducted annually.

(4) Refresher training must include training on the command instruction with particular attention to warnings and safe operations.

(5) Refresher training records shall be maintained in organizational records for a period of three years.

f. The XRF must have warning light(s) indication that the unit is "on" and producing x-rays.

g. The XRF must have key-controlled restricted operation.

h. Must have labels stating, "Caution this device produces x-rays when energized" and "Operated by Qualified Personnel Only", per reference (a).

i. Repair/modifications must be performed by the manufacturer.

4. XRF Safe Operations: See reference (b) of this enclosure.

5. Utilization Log: A Utilization Log must be filled out upon every use of the device. Do not remove log from binder.

6. Storage: Regulations require that the XRF analyzer be locked in a secured area to prevent access, use, and/or removal by unauthorized individuals. Contact the RSO for the XRF to identify the specific storage requirements.

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7. Lead Analyzer Check Out Procedure:

- a. Key must be requested in room 107 of building 1005.
- b. Enter required information on sign-out sheet located on locker door.
- c. Unlock and remove case from locker.
- d. Open case and verify all unit components to include charged batteries are in place (Batteries may be on charger located next to storage locker).
- e. User must read SOP before operation.
- f. User will fill out utilization sheet every use (if the utilization sheet is not in the field, the user must track every use by note in order to properly fill out utilization sheet on return).
- g. If batteries require charging after use, place on charger located next to storage locker.
- h. Once device is returned to locker and utilization sheet has been completed the locker must be relocked and key returned to room 107.

8. Transportation: There are no x-ray tube specific DOT or International Air Transport Association radiation regulations regarding shipping the Niton XL2 analyzer. It is recommended that you ship the analyzer in its carrying case and an over-pack to protect the sensitive measuring equipment inside the analyzer. Do NOT ship the analyzer with the battery pack connected to the analyzer.

9. Emergency Procedure:

a. Lost or Stolen Instrument: If the Niton XL600 analyzer is lost or stolen, notify your Installation Radiation Safety Officer (IRSO) or the Installation Assistant Radiation Safety Officer (IARSO) immediately. Your RSO, as well as other important emergency contacts, are listed below. The IRSO or the RSO may need to notify the x-ray tube regulatory authority and the local police.

b. Damaged Instrument:

(1) Minor Damage: If the instrument is intact but there is indication of an unsafe condition such as a cracked case, a shutter mechanism failure, or the lights remain flashing after a measurement is terminated, follow these steps:

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(a) Stop using the instrument.

(b) Remove the battery. The x-ray tube cannot produce radiation when the battery is disconnected. The instrument is now safe to handle.

(c) Place the instrument securely in the holster.

(d) Place the instrument in the carrying case that came with the instrument.

(e) Notify the RSO or the ARSO immediately.

c. Major Damage:

(1) Perform the same steps as described above for minor damage. There will be no radiation hazard as long as the battery is removed from the instrument.

(2) Place all components in a plastic bag and contact the IRSO or the IARSO immediately.

10. Registration: The Niton XL2 XRF analyzer must be registered by Naval Sea Systems Command, Radiation Safety Office Detachment (NAVSEA DET RASO) through the RSO.

11. Inventory: The user will conduct a semiannual (hands on) inventory of this device as directed by the RSO/ARSO.

12. Contacts: Fire 911, Police 911, for the XRF RSO (910)451-5725, to email the RSO/ARSO use Lejeune\_Safety@usmc.mil.